

ExOne Co
Form 10-K
March 15, 2019

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

WASHINGTON, DC 20549

FORM 10-K

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 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 001-35806

The ExOne Company

(Exact Name of Registrant as Specified in its Charter)

Delaware 46-1684608
(State or Other Jurisdiction of (I.R.S. Employer

Incorporation or Organization) Identification No.)

127 Industry Boulevard

North Huntingdon, PA 15642

(Address of Principal Executive Offices) (Zip Code)

(724) 863-9663

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(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 \$0.01 per share	The NASDAQ Stock Market

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

None

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

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

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

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

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405 of this chapter) 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.

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

Large accelerated filer	Accelerated filer
Non-accelerated filer	Smaller reporting company
	Emerging growth company

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

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

The aggregate market value of common stock held by non-affiliates for the last business day of the registrant's most recently completed second fiscal quarter was approximately \$79.4 million.

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As of March 15, 2019, 16,331,202 shares of common stock, par value \$0.01 per share, were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive proxy statement to be filed pursuant to Regulation 14A of the general rules and regulations under the Securities Exchange Act of 1934, as amended, for its 2019 Annual Meeting of Stockholders are incorporated by reference into Part III of this Annual Report on Form 10-K.

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PART I

Item 1. Business.

General

As used in this Annual Report on Form 10-K, unless the context otherwise requires or indicates, the terms “ExOne,” “Company,” “we,” “our,” “ours,” and “us” refer to The ExOne Company and its wholly-owned subsidiaries.

Cautionary Statement Concerning Forward-Looking Statements

This Annual Report on Form 10-K may contain forward-looking statements within the meaning of the Private Securities Litigation Reform Act with respect to our future financial or business performance, strategies, or expectations. Forward-looking statements typically are identified by words or phrases such as “trend,” “potential,” “opportunity,” “pipeline,” “believe,” “comfortable,” “expect,” “anticipate,” “current,” “intention,” “estimate,” “position,” “assumption,” “continue,” “remain,” “maintain,” “sustain,” “seek,” “achieve,” as well as similar expressions, or future or conditional verbs such as “will,” “would,” “should,” “could” and “may.”

We caution that forward-looking statements are subject to numerous assumptions, risks and uncertainties, which change over time. Forward-looking statements speak only as of the date they are made and we assume no duty to and do not undertake to update forward-looking statements. Actual results could differ materially from those anticipated in forward-looking statements and future results could differ materially from historical performance.

In addition to risk factors previously disclosed in our reports and those identified elsewhere in this report, the following factors, among others, could cause results to differ materially from forward-looking statements or historical performance: our ability to consistently generate operating profits; fluctuations in our revenues and operating results; our competitive environment and our competitive position; our ability to enhance our current 3D printing machines and technology and develop new 3D printing machines; our ability to qualify more industrial materials in which we can print; demand for our products; the availability of skilled personnel; the impact of loss of key management; the impact of market conditions and other factors on the carrying value of long-lived assets; our ability to continue as a going concern; the impact of customer specific terms in machine sale agreements on the period in which we recognize revenue; risks related to global operations including effects of foreign currency; the adequacy of sources of liquidity; the amount and sufficiency of funds for required capital expenditures, working capital, and debt service; dependency on certain critical suppliers; nature or impact of alliances and strategic investments; reliance on critical information technology systems; the effect of litigation, contingencies and warranty claims; liabilities under laws and regulations protecting the environment; the impact of governmental laws and regulations; operating hazards, war, terrorism and cancellation or unavailability of insurance coverage; the impact of disruption of our manufacturing facilities, Production Service Centers (“PSCs”) or ExOne Adoption Centers (“EACs”); the adequacy of our protection of our intellectual property; and expectations regarding demand for our industrial products, operating revenues, operating and maintenance expenses, insurance expenses and deductibles, interest expenses, debt levels, and other matters with regard to outlook.

These and other important factors, including those discussed under Item 1A, “Risk Factors” and Item 7, “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in this Annual Report on Form 10-K, may cause our actual results of operations to differ materially from any future results of operations expressed or implied by the forward-looking statements contained in this Annual Report on Form 10-K. Before making a decision to purchase our common stock, you should carefully consider all of the factors identified in this Annual Report on Form 10-K that

could cause actual results to differ from these forward-looking statements.

This Annual Report on Form 10-K may contain trademarks, service marks and trade names of other companies, which are the property of their respective owners. Solely for convenience, marks and trade names referred to in this Annual Report on Form 10-K may appear without the ® or TM symbols, but such references are not intended to indicate, in any way, that we will not assert, to the fullest extent under applicable law, our rights or the right of the applicable licensor to these marks and trade names. Third-party marks and trade names used herein are for nominative informational purposes only and their use herein in no way constitutes or is intended to be commercial use of such names and marks. The use of such third-party names and marks in no way constitutes or should be construed to be an approval, endorsement or sponsorship of us, or our products or services, by the owners of such third-party names and marks.

Our Business

We are a global provider of 3D printing machines and 3D printed and other products, materials and services to industrial customers. Our business primarily consists of manufacturing and selling 3D printing machines and printing products to specification for our customers using our installed base of 3D printing machines. Our machines serve direct and indirect applications. Direct printing produces a component; indirect printing makes a tool to produce a component. We offer pre-production collaboration and print products for customers through our network of PSCs and EACs. We also supply the associated materials, including consumables and replacement parts, and other services, including training and technical support, that are necessary for purchasers of our 3D printing machines to print products. We believe that our ability to print in a variety of industrial materials, as well as our industry-leading volumetric output (as measured by build box size and printing speed), uniquely position us to serve the needs of industrial customers.

Our History

Our business began as the advanced manufacturing business of the Extrude Hone Corporation, which manufactured its first 3D printing machine in 2003 using licensed technology developed by researchers at the Massachusetts Institute of Technology (“MIT”).

In 2005, our business assets were transferred to The Ex One Company, LLC, a Delaware limited liability company, when Extrude Hone Corporation was purchased by another company. In 2007, we were acquired by S. Kent Rockwell through his wholly-owned company, Rockwell Forest Products, Inc. On January 1, 2013, the Company was formed when The Ex One Company, LLC was merged with and into a newly created Delaware corporation, which changed its name to The ExOne Company. On February 12, 2013, we completed our initial public offering, raising approximately \$90.4 million in unrestricted net proceeds after underwriting commissions and offering costs. Subsequent secondary offerings of our common stock have resulted in raising approximately \$78.0 million in additional unrestricted net proceeds after underwriting commissions and offering costs.

The Additive Manufacturing Industry and 3D Printing

3D printing is the most common type of an emerging manufacturing technology that is broadly referred to as additive manufacturing (“AM”). In general, AM is a term used to describe a manufacturing process that produces 3D objects directly from digital or computer models through the repeated deposit of very thin layers of material. 3D printing is the process of joining materials from a digital 3D model, usually layer by layer, to make objects using a printhead, nozzle, or other printing technology. The terms “AM” and “3D printing” are increasingly being used interchangeably, as the media and marketplace have popularized the term 3D printing rather than AM, which is the industry term.

AM represents a transformational shift from traditional forms of manufacturing (e.g., machining or tooling), which are sometimes referred to as subtractive manufacturing. We believe that AM and 3D printing are increasingly poised to displace traditional manufacturing methodologies in a growing range of industrial applications. Our 3D printing process differs from other forms of 3D printing processes, in that we use a chemical binding agent and focus on industrial applications.

AM has focused on prototyping and small, limited production in order to find acceptance of its varying technologies by end users in order to convince users of traditional methods of the viability of such new applications. As AM has evolved, the focus has evolved into production readiness and increasing reliability and repeatability standards associated with higher volumetric output and specifications that industrial applications demand.

ExOne and 3D Printing

We provide 3D printed and other products, materials and services primarily to industrial customers and other end-market users. We are an early entrant into the AM industrial products market, which we believe provides us with a competitive advantage over future entrants.

Our binder jetting technology was developed over 20 years ago by researchers at MIT. Our 3D printing machines build or print products from computer-aided drafting (“CAD”) models by depositing successive thin layers of particles of materials such as silicate sand or metal powder in a “build box.” A moveable printhead passes over each layer and deposits a chemical binding agent in the selected areas where the finished product will be materialized. Each layer can be unique.

Depending on the industrial material used in printing, printed products may need post-production processing. We generally use silica sand or foundry sand for casting, both of which typically require no additional processing. Products printed in other materials, such as metals, or for use in specific applications, may need varying amounts of heat treating or sintering, drying or curing, or other post-processing or finishing.

Pre-Print. We believe that our customers have the opportunity to take greater advantage of the design freedom that our 3D printing technology provides. We collaborate with our customers to develop and refine CAD designs that meet our customers’ specifications and can be read and processed by our 3D printing machines. We continue to invest in

additional pre-print capabilities and resources that empower our customers to fully exploit the design freedom of 3D printing.

Industrial Materials. We supply printing materials to our customers that have been qualified for use with our machines. As we experience increased demand for our products globally, it is essential that the material supply chain and distribution channels be in close proximity to our current and prospective customers. For the highest quality printed products, the sand grains and metal particles used in the 3D printing process must be uniform in size and meet very specific tolerances. We continue to focus on material development activities associated with our 3D printing process, including collaborative arrangements with customers targeted at local supply resources. In addition, we have specifically targeted fine powder printing with respect to our direct printing technologies as one of our strategic priorities as an organization.

Our Machines. Our 3D printing machines consist of a build box that includes a machine platform and a computer processor controlling the printheads for applying layers of industrial materials and binding agents. We currently build our 3D printing machines in both Germany and the United States. Our machines serve direct and indirect applications. Direct printing produces a component; indirect printing makes a tool to produce a component. Our focus is on enhancing our existing machine technologies and developing large format printers for both direct and indirect applications, with specific emphasis on fine powder printing for our direct technologies.

Our 3D printing machines are used primarily to manufacture industrial products that are ordered in relatively low volumes, are highly complex and have a high value to the customer. Our technology is not appropriate for the mass production of simple parts, such as certain higher volume injection molded parts or certain higher volume parts made in metal stamping machines. Traditional manufacturing technology is more economical in making those parts. While we expect over time to be able to increase the kinds of parts that we can make more economically than using subtractive manufacturing, we do not ever expect to use our technology to make simple, low-cost, mass-produced parts.

Post-Print Processing. After a product is printed, the bound and unbound powder in the build box requires curing of the chemical binding agent. For indirect printing of sand molds and cores, curing may occur at room temperature and the printed product is complete after the binder is cured. For certain binder types, a drying process (utilizing an industrial microwave or other means) may be necessary. The mold or core is then poured at a foundry, yielding the finished metal product. We believe that our casting technology offers a number of advantages over traditional casting methods, including increased yield, weight reduction and improved thermal range.

For direct printing, the product needs to be either sintered, or sintered and infiltrated. With sintering, the product is placed into a furnace in an inert atmosphere to sinter the bonded particles and form a strong bonded porous structure. The porous structure can be further infiltrated with another material to fill the voids. After the sintering and infiltration, the product can be polished and finished with a variety of standard industrial methods and coatings. We believe that our 3D printing capabilities enable customers to develop the ideal design for products, freeing them of some of the design constraints inherent in traditional manufacturing, in the industrial metal of choice and in a more efficient manner than traditional manufacturing methods.

Customers and Sales

Our Customers

Our customers are located primarily in the Americas, Europe/Middle East/Africa (“EMEA”) and Asia Pacific regions. We are a party to non-disclosure agreements with many of our customers and, therefore, are often prohibited from disclosing many of our customers’ identities. Our customers include a number of Fortune 500 companies that are leaders in their respective markets, as well as mid-cap and smaller public and private companies. During 2018 and 2017, we conducted a significant portion of our business with a limited number of customers, though not necessarily the same customers for each respective period. During 2018 and 2017, our five most significant customers represented approximately 16.5% and 20.5% of our total revenue, respectively. During 2018 and 2017, there were no customers that individually represented 10.0% or greater of our total revenue. Sales of 3D printing machines are low volume, but generate significant revenue based on their per-unit pricing. Generally, sales of 3D printing machines are to different customers in each respective period. The timing of such sales may be dependent on various factors, including a customer’s capital budgeting cycle, its facility preparedness and the terms of the underlying arrangement with a customer (including certain substantive acceptance provisions) which may vary from period to period. The nature of our revenue from 3D printing machines does not leave us dependent upon a single or a limited number of customers. Sales of 3D printed and other products, materials and services generally result in a significantly lower aggregate price per order as compared to 3D printing machine sales. The nature of the revenue from 3D printed and other products, materials and services does not leave us dependent upon a single or a limited number of customers.

Educating Our Customers

Educating our customers and raising awareness in our target markets about the many uses and benefits of our 3D printing technology is an important part of our sales process. We believe that customers who experience the efficiency gains, decreased lead-time, increased design flexibility, and decreased cost potential of 3D printing, as compared to subtractive manufacturing, are more likely to purchase our 3D printing machines and be repeat customers of our products and services. We educate our customers on the design freedom, speed, and other benefits of 3D printing by providing printing and design services and support through our PSCs and EACs. We also seek to expose key potential users to our products through our PSCs and EACs, installed machines at customers’ locations, university programs, and sales and marketing efforts. Additionally, our EACs provide our customers exposure to a greater variety of our latest machine platforms and material sets.

Production Service Centers and ExOne Adoption Centers

We have established a network of PSCs and EACs in North Huntingdon, Pennsylvania; Troy, Michigan; Gersthofen, Germany; and Kanagawa, Japan. Each of our PSCs and EACs are certified to ISO 9001:2015 standards with various scopes. Through our PSCs and EACs, we provide sales and marketing and delivery of support and printing services to our customers. Our customers see our 3D printing machines in operation and can evaluate their production capabilities before ordering a 3D printing machine or a printed product or service. While our centers are scalable and have a well-defined footprint that can be easily replicated to serve additional regional markets, we are focusing on enhancing our existing centers to enable adoption rather than geographic expansion. As described below, enhancing our position in strategic locations around the world is an important part of our business strategy.

For all customers, we offer the following support and services through our PSCs and EACs:

Pre-production Collaboration. Our pre-print services include data capture using software that enables customers to translate their product vision into a digital design format that can be used as an input to our 3D printing equipment. We help our customers successfully move from the design stage to the production stage, and help customers evaluate the optimal design and industrial materials for their production needs. For example, we worked with a customer to design and manufacture certain critical parts of a helicopter that significantly improved the weight-strength ratio for the related parts, which was possible because of the flexibility and precision of our AM process. Our 3D printing machines are also able to deliver a replacement for a product broken by the customer rapidly or often immediately because we will already have the production computer file. Using subtractive manufacturing would take significantly longer.

Consumable Materials. We provide customers with the inputs used in our 3D printing machines, including tools, printing materials, and bonding agents. Our EACs provide a greater variety of our latest binder and material sets.

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• **Training and Technical Support.** Our technicians train customers to use our 3D printing machines through hands-on experience at our PSCs and EACs and provide field support to our customers, including design assistance, education on industrial materials, operations and printing training, instruction on cleaning, and maintenance and troubleshooting.

• **Aftermarket.** We generally offer a standard warranty with the sale of our 3D printing machines. Thereafter, we offer a variety of service and support plans.

Our Competitive Strengths

We believe that our competitive strengths include:

• **Volumetric Output Rate.** We believe that our 3D printing machines provide us the highest rate of volume output per unit of time among competing AM technologies. Because of our early entrance into the industrial market for AM and our investment in our core 3D printing technology, we have been able to improve the printhead speed and build box size of our 3D printing machines. As a result, we have made strides in improving the output efficiency of our 3D printing machines, as measured by volume output per unit of time. With continued advances in our core 3D printing technologies, we believe that our cost of production will continue to decline, increasing our ability to compete with subtractive manufacturing processes, particularly for complex products, effectively expanding our addressable market.

• **Printing Platform Size.** The size of the build box area and the platform upon which we construct a product is important to industrial customers who may want to either make a high number of products per job run or make an industrial product that has large dimensions and is heavy in final form. We believe that our technology and experience give us the potential to develop large build platforms to meet the production demands of current and potential industrial customers. In addition, we have created machine platforms in various size ranges in order to cater to the varying demands of our customers.

• **Industrial Materials.** Our indirect 3D printing machines are able to manufacture sand molds and cores from specialty sands and ceramics, which are the traditional materials for these casting products. Our direct 3D printing machines are capable of printing in a variety of industrial metals and other materials. We are in varying stages of qualifying additional industrial materials for both indirect and direct applications and advancing materials that are printable in our machines, including fine powder capability development.

• **Chemical Binding.** We use liquid chemical binding agents during the printing process. We believe that our unique chemical binding agent technology can more readily achieve efficiency gains over time than other AM technologies, such as laser-fusing technologies.

• **International Presence.** Since our inception, we have structured our business to cater to major international markets. We have strategically established one or more PSCs or EACs in each of the Americas, EMEA and Asia Pacific regions. Because many of our current or potential customers are global industrial companies, it is important that we have a presence in or near the areas where these companies have manufacturing facilities.

Our Business Strategy

The principal elements of our growth strategy include:

• **Increase the Efficiency and Capabilities of Our Machines to Expand the Addressable Market.** We intend to invest in further developing our machine technology so as to increase the volumetric output per unit of time that our machines can produce for both direct and indirect applications. We also intend to invest in continued advancements to the core capabilities of our equipment, which include broadening the range of material particle sizes that can be printed in our equipment (with particular emphasis on fine powder capabilities for direct printing technologies), enhancing real-time process monitoring, improving material handling, and improving overall machine post-printing productivity.

• **Qualify New Industrial Materials Printable In Our Systems.** Our 3D printing machines are used for both development and commercial printing. We believe that the variety of materials printable in our printing systems is more diverse

than competing 3D printing technologies. By expanding both qualified and printable materials (with particular emphasis on fine powder capabilities for direct printing technologies), we believe we can expand our market share and better serve our industrial customer base.

Reduce Overall Costs of Operating Our Machines. We continue to reduce costs associated with operating our 3D printing machines. We collaborate with customers and suppliers to qualify locally-based, lower cost printing materials. We seek to reduce the cost of ownership of our 3D printing machines by targeting reductions in consumable materials cost and replacement part cost for our 3D printing machines. We use a variety of means, including traditional supply chain and development projects, to reduce those costs. We believe as we lower the cost of ownership of our 3D printing machines, we will improve the adoption rate by forming more cost-efficient production processes.

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•**Advance Pre-Print Design and Post-Print Processing Capabilities to Accelerate the Growth of Our 3D Printing Technology.** Our next generation 3D printing machine platforms have achieved the volumetric output rate and quality necessary to serve industrial markets on a production scale. We believe that there is an opportunity to similarly advance the pre-print and post-print processing phases of product materialization to more fully exploit the transformative power of our 3D printing machines and drive growth. These opportunities relate to both direct and indirect printing. For direct printing, we believe that enhancing pre-print processes, notably design optimization tools and suitable print material availability, can greatly accelerate our capture of market share. Additionally, enhancements to post-print processing will increase the applications for printed products. In indirect printing utilizing 3D printed molds and cores, advanced performance casting technologies can be leveraged to increase yields and reduce weight of casted products. To promote this advantage to the market, we have developed a suite of processes, many of which are proprietary, for producing high-quality castings.

•**Pursue Growth Opportunities Through Alliances and/or Strategic Investments.** We may opportunistically identify and, through alliances and/or strategic investment, integrate and advance complementary businesses, technologies and capabilities. Our goal is to expand the functionality of our products, provide access to new customers and markets, and increase our production capacity.

Marketing and Sales

We market our products under the ExOne brand name in three major geographic regions — the Americas, EMEA and Asia Pacific. Our sales are made primarily by our global sales force. Our sales force is augmented, in certain territories, by representatives with specific industry or territorial expertise. Even where we are supported by a representative, substantially all of our product and service offerings provided by our PSCs and EACs are sold directly to customers by us.

We believe that our direct selling relationship helps to create one of the building blocks for our business — the creation of true collaboration between us and industrial customers who are interested in 3D printing. Increasingly, industrial producers are considering shifting from subtractive manufacturing techniques to 3D printing. Our marketing efforts include educating potential customers about 3D printing technology through collaboration, starting with pre-production services and continuing with production and technical support at our PSCs and EACs.

Suppliers

Our largest suppliers in 2018, based upon dollar volume of purchases, were Bauer GmbH & Co KG, Fuji Film Dimatix, ASK Chemicals, Astro Manufacturing & Design and Erhardt & Leimer GmbH.

We buy our industrial materials from several suppliers and, except as set forth below, the loss of any one would not materially adversely affect our business. We currently have a single supplier of certain printhead components for our 3D printing machines. While we believe that this printhead component supplier is replaceable, in the event of the loss of this supplier, we could experience delays and interruptions that might adversely affect the financial performance of our business. Additionally, we obtain certain pre-production services through design and data capture providers, and certain post-production services through vendors with whom we have existing and good relationships. The loss of any one of these providers or vendors would not materially adversely affect our business.

Research and Development

We spent approximately \$10.7 million and \$9.9 million on research and development during 2018 and 2017, respectively. We expect to continue to invest in our research and development activities in the future.

A significant portion of our research and development expenditures have been focused on the following:

- Chemistry of print materials and binder formulation;
- Mechanics of droplet flight into beds of powder;
- Metallurgy of thermally processing metals that are printed through AM;
- Mechanical design elements of our 3D printing machines;
- Mechanics of spreading powders in a job box;
- Evaluation of product applications utilizing our 3D printing machines;
- Transfer of digital data through a series of software links to drive a printhead; and
- Synchronizing all of the above to print ever-increasing volumes of material per unit time.

Intellectual Property

Patents and Licenses. Significant portions of our technology are covered by a variety of patents. Through December 31, 2016, we were the worldwide licensee of certain patents held by MIT for certain AM printing processes (the “MIT Patents”), with exclusive rights to practice the patents in certain fields including the application of the printing processes to metals (with sublicensing rights),

and non-exclusive rights to practice the patents in certain fields including the application of the printing processes to certain non-metals (without sublicensing rights) which gave us a significant head start in the AM industry.

We continue from time to time to evaluate our current licenses and patents. On March 1, 2018, our ExOne GmbH subsidiary notified Voxeljet AG that it has materially breached a 2003 Patent and Know-How Transfer Agreement and asserted its rights to set off damages as a result of the breaches against the annual license fee that we pay to Voxeljet AG under the agreement.

We hold patents as a result of our own technological developments. Our patents were issued in the United States and in various foreign jurisdictions, including Germany and Japan. As a result of our commitment to research and development, we also have applied for other patents for equipment, processes, materials and 3D printing applications in the United States and in various foreign countries. The expiration dates of our patents range from 2023 to 2036. We are also a minority owner of patent rights of several patents in the United States and in various foreign jurisdictions as a successor interest to a 2003 agreement made between Generis GmbH and Extrude Hone GmbH.

We have developed know-how and trade secrets relative to our 3D printing technology and believe that our early entrance into the industrial market provides us with a timing and experience advantage. Through our investment in our technology, we have been able to qualify industrial materials for use in our 3D printing machines and we intend to continue such efforts. In addition, we have taken steps to protect much of our technology as a trade secret. Given the significant steps that we have taken to establish our experience in AM for industrial applications, as well as our ongoing commitment to research and development, we intend to maintain our preeminent position in the AM industry market.

Trademarks. We have registrations in the United States for the following trademarks: EXONE, X1 ExOne Digital Part Materialization (plus design), EXCAST, EXMAL, EXTEC, INNOVENT, M-FLEX, M-PRINT, S MAX, S-MAX, S-PRINT, X1, and X1-LAB. We also have an application in the United States for registration pending for the following trademarks: INNOVENT+ and X1 25PRO. We also have registrations for EXONE in Canada, China, Europe (Community Trade Mark), Japan, and South Korea. We have registrations for X1 ExOne Digital Part Materialization (plus design) in Brazil, Canada, China, Europe (Community Trade Mark), Japan, and South Korea. We have a registration for the mark X1 in Europe (Community Trade Mark). We have registrations for a stylized form of X1 in Europe (Community Trade Mark). We have registrations for DIGITAL PART MATERIALIZATION in Japan and South Korea. We have registrations for the trademarks EXERIAL, INNOVENT, M-FLEX, S-MAX, and S-PRINT in Europe (Community Trade Mark). We also have registration for the trademark S-PRINT in Canada, China, and Japan.

Trade Secrets. The development of our products, processes and materials has involved a considerable amount of experience, manufacturing and processing know-how and research and development techniques that are not easily duplicated. We protect this knowledge as a trade secret through the confidentiality and non-disclosure agreements which all employees, customers and consultants are required to sign at the time they are employed or engaged by us. Additional information related to the risks associated with our intellectual property rights are described within Item 1A, "Risk Factors" of this Annual Report on Form 10-K.

Competition

Other companies are active in the market for 3D printing products and services. These companies use a variety of AM methods, including:

- Material extrusion;
- Material jetting;

- Powder bed fusion;
- Directed energy deposition;
- Vat photopolymerization;
- Sheet lamination; and
- Binder jetting

Some of the companies that have developed and employ one or more AM technologies include: 3D Systems Corporation, Stratasys Inc., HP Inc., Desktop Metal, EOS GmbH, EnvisionTEC, Concept Laser, Solid Model Ltd., Viridus3d, Voxeljet AG and General Electric Co.

Some of these processes and companies compete with some of the products and services that we provide. Despite the challenging competitive landscape, we believe that we are the only AM printing solutions provider that focuses primarily on metal industrial applications on a production scale. Our competitive advantages, including the size of our build platforms, the speed of our printheads, the variety of materials used by industrial manufacturers in which we can print, the industry qualification of many of the materials we print in, our robust market capabilities, our considerable global installed base of 3D printing machines, and our suite of machine system families offering scale and flexibility, also serve to differentiate us from the other competitors in the AM market.

We also compete with established subtractive manufacturers in the industrial products market. These companies often provide large-scale, highly capitalized facilities that are designed or built to fill specific production purposes, usually mass production. However, we believe that we are well positioned to expand our share of the industrial products market from these manufacturers as AM gains recognition. As our technologies improve and our unit cost of production decreases, we expect to be able to compete with subtractive manufacturing on a wide range of products, thereby expanding our addressable market.

Seasonality

Purchases of our 3D printing machines are often subject to the capital expenditure cycles of our customers. Generally, 3D printing machine sales are higher in our third and fourth quarters than in our first and second quarters; however, as acceptance of our 3D printing machines as a credible alternative to traditional methods of production grows, we expect to limit the seasonality we experience.

Backlog

At December 31, 2018, our backlog was approximately \$12.3 million, of which approximately \$9.6 million is expected to be fulfilled during the next twelve months. At December 31, 2017, our backlog was approximately \$21.3 million.

Environmental Matters

Compliance with federal, state and local laws and regulations relating to the discharge of materials into the environment or otherwise relating to the protection of the environment has not had a material impact on capital expenditures, earnings or the competitive position of us and our subsidiaries. We are not the subject of any legal or administrative proceeding relating to the environmental laws of the United States or any country in which we have an office. We have not received any notices of any violations of any such environmental laws.

Employees

At December 31, 2018, we employed a total of 296 (257 full-time) employees at our five global locations. None of these employees is a party to a collective bargaining agreement, and we believe our relations with employees are good.

Product, Geographic and Other Information

Refer to Note 22 to the consolidated financial statements included in Part II Item 8 of this Annual Report on Form 10-K for product and geographic information related to our revenues (based on the country where the sale originated) and geographic information related to our long-lived assets (based on the physical location of assets). For information on risks related to our international operations refer to Item 1A, "Risk Factors". Other information relating to our revenues, measurement of profit or loss and total assets is provided in the consolidated financial statements and related notes thereto in Part II Item 8 of this Annual Report on Form 10-K.

Executive Offices

Our principal executive offices are located at 127 Industry Boulevard, North Huntingdon, Pennsylvania 15642 and our telephone number is (724) 863-9663.

Available Information

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Our website address is <http://www.exone.com>. Information contained on our website is not incorporated by reference into this Annual Report on Form 10-K unless expressly noted.

We file reports with the Securities and Exchange Commission (“SEC”), which we make available on our website free of charge at <http://www.exone.com/financials.cfm>. These reports include Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q and Current Reports on Form 8-K, each of which is provided on our website as soon as reasonably practicable after we electronically file such materials with, or furnish them to, the SEC. We also make, or will make, available through our website other reports filed with or furnished to the SEC under the Securities Exchange Act of 1934, as amended (the “Exchange Act”), including our proxy statements and reports filed by officers and directors under Section 16(a) of that Act. You can also read and copy any materials we file with the SEC at the SEC’s Public Reference Room at 100 F Street, N.E., Washington, DC 20549. You can obtain additional information about the operation of the Public Reference Room by calling the SEC at 1-800-SEC-0330. In addition, the SEC maintains a website (<http://www.sec.gov>) that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC, including us.

You can obtain copies of exhibits to our filings electronically at the SEC’s website at www.sec.gov or by mail from the Public Reference Section of the SEC at 100 F Street, N.E., Washington, D.C. 20549 at prescribed rates. The exhibits are also available as part of the Annual Report on Form 10-K for the year ended December 31, 2018, which is available on our corporate website at www.exone.com. Stockholders may also obtain copies of exhibits without charge by contacting our General Counsel and Corporate Secretary at (724) 863-9663.

Item 1A. Risk Factors.

RISK FACTORS

As a smaller reporting company, we are not required to provide a statement of risk factors on our Annual Report on Form 10-K. However, we believe this information is valuable to our shareholders. We reserve the right to not provide risk factors in future filings.

You should carefully consider the following risks, together with all of the other information in this Annual Report on Form 10-K, including our consolidated financial statements and related notes, in evaluating our business, future prospects and an investment in our common stock. If any of the following risks and uncertainties develops into actual events, our business, financial condition, results of operations and cash flows could be materially adversely affected. In that case, the price of our common stock could decline and you may lose all or part of your investment.

Risks Related to Our Business and Industry

We may not be able to consistently generate operating profits.

Since our inception, we have not consistently generated operating profits, and we may be unable to consistently generate operating profits in the future if we are unable to execute on our business plan. Our operating expenses (which include research and development and selling, general and administrative expenses) were approximately \$33.9 million and \$34.1 million for 2018 and 2017, respectively. Our research and development expenses are due primarily to continued investment in our binder jetting technologies, including 3D printing machine development (including our fine powder direct printing capabilities and larger format direct and indirect 3D printing machines) and materials development (including our proprietary binders). Our selling, general and administrative expenses are due primarily to employee-related costs and professional service fees, including those associated with managing a public company. We believe that our operating expenses may increase in future periods as we pursue our growth strategies. Increases in our research and development expenses and selling, general and administrative expenses will directly affect our future results of operations and may have an adverse effect on our financial condition.

Our revenues and operating results may fluctuate.

Our revenues and operating results have fluctuated in the past from quarter-to-quarter and year-to-year and are likely to continue to vary due to a number of factors, many of which are not within our control. Both our business and the AM industry are changing and evolving rapidly, and our historical operating results may not be useful in predicting our future operating results.

Our machine orders are often subject to the capital expenditure cycles of our customers. Thus, revenues and operating results for any future period are not predictable with any significant degree of certainty. Comparing our operating results on a period-to-period basis may not be meaningful. You should not rely on our past results as an indication of our future performance.

Fluctuations in our operating results and financial condition may occur due to a number of factors, including, but not limited to, those listed below and those identified throughout this “Risk Factors” section:

- Our ability to compete with competitors (some of which may also serve as current or future customers of our products) that have significantly more resources than we have, have larger and more experienced sales and service teams and have more experience bringing new products to the market;
- The mix of machines and products that we sell during any period;

- Our lengthy sales cycle for 3D printing machines;
- Entry of new competitors into our markets;
- Changes in our pricing policies or those of our competitors, including our response to price competition;
- Delays between our expenditures to develop and market new or enhanced machines and products or to develop, acquire or license new technologies and processes and the generation of sales related thereto;
- Changes in the amount we spend to promote our products and services;
- The geographic distribution of our sales;
- Changes in the cost of satisfying our warranty obligations and servicing our installed base of products;
- Our level of research and development activities and their associated costs and rates of success;
- Changes in the size and complexity of our organization;
- Interruptions to or other problems with our information technology systems, manufacturing processes or other operations;
- Changes in regulatory requirements governing the handling and use of certain chemicals or powders printed or used in our equipment;

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• General economic and industry conditions that affect end-user demand and end-user levels of product design and manufacturing; or

• Changes in accounting rules and tax laws.

Due to the foregoing factors, you should not rely on quarter-to-quarter or year-to-year comparisons of our operating results as an indicator of future performance.

Customer demands for certain qualities and capabilities in our machines is constantly evolving. We may not be able to respond to customer demand as quickly as a better capitalized competitor may be able to respond.

Generally, our business is focused on the sale of 3D printing machines for, and products manufactured using, AM. Most recently, our company has focused on developing our fine powder direct printing capabilities and larger format direct and indirect 3D printing machines.

We have encountered and will continue to encounter risks and difficulties frequently experienced by growing companies in a market subject to innovation and rapidly developing and changing technology. A variety of technologies have the capacity to compete against one another in the AM market, which is, in part, driven by technological advances and end-user requirements and preferences, as well as the emergence of new standards and practices. Our ability to compete in the industrial AM market depends, in large part, on our success in enhancing and developing new 3D printing machines, in enhancing our current 3D printing machines, in enhancing and adding to our technology, and in developing and qualifying materials with which we can print. We believe that to remain competitive we must continuously enhance and expand the functionality and features of our products and technologies. However, we may not be able to:

• Develop machines that are capable of directly printing fine powders;

• Enhance our existing products and technologies;

• Continue to leverage advances in binder printing and other industrial printhead technology;

• Develop new products and technologies that address the increasingly sophisticated and varied needs of prospective end-users, particularly with respect to the physical properties of fine powders, binder jetting and other materials;

• Respond to technological advances and emerging industry standards and practices on a cost-effective and timely basis;

• Develop products that are cost-effective or that otherwise gain market acceptance;

• Distinguish ourselves from our competitors in our industry; and

• Adequately protect our intellectual property as we develop new products and technologies.

We face significant competition in many aspects of our business, which could cause our revenues and gross profit to decline. Competition could also cause us to reduce sales prices or to incur additional marketing or production costs, which could result in decreased revenue, increased costs and reduced margins.

We compete for customers with a wide variety of producers of equipment for models, prototypes, other 3D objects and end-use parts as well as producers of print materials and services for this equipment. Some of our existing and potential competitors are researching, designing, developing and marketing other types of competitive equipment, print materials and services. Many of these competitors have financial, marketing, manufacturing, distribution and other resources that are substantially greater than ours.

We also expect that future competition may arise from the development of allied or related techniques for equipment and print materials that are not encompassed by our patents, from the issuance of patents to other companies that may inhibit our ability to develop certain products, from our entry into new geographic markets and industries and from improvements to existing print materials and equipment technologies. In addition, a number of companies that have substantial resources have announced that they intend to begin producing 3D printing machines, which will further enhance the competition we face.

We intend to continue to follow a strategy of continuing product development to enhance our position to the extent practicable. We cannot assure you that we will be able to maintain our current position in the field or continue to compete successfully against current and future sources of competition. If we do not keep pace with technological change and introduce new products, our revenues and demand for our products may decrease.

We may not be able to retain or hire the number of skilled employees that we need to achieve our business plan.

For our business to grow in accordance with our business plan, we will need to recruit, hire, integrate and retain additional employees with the technical competence and engineering skills to operate our machines, improve our technology and processes and expand our technological capability to print using an increasing variety of materials. People with these skills are in short supply and may not be available in sufficient numbers to allow us to meet the goals of our business plan. In addition, new employees often require significant training and, in many cases, take significant time before they achieve full productivity. As a result, we may incur significant costs to attract and retain employees, including significant expenditures related to salaries and benefits, and we may lose new employees to our competitors or other companies before we realize the benefit of our investment in recruiting and training them. Moreover, new employees may not be or become as productive as we expect, as we may face challenges in adequately or appropriately integrating them into our workforce and culture. If we cannot obtain the services of a sufficient number of technically skilled employees, we may not be able to achieve our planned rate of growth, which could adversely affect our results of operations.

Loss of key management or sales or customer service personnel could adversely affect our results of operations.

Our future success depends to a significant extent on the skills, experience and efforts of our management and other key personnel. We must continue to develop and retain a core group of management individuals if we are to realize our goal of continued expansion and growth. While we have not previously experienced significant problems attracting and retaining members of our management team and other key personnel, there can be no assurance that we will be able to continue to retain these individuals and the loss of any or all of these individuals could materially and adversely affect our business.

We may incur future impairment charges to our long-lived assets held and used.

As a result of continued operating losses and cash flow deficiencies, we have completed certain tests for the recoverability of long-lived assets held and used at the asset group level. Assessing the recoverability of long-lived assets held and used requires significant judgments and estimates by management. We will be required to conduct additional testing for the recoverability of long-lived assets held and used to the extent that a triggering event requiring such testing is identified in a future period. A significant decrease in the market price of a long-lived asset, adverse change in the use or condition of a long-lived asset, adverse change in the business climate or legal or regulatory factors impacting a long-lived asset and continued operating losses and cash flow deficiencies associated with a long-lived asset, among other indicators, could cause a future assessment to be performed which may result in an impairment of long-lived assets held and used. The amount of any impairment could be significant and could have a material adverse impact on our financial condition and results of operations for the period in which the impairment is recorded.

We may conclude that there is substantial doubt regarding our ability to continue as a going concern.

As a result of our continued operating losses, cash flow deficiencies and liquidity, we may conclude that there is substantial doubt regarding our ability to continue as a going concern. In connection with this conclusion, if our independent registered public accounting firm issues a “going concern” opinion, it could impair our ability to finance our operations through the sale of equity, incurring debt, or other financing alternatives. If we fail to raise sufficient additional capital, we will not be able to completely execute our business plan. As a result our business would be jeopardized and we may not be able to continue.

Some of our arrangements for 3D printing machines contain customer-specific provisions that may impact the period in which we recognize the related revenues under U.S. GAAP.

Some customers that purchase 3D printing machines from us may require specific, customized factors relating to their intended use of the machine or the installation of the machine in the customer’s facilities. These specific, customized factors are often required by the customer to be included in our commercial agreements relating to the purchase. As a result, our responsiveness to our customers’ specific requirements has the potential to impact the period in which we recognize the revenue relating to that 3D printing machine sale.

Similarly, some customers must build or prepare facilities to install our 3D printing machines, and the completion of such projects can be unpredictable, which can impact the period in which we recognize the revenue relating to that 3D printing machine sale.

Our business is subject to risks associated with having significant operations in Germany and selling machines and other products in other non-United States locations.

We have significant manufacturing and development operations in Germany. In addition, a significant portion of our revenue is derived from transactions outside of the United States (approximately 54.3% and 56.7% for 2018 and 2017, respectively).

Our operations outside of the United States are subject to risks associated with the political, regulatory and economic conditions of Germany and other countries in which we sell or service machines, such as:

- Challenges in providing solutions across a significant distance, in different languages and among different cultures;
- Civil unrest, acts of terrorism and similar events;
- Fluctuations in foreign currency exchange rates;
- Potentially longer sales and payment cycles;
- Potentially greater difficulties in collecting accounts receivable;
- Potentially adverse tax consequences;
- Reduced protection of intellectual property rights in certain countries;
- Different, complex and changing laws governing intellectual property rights; sometimes affording reduced protection of intellectual property rights in certain countries;
- Difficulties in staffing and managing foreign operations;
- Laws and business practices favoring local competition;
- Costs and difficulties of customizing products for foreign countries;
- Compliance with a wide variety of complex foreign laws, treaties and regulations;

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- Restrictions imposed by local labor practices and laws on our business and operations;
- Rapid changes in government, economic and political policies and conditions; political or civil unrest or instability, terrorism or epidemics and other similar outbreaks or events;
- Operating in countries with a higher incidence of corruption and fraudulent business practices;
- Seasonal reductions in business activity in certain parts of the world, particularly during the summer months in Europe;
- Costs and difficulties of customizing products for foreign countries;
- Transportation delays;
- Tariffs, trade barriers and other regulatory or contractual limitations on our ability to sell or develop our products in certain foreign markets;
- Becoming subject to the laws, regulations and court systems of many jurisdictions;
- Specific and significant regulations, including the European Union’s (“EU”) General Data Protection Regulation (“GDPR”), which as of May 2018, imposes compliance obligations on companies who possess and use data of EU residents, with resultant fines and penalties for failure to comply;
- Uncertainty and resultant political, financial and market instability arising from the United Kingdom’s anticipated exit from the EU (“Brexit”); and
- Risks of violations of Foreign Corrupt Practices Act or similar anti-bribery laws.

In addition, our operating results may be affected by volatility in currency exchange rates and our ability to effectively manage our currency transaction and translation risks because we generally conduct our business, earn revenue and incur costs in the local currency of the countries in which we operate. For example, the financial condition and results of operations of Germany operations are reported in euros and then translated to United States dollars at the applicable currency exchange rate for inclusion in our consolidated financial statements. We do not manage our foreign currency exposure in a manner that would eliminate the effects of changes in foreign exchange rates, which means that changes in exchange rates between these foreign currencies and the United States dollar will affect the recorded levels of our foreign assets and liabilities, as well as our revenues, cost of sales, and operating margins, and could result in exchange losses in any given reporting period. Given the volatility of exchange rates, we can give no assurance that we will be able to effectively manage our currency transaction and/or translation risks or that any volatility in currency exchange rates will not have an adverse effect on our results of operations.

One of our principal stockholders is able to exert substantial influence in determining the outcome of matters which require the approval of our stockholders.

Our Chairman and Chief Executive Officer, S. Kent Rockwell, beneficially owns approximately 28% of our outstanding shares of common stock. As a holder of 28% of our shares of common stock, Mr. Rockwell may have effective control over the election of our Board of Directors and the direction of our affairs. As a result, he could exert considerable influence over the outcome of any corporate matter submitted to our stockholders for approval, including the election of directors and any transaction that might cause a change in control, such as a merger or acquisition. Any stockholders in favor of a matter that is opposed by Mr. Rockwell would have to obtain a significant number of votes to overrule the votes of Mr. Rockwell.

We may need to raise additional capital from time to time if we are going to meet our growth strategy and may be unable to do so on attractive terms.

Expanding our business to meet the growth strategy may require additional investments of capital from time to time, and our existing sources of cash and any funds generated from operations may not provide us with sufficient capital. For various reasons, including any current non-compliance with existing or future lending arrangements, additional financing may not be available when needed, or may not be available on terms favorable to us. If we fail to obtain adequate capital on a timely basis or if capital cannot be obtained at reasonable costs, we may not be able to achieve our planned rate of growth, which will adversely affect our results of operations. Additional equity financing may

result in ownership and economic dilution to our existing stockholders and/or require us to grant certain rights and preferences to new investors. Also, although S. Kent Rockwell, our Chairman and Chief Executive Officer and our controlling stockholder, has previously provided capital to us through related entities (including our current \$15.0 million revolving credit facility), he has no obligation to do so and our stockholders should have no expectation that he will do so in the future.

We are currently dependent on a single supplier of certain printhead components.

We currently rely on a single source to supply certain printhead components used by our 3D printing machines. While we believe that there are other suppliers of printhead components upon which we could rely, we could experience delays and interruptions if our supply is interrupted that might temporarily impact the financial performance of our business.

We may not be able to consummate and/or effectively integrate strategic transactions.

We may from time to time engage in strategic transactions with third parties if we determine that they will likely provide future financial and operational benefits. Successful completion of any strategic transaction depends on a number of factors that are not entirely within our control, including our ability to negotiate acceptable terms, conclude satisfactory agreements and obtain all necessary regulatory approvals. In addition, our ability to effectively integrate an investment into our existing business and culture may not be successful, which could jeopardize future operational performance for the combined businesses.

We explore from time to time various strategic investments and/or alliances. With respect to strategic investments and/or alliances that we may pursue, there is no guarantee that we will complete such transactions on favorable terms or at all. The exploration, negotiation, and consummation of strategic investments and/or alliances may involve significant expenditures by us, which may adversely affect our results of operations at the time such expenses are incurred. We may not be able to successfully negotiate and complete a specific investment or alliance on favorable terms. If we do complete transactions, they may not ultimately strengthen our competitive position or may not be accretive to us for a period of time which may be significant following the completion of such transaction.

We may be required to pay cash, incur debt and/or issue equity securities to pay for any such transaction, each of which could adversely affect our financial condition and the value of our common stock. Our use of cash to pay for transactions would limit other potential uses of our cash. The issuance or sale of equity or convertible debt securities to finance any such transactions would result in dilution to our stockholders. If we incur debt, it could result in increased fixed obligations and could also impose covenants or other restrictions that could impede our ability to manage our operations.

We rely on our information technology (“IT”) systems to manage numerous aspects of our business and customer and supplier relationships, and a disruption or failure of these systems could adversely affect our results of operations.

We rely on our IT systems to manage numerous aspects of our business and provide analytical information to management. We may incur significant costs in order to implement the security measures that we feel are necessary to protect our IT systems. However, our IT systems may remain vulnerable to damage despite our implementation of security measures that we deem to be appropriate. Our IT systems allow us to efficiently purchase products from our suppliers, provide procurement and logistic services, ship products to our customers on a timely basis, maintain cost-effective operations and provide service to our customers. Our IT systems are an essential component of our business and growth strategies, and a disruption to or failure of our IT systems, including our computer systems, could significantly limit our ability to manage and operate our business efficiently. Although we take steps to secure our IT systems, including our computer systems, intranet and internet sites, email and other telecommunications and data networks, the security measures we have implemented may not be effective and our systems may be vulnerable to, among other things, damage and interruption from power loss, including as a result of natural disasters, computer system and network failures, loss of telecommunication services, operator negligence, loss of data, security breaches and computer viruses. If our systems for protecting against cyber security risks prove not to be sufficient, we could be adversely affected by loss or damage of intellectual property, proprietary information, or client data, interruption of business operations, or additional costs to prevent, respond to, or mitigate cyber security attacks. Any such disruption or loss of business information could materially and adversely affect our reputation, brand, results of operations and financial condition.

We could be subject to personal injury, property damage, product liability, warranty and other claims involving allegedly defective products that we supply.

The products we supply are sometimes used in potentially hazardous applications, such as the assembled parts of an aircraft or automobile, that could result in death, personal injury, property damage, loss of production, punitive damages and consequential damages. While we have not experienced any such claims to date, actual or claimed defects in the products we supply could result in our being named as a defendant in lawsuits asserting potentially large claims.

We attempt to include legal provisions in our agreements with customers that are designed to limit our exposure to potential liability for damages arising from defects or errors in our products. However, it is possible that these limitations may not be effective as a result of unfavorable judicial decisions or laws enacted in the future. Any such lawsuit, regardless of merit, could result in material expense, diversion of management time and efforts and damage to our reputation, and could cause us to fail to retain or attract customers, which could adversely affect our results of operations.

Defects in new products or in enhancements to our existing products that give rise to product returns or warranty or other claims could result in material expenses, diversion of management time and attention and damage to our reputation.

Our 3D printing machines may contain undetected defects or errors when first introduced or as enhancements are released that, despite testing, are not discovered until after a machine has been used. This could result in delayed market acceptance of those machines or claims from sales agents, end-users or others, which may result in litigation, increased end-user service and support costs and warranty claims, damage to our reputation and business or significant costs to correct the defect or error. We may from time to time become subject to warranty or product liability claims related to product quality issues that could lead us to incur significant expenses.

We could face liability if our 3D printers are used by our customers to print dangerous objects.

Customers may use our 3D printing machines to print products that could be used in a harmful way or could otherwise be dangerous. For example, there have been recent news reports that 3D printing machines were used to print guns or other weapons. We have little, if any, control over what objects our customers print using our 3D printing machines, and it may be difficult, if not impossible, for us to monitor and prevent customers from printing weapons with our 3D printing machines. While we have never printed firearms in any of our service centers, there can be no assurance that we will not be held liable if someone were injured or killed by a weapon printed by a customer using one of our 3D printing machines.

If any of our manufacturing facilities or PSCs or EACs are disrupted, sales of our products may be disrupted, which could result in loss of revenues and an increase in unforeseen costs.

We manufacture our machines at our facilities in Gersthofen, Germany and North Huntingdon, Pennsylvania. In addition, we have a network of PSCs and EACs in the United States, Germany and Japan to provide sales and marketing and delivery of support and printing services to our customers. If the operations of these facilities are materially disrupted, we would be unable to fulfill customer orders for the period of the disruption, we would not be able to recognize revenue on orders and we might need to modify our standard sales terms to secure the commitment of new customers during the period of the disruption and perhaps longer. Depending on the cause of the disruption, we could incur significant costs to remedy the disruption and resume product shipments. Such a disruption could have an adverse effect on our results of operations.

Our manufacturing facilities, our suppliers' and our customers' facilities are vulnerable to disruption due to natural or other disasters, strikes and other events beyond our control.

A major earthquake, fire, tsunami, hurricane, cyclone or other disaster, such as a major flood, seasonal storms, nuclear event or terrorist attack affecting our facilities or the areas in which they are located, or affecting those of our customers or third party manufacturers or suppliers, could significantly disrupt our or their operations, and delay or prevent product shipment or installation during the time required to repair, rebuild or replace our or their damaged manufacturing facilities. These delays could be lengthy and costly. If any of our manufacturers', suppliers' or customers' facilities are negatively impacted by such a disaster, production, shipment and installation of our 3D printing machines could be delayed, which can impact the period in which we recognize the revenue related to that 3D printing machine sale. Additionally, customers may delay purchases of our products until operations return to normal. Even if we are able to respond quickly to a disaster, the continued effects of the disaster could create uncertainty in our business operations. In addition, concerns about terrorism, the effects of a terrorist attack, political turmoil, labor strikes, war or the outbreak of epidemic diseases could have a negative effect on our operations and sales.

Under applicable employment laws, we may not be able to enforce covenants not to compete and therefore may be unable to prevent our competitors from benefiting from the expertise of some of our former employees.

We generally enter into non-competition agreements with our employees. These agreements prohibit our employees, if they cease working for us, from competing directly with us or working for our competitors or customers for a limited period. We may be unable to enforce these agreements under the laws of the jurisdictions in which our employees work, including Germany and Japan, and it may be difficult for us to restrict our competitors from benefitting from the expertise of our former employees or consultants developed while working for us. If we cannot demonstrate that our legally protectable interests will be harmed, we may be unable to prevent our competitors from benefiting from the expertise of our former employees or consultants and our ability to remain competitive may be diminished.

Risks Related to Our Intellectual Property

We may not be able to protect our trade secrets and intellectual property.

Our success and future revenue growth will depend, in part, on our ability to protect our intellectual property. We cannot assure you that any of our existing or future intellectual property rights will be enforceable, will not be challenged, invalidated or circumvented, or will otherwise provide us with meaningful protection or any competitive advantage.

We rely primarily on a combination of trade secrets, patents, trademarks, confidentiality or non-disclosure agreements and other contractual arrangements with our employees, end-users and others to maintain our competitive position to protect our proprietary technologies and processes globally. While some of our technology is licensed under patents belonging to others or is covered by process patents which are owned or applied for by us, we have devoted substantial resources to the development of our technology, trade secrets, know-how and other unregistered proprietary rights and much of our key technology is not protected by patents. In particular, in fast-growing markets such as China and India, our technology is not protected by patents.

Despite our efforts to protect our proprietary rights, it is possible that competitors or other unauthorized third parties may obtain, copy, use or disclose our technologies, inventions, processes or improvements. While we enter into various agreements intended to protect our proprietary rights, these agreements may be breached and confidential information may be willfully or unintentionally disclosed, and these agreements can be difficult and costly to enforce or may not provide adequate remedies if violated. In addition, our competitors or other parties may learn of our proprietary rights in some other way. Because we cannot legally prevent one or more other companies from developing similar or identical technology to our unpatented technology, it is likely that, over time, one or more other companies may be able to replicate our technology, thereby reducing our technological advantages. If we do not protect our technology or are unable to develop new technology that can be protected by patents or as trade secrets, we may face increased competition from other companies, which may adversely affect our results of operations.

We do, from time to time, apply for patent protection for some of our intellectual property. Our pending patent applications may not be granted. We cannot assure you that any of our existing or future patents will not be challenged, invalidated, or circumvented or will otherwise provide us with meaningful protection. Furthermore, patents are jurisdictional in nature and therefore only protect us in certain markets, rather than globally. We may not be able to obtain foreign patents corresponding to our United States or foreign patent applications. Even if foreign patents are granted, effective enforcement in foreign countries may not be available. If our patents do not adequately protect our technology, our competitors may be able to offer additive manufacturing systems or other products similar to ours. Our competitors may also be able to develop similar technology independently or design around our patents, and we may not be able to detect the unauthorized use of our proprietary technology or take appropriate steps to prevent such use. Any of the foregoing events would lead to increased competition and lower revenues or gross margins, which could adversely affect our operating results.

If our patents and other intellectual property protections do not adequately protect our technology, our competitors may be able to offer products similar to ours. We may not be able to detect the unauthorized use of our proprietary technology and processes or take appropriate steps to prevent such use. Our competitors may also be able to develop similar technology independently or design around our patents. Any of the foregoing events would lead to increased competition and lower revenue or gross profits, which would adversely affect our results of operations.

We may incur substantial costs enforcing or acquiring intellectual property rights and defending against third-party claims as a result of litigation or other proceedings.

In connection with the enforcement of our intellectual property rights, opposing third parties from obtaining patent rights or disputes related to the validity or alleged infringement of our or third-party intellectual property rights, including patent rights, we have been and may in the future be subject or party to claims, negotiations or complex, protracted litigation. Intellectual property disputes and litigation, regardless of merit, can be costly and disruptive to our business operations by diverting attention and energies of management and key technical personnel, and by increasing our costs of doing business. We may not prevail in any such dispute or litigation, and an adverse decision in any legal action involving intellectual property rights, including any such action commenced by us, could limit the scope of our intellectual property rights and the value of the related technology. While we strive to avoid infringing the intellectual property rights of third parties, we cannot provide any assurances that we will be able to avoid any infringement claims.

We may be subject to alleged infringement claims.

Our products and technology, including the technology that we license from others, may infringe the intellectual property rights of third parties. Patent applications in the United States and most other countries are confidential for a period of time until they are published, and the publication of discoveries in scientific or patent literature typically lags actual discoveries by several months or more. As a result, the nature of claims contained in unpublished patent filings around the world is unknown to us, and we cannot be certain that we were the first to conceive inventions covered by our patents or patent applications or that we were the first to file patent applications covering such inventions. Furthermore, it is not possible to know in which countries patent holders may choose to extend their filings under the Patent Cooperation Treaty or other mechanisms. In addition, we may be subject to intellectual property infringement claims from individuals, vendors and other companies, including those that are in the business of asserting patents, but are not commercializing products in the field of 3D printing. Any claims that our products or processes infringe the intellectual property rights of others, regardless of the merit or resolution of such claims, could cause us to incur significant costs in responding to, defending and resolving such claims, and may prohibit or otherwise impair our ability to commercialize new or existing products. Any infringement by us or our licensors of the intellectual property rights of third parties may have a material adverse effect on our business, financial condition and results of operations.

Third-party claims of intellectual property infringement successfully asserted against us may require us to redesign infringing technology or enter into costly settlement or license agreements on terms that are unfavorable to us, prevent us from manufacturing or licensing certain of our products, subject us to injunctions restricting our sale of products and use of infringing technology, cause severe disruptions to our operations or the markets in which we compete, impose costly damage awards or require indemnification of our sales agents and end-users. In addition, as a consequence of such claims, we may incur significant costs in acquiring the necessary third-party intellectual property rights for use in our products or developing non-infringing substitute technology. Any of the foregoing developments could seriously harm our business.

Certain of our employees and patents are subject to the laws of Germany.

Many of our employees work in Germany and are subject to German employment law. Ideas, developments, discoveries and inventions made by such employees and consultants are subject to the provisions of the German Act on Employees' Inventions (Gesetz über Arbeitnehmererfindungen), which regulates the ownership of, and compensation for, inventions made by employees. We face the risk that disputes can occur between us and our employees or ex-employees pertaining to alleged non-adherence to the provisions of this act that may be costly to defend and take up our management's time and efforts whether we prevail or fail in such dispute. In addition, under the German Act on Employees' Inventions, certain employees retained rights to patents they invented or co-invented prior to 2009. Although most of these employees have subsequently assigned their interest in these patents to us, there is a risk that the compensation we provided to them may be deemed to be insufficient in the future and we may be required under German law to increase the compensation due to such employee for the use of their patent. In those cases where employees have not assigned their interests to us, we may need to pay compensation for the use of those patents. If we are required to pay additional compensation or face other disputes under the German Act on Employees' Inventions, our results of operations could be adversely affected.

We may be subject to claims that our employees have wrongfully used or disclosed alleged trade secrets of their former employers.

Certain of our past and present employees were previously employed at other additive manufacturing companies, including our competitors or potential competitors. Some of these employees executed proprietary rights, non-disclosure and non-competition agreements in connection with such previous employment. Although we try to ensure that our employees do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that we or these employees have used or disclosed intellectual property, including trade secrets or other proprietary information, of any such employee's former employer. We are not aware of any threatened or pending claims related to these matters, but in the future litigation may be necessary to defend against such claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable personnel or intellectual property rights. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management.

Risks Related to the Securities Markets and Ownership of Our Common Stock

We have broad discretion as to the use of the net proceeds from securities offerings and may not use them effectively.

We cannot specify with certainty how we may use the net proceeds from securities offerings. Our management has broad discretion in the application of the net proceeds, and we may use these proceeds in ways with which you may disagree or for purposes other than those contemplated at the time of the offering. The failure by our management to apply these funds effectively could have a material adverse effect on our business, financial condition and results of operations. Pending their use, we may invest the net proceeds from a securities offering in a manner that does not produce income or that loses value.

Sales of a significant number of shares of our common stock in the public markets, or the perception that such sales could occur, could depress the market price of our common stock.

Sales of a significant number of shares of our common stock in the public markets or utilization of our universal shelf registration statement could depress the market price of our common stock and impair our ability to raise capital through the sale of additional equity securities. We cannot predict the effect that future sales of our common stock or the market perception that we are permitted to sell a significant number of our securities would have on the market price of our common stock.

The market price of our common stock may fluctuate significantly.

The market price of our common stock has been and is expected to continue to be highly volatile and may be significantly affected by numerous factors, including the risk factors described in this report and other factors which are beyond our control and may not be directly related to our operating performance. These factors include:

- Significant volatility in the market price and trading volume of securities of companies in our sector, which is not necessarily related to the operating performance of these companies;
- The mix of products that we sell, and related services that we provide, during any period;
- Delays between our expenditures to develop and market new products and the generation of sales from those products;
- Changes in the amount that we spend to develop, acquire or license new products, technologies or businesses;
- Changes in our expenditures to promote our products and services;
- Changes in the cost of satisfying our warranty obligations and servicing our installed base of systems;
- Success or failure of research and development projects of us or our competitors;

- Announcements of technological innovations, new solutions or enhancements or strategic partnerships or acquisitions by us or one of our competitors;
- The public's response to press releases or other public announcements by us or third parties, including our filings with the SEC;
- The general tendency towards volatility in the market prices of shares of companies that rely on technology and innovation;
- Changes in regulatory policies or tax guidelines;
- Changes or perceived changes in earnings or variations in operating results;
- Any shortfall in revenue or earnings from levels expected by investors or securities analysts;
- Threatened or actual litigation;
- Changes in our senior management; and
- General economic trends and other external factors, including Brexit.

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If equity research analysts do not publish research or reports about our business, or if they issue unfavorable commentary or downgrade our shares, the price of our shares could decline.

The trading market for our shares will rely in part on the research and reports that equity research analysts publish about us and our business. We do not have control over these analysts, and we do not have commitments from them to write research reports about us. The price of our shares could decline if one or more equity research analysts downgrades our shares, issues other unfavorable or inaccurate commentary or ceases publishing reports about us or our business.

The price of our shares could decline if there are substantial sales of our common stock, particularly by our directors, their affiliates or our executive officers or when there is a large number of shares of our common stock available for sale. The perception in the public market that our stockholders might sell our shares also could depress the market price of our shares. From time to time, we may conduct offerings of our securities and our executive officers, directors and selling stockholders would be subject to lock-up agreements that restrict their ability to transfer their shares following the offering. The market price of our shares may drop significantly when the restrictions on resale by our existing stockholders lapse and these stockholders are able to sell their shares into the market. If this occurs, it could impair our ability to raise additional capital through the sale of securities, should we desire to do so.

We incur increased costs as a result of operating as a public company, and our management is required to devote substantial time to compliance initiatives.

As a public company with shares listed on The NASDAQ Stock Market, we incur significant accounting, legal and other expenses that we would not incur as a private company. Although we now qualify as a “smaller reporting company” pursuant to Rule 12b-2 of the Exchange Act, we still incur significant costs associated with our compliance with the public company reporting requirements of the Exchange Act, requirements imposed by the Sarbanes-Oxley Act (most notably Section 404), the Dodd-Frank Wall Street Reform and Protection Act, and other rules adopted, and to be adopted, by the SEC and the NASDAQ Stock Market. Compliance with these rules and regulations result in increased legal and financial compliance costs and make certain activities more time-consuming and costly. They also make it more difficult for us to obtain director and officer liability insurance, and we incur substantial costs to maintain sufficient coverage.

In addition, changing laws, regulations and standards relating to corporate governance and public disclosure create uncertainty for public companies generally, increasing legal and financial compliance costs and making some activities more time consuming. These laws, regulations and standards are subject to varying interpretations, in many cases due to their lack of specificity, and, as a result, their application in practice may evolve over time as new guidance is provided by regulatory and governing bodies. This could result in continuing uncertainty regarding compliance matters and higher costs necessitated by ongoing revisions to disclosure and governance practices. We have invested resources to comply with evolving laws, regulations and standards, and this investment may result in increased general and administrative expenses and a diversion of management’s time and attention from revenue-generating activities to compliance activities. If our efforts to comply with new laws, regulations and standards differ from the activities intended by regulatory or governing bodies due to ambiguities related to their application and practice, regulatory authorities may initiate legal proceedings against us and our business may be adversely affected. We cannot predict or estimate the amount or timing of additional costs we may incur in the future to respond to these constantly evolving requirements. The impact of these requirements could also make it more difficult for us to attract and retain qualified persons to serve on our Board of Directors, our board committees or as executive officers.

We have never paid cash dividends on our common stock, and we do not anticipate paying any cash dividends on our common stock in the foreseeable future. Therefore, if our share price does not appreciate, our investors may not gain

and could potentially lose on their investment in our shares.

We have never declared or paid cash dividends on our common stock, nor do we anticipate paying any cash dividends on our common stock in the foreseeable future. We currently intend to retain all available funds and any future earnings to fund the development and growth of our business and service and repay indebtedness, if any. As a result, capital appreciation, if any, of our shares will be investors' sole source of gain for the foreseeable future.

The right of stockholders to receive liquidation and dividend payments on our common stock is junior to the rights of holders of indebtedness and to any other senior securities we may issue in the future.

Shares of our common stock are equity interests and do not constitute indebtedness. This means that shares of our common stock will rank junior to all of our indebtedness and to other non-equity claims against us and our assets available to satisfy claims against us, including our liquidation. Additionally, holders of our common stock are subject to the prior dividend and liquidation rights of holders of our outstanding preferred stock, if any. Our Board of Directors is authorized to issue classes or series of preferred stock in the future without any action on the part of our common stockholders.

If we fail to maintain an effective system of internal control over financial reporting in the future, we may not be able to accurately report our financial condition, results of operations or cash flows, which may adversely affect investor confidence in us and, as a result, the value of our common stock.

The Sarbanes-Oxley Act requires, among other things, that we maintain effective internal controls for financial reporting and disclosure controls and procedures. The term “disclosure controls and procedures,” as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act, means controls and other procedures of a company that are 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 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. We are required under Section 404(a) of the Sarbanes-Oxley Act to furnish a report by management on, among other things, the effectiveness of our internal control over financial reporting. This assessment includes disclosure of any material weaknesses identified by our management in our internal control over financial reporting.

Additionally, Section 404(b) of the Sarbanes-Oxley Act requires an attestation from our independent registered public accounting firm on the effectiveness of our internal control over financial reporting beginning with our Annual Report on Form 10-K for the year ended December 31, 2018.

Any failure to maintain internal control over financial reporting could severely inhibit our ability to accurately report our financial condition, results of operations or cash flows. If we are unable to conclude that our internal control over financial reporting is effective, or if our independent registered public accounting firm determines we have a material weakness in our internal control over financial reporting, we could lose investor confidence in the accuracy and completeness of our financial reports, the market price of our common stock could decline, investor groups like Institutional Shareholder Services could initiate a withhold vote campaign with respect to the re-election of the members of our audit committee, and we could be subject to sanctions or investigations by the NASDAQ Stock Market, the SEC or other regulatory authorities. Failure to remedy any material weakness in our internal control over financial reporting, or to implement or maintain other effective control systems required of public companies, could also restrict our future access to the capital markets.

Provisions in our charter documents or Delaware law may inhibit a takeover or make it more difficult to effect a change in control, which could adversely affect the value of our common stock.

Our Certificate of Incorporation and Bylaws contain, and Delaware corporate law contains, provisions that could delay or prevent a change of control or changes in our management. These provisions will apply even if some of our stockholders consider the offer to be beneficial or favorable. If a change of control or change in management is delayed or prevented, the market price of our common stock could decline.

Raising additional capital by issuing securities may cause dilution to our stockholders.

We may need or desire to raise substantial additional capital in the future. Our future capital requirements will depend on many factors, including, among others:

- Research and development investments (including our investment in fine powder capabilities for direct printing and our development efforts tied to large format direct and indirect 3D printing machines);
- Our degree of success in capturing a larger portion of the industrial products production market;
- The costs of establishing or acquiring sales, marketing, and distribution capabilities for our products;

- The costs of preparing, filing, and prosecuting patent applications, maintaining and enforcing our issued patents, and defending intellectual property-related claims;
- The extent to which we acquire or invest in businesses, products or technologies and other strategic relationships; and
- The costs of financing unanticipated working capital requirements and responding to competitive pressures.

If we raise additional funds by issuing equity or convertible debt securities, we may reduce the percentage ownership of our then-existing stockholders, and the holders of those newly-issued equity or convertible debt securities may have rights, preferences, or privileges senior to those possessed by our then-existing stockholders. Additionally, future sales of a substantial number of shares of our common stock or other equity-related securities in the public market could depress the market price of our common stock and impair our ability to raise capital through the sale of additional equity or equity-linked securities. We cannot predict the effect that future sales of our common stock or other equity-related securities would have on the market price of our common stock.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

We have the following locations:

Location	Nature of Facility	Owned or Leased	Approximate Square Footage
United States			
North Huntingdon, Pennsylvania	Corporate Headquarters,	Owned	67,886
	Machine Manufacturing, PSC/EAC		
	and Machine Sales Center		
Troy, Michigan	PSC/EAC	Owned	19,646
St. Clairsville, Ohio	Research and Development	Owned	12,800
Europe			
Gersthofen, Germany	European Headquarters,	Owned	200,585
	Machine Manufacturing, PSC/EAC		
	and Machine Sales Center		
Asia			
Kanagawa, Japan	PSC/EAC and Machine Sales Center	Owned	19,639

Item 3. Legal Proceedings.

We are subject to various litigation, claims, and proceedings which have been or may be instituted or asserted from time to time in the ordinary course of business. Management does not believe that the outcome of any pending or threatened matters will have a material adverse effect, individually or in the aggregate, on our financial position, results of operations or cash flows.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

Item 5. Market for Registrant’s Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.

Market Information

Our common stock has been listed on the NASDAQ Stock Market since February 7, 2013, under the symbol “XONE.”

Stockholders

As of March 5, 2019, there were 37 stockholders of record. The actual number of holders of our common stock is greater than the number of record holders, and includes stockholders who are beneficial owners and 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.

Dividend Policy

We do not anticipate that we will declare or pay regular dividends on our common stock in the foreseeable future, as we generally intend to invest any future earnings in the development and growth of our business. Future dividends, if any, will be at the discretion of our Board of Directors and will depend on many factors, including general economic and business conditions, our strategic plans, our financial results and condition, legal requirements, any contractual obligations or limitations, and other factors that our Board of Directors deems relevant.

Securities Authorized for Issuance Under Equity Compensation Plans

Our 2013 Equity Incentive Plan (the “Plan”) was adopted on January 24, 2013, and approved by our stockholders on August 19, 2013. The table below sets forth information with regard to securities authorized for issuance under the Plan as of December 31, 2018:

Plan Category	Number of Securities to be Issued Upon Exercise of Outstanding Options, Warrants and Rights	Weighted-Average Exercise Price of Outstanding Options, Warrants and Rights	Number of Securities Remaining Available for Future Issuance Under Equity Compensation Plans (Excluding Securities

			Reflected in the First Column)*
Equity Compensation Plans Approved by			
Security Holders	621,986	\$ 10.66	1,024,185
Equity Compensation Plans Not Approved by			
Security Holders	N/A	N/A	N/A

*1,992,241 shares of common stock are currently authorized for issuance under the Plan, which is the maximum amount permitted under the Plan. At January 1, 2018, 1,044,077 shares of common stock remained available for issuance under the Plan. In 2018, awards of stock options and restricted stock were made with a total of 304,500 shares underlying such awards, and 284,608 shares previously subject to awards under the Plan were forfeited or expired.

Item 6. Selected Financial Data.

We are a smaller reporting company as defined by Rule 12b-2 of the Exchange Act and are not required to provide the information under this item.

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

(dollars in thousands, except per-share amounts)

The following discussion and analysis should be read in conjunction with our consolidated financial statements and related notes thereto in Part II Item 8 of this Annual Report on Form 10-K. Certain statements contained in this discussion may constitute forward looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended (the "Securities Act") and Section 21E of the Exchange Act. These statements involve a number of risks, uncertainties and other factors that could cause actual results to differ materially from those reflected in any forward looking statements, as a result of a variety of risks and uncertainties, including those described under Item 1, "Cautionary Statements Concerning Forward Looking Statements" and Item 1A, "Risk Factors".

Overview

Our Business

We are a global provider of 3D printing machines and 3D printed and other products, materials and services to industrial customers. Our business primarily consists of manufacturing and selling 3D printing machines and printing products to specification for our customers using our installed base of 3D printing machines. Our machines serve direct and indirect applications. Direct printing produces a component; indirect printing makes a tool to produce a component. We offer pre-production collaboration and print products for customers through our network of PSCs and EACs. We also supply the associated materials, including consumables and replacement parts, and other services, including training and technical support, that are necessary for purchasers of our 3D printing machines to print products. We believe that our ability to print in a variety of industrial materials, as well as our industry-leading volumetric output (as measured by build box size and printing speed), uniquely position us to serve the needs of industrial customers.

Recent Developments

In April 2018 we completed the introduction of our newest direct 3D printing machine, the Innovent+. Based on the Innovent platform, the Innovent+ system comes with our new ultrasonic recoater designed for material flexibility and ease of use. We believe that the ultrasonic recoater is the most advanced powder dispensing technology in the market. It can be quickly removed for system cleaning or powder change over. Each recoater comes with four screen configurations which allow for greater material compatibility. Expanded dust collection options have been localized to pull powder from around the buildbox and utilize a dust particulate remover with variable control. Expanded dust collection options are compatible with both the Innovent and the Innovent+ 3D printing machine platforms.

In August 2018 we announced the release of 304L stainless steel as a printable material through our PSC/EAC in North Huntingdon, Pennsylvania and as a qualified material on our direct printers. 304L is the most commonly used stainless steel and is suitable to applications in a wide range of industries due to its high durability, corrosion resistance and low cost. Common applications include components for appliances, marine, medical, kitchenware, fasteners and heat exchangers. 304L stainless steel joins 316L stainless steel and 17-4PH stainless steel as high density, single-alloy qualified materials for printing through our PSC/EAC and direct printers, in addition to our matrix materials, which include 420 stainless steel infiltrated with bronze and 316 stainless steel infiltrated with bronze.

In November 2018 we announced the introduction of our next direct 3D printing machine, the X1 25PRO. The X1 25PRO combines the fine metal injection molding powder capability of our Innovent+ with production volume capability. This machine is targeted to meet the needs of metal injection molding, powder metallurgy and

manufacturing customers seeking a larger platform solution for producing reliable parts in a production environment. We expect to commence sales of our X1 25PRO to customers in the second half of 2019.

Outlook

We plan to grow our market leading position with respect to 3D printing solutions for customers and continue advancing our innovations in direct and indirect printing, principally through an expansion of our fine powder (less than 20 micron) direct printing capabilities and development activities associated with large format direct and indirect 3D printing machines. Our focus continues to be industrial markets for utilization of binder jetting technologies for non-polymer based materials. Our strength in industrial markets is rooted in our diverse material capabilities, our lower cost of adoption versus other competing technologies, our faster printing speeds and our scalability to larger product size.

Backlog

At December 31, 2018, our backlog was approximately \$12,300 of which approximately \$9,600 is expected to be fulfilled during the next twelve months. At December 31, 2017, our backlog was approximately \$21,300.

Restructuring

In August 2018 we committed to a plan to consolidate certain of our 3D printing operations from our Houston, Texas facility into our Troy, Michigan facility. These actions were taken as part of our efforts to optimize our business model and maximize our facility utilization. During 2018, we recorded a charge of approximately \$28 split between cost of sales (\$15) and selling, general and administrative expense (\$13) associated with involuntary employee terminations related to this plan. During 2018, we recorded an additional charge of approximately \$1 (to cost of sales) associated with asset impairments related to this plan. There are no additional

charges expected to be incurred associated with this plan in future periods. We settled all amounts associated with involuntary employee terminations during 2018.

At December 31, 2018 we reclassified approximately \$822 in property and equipment relating to our Houston, Texas facility (principally land and building) associated with certain assets meeting required criteria as held for sale (included in prepaid expenses and other current assets in the accompanying consolidated balance sheet).

The consolidation of our 3D printing operations from our Houston, Texas facility into our Troy, Michigan facility is expected to result in a reduction in our annual revenues of approximately \$1,400. Revenues associated with our Houston, Texas facility were approximately \$951 and \$1,932 for 2018 and 2017, respectively. We expect annualized cost savings related to this consolidation of approximately \$1,800, with approximately \$1,600 in the form of cash cost savings (principally employee-related and other operating costs) and approximately \$200 in the form of reduced depreciation expense. Cost savings associated with the exit of this facility are expected to benefit cost of sales by approximately \$1,600 and selling, general and administrative expenses by approximately \$200. We expect to invest these cost savings into technological or process advancements that support either long-term cost benefits or revenue growth.

In December 2017 we committed to a plan to consolidate certain of our 3D printing operations from our Desenzano del Garda, Italy facility into our Gersthofen, Germany facility. These actions were taken as part of our efforts to optimize our business model and maximize our facility utilization. During 2017, we recorded a charge of approximately \$72 split between cost of sales (\$19) and selling, general and administrative expense (\$53) associated with involuntary employee terminations related to this plan. During 2018, we recorded additional charges of approximately \$258 associated with other exit costs (\$17) and asset impairments (\$241) related to this plan. In addition, during 2018, we recorded a gain from disposal of certain property and equipment of approximately \$51 (recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss). Charges associated with other exit costs recorded during 2018 were recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss. Charges associated with asset impairments recorded during 2018 were recorded to cost of sales as a component of depreciation expense in the accompanying statement of consolidated operations and comprehensive loss. Other exit costs relate to the remaining facility rent due under a non-cancellable operating lease following the cessation of operations at the facility in January 2018. Asset impairment charges relate to certain leasehold improvements associated with the exited facility and other equipment which we abandoned. There are no additional charges expected to be incurred associated with this plan in future periods. We settled all amounts associated with involuntary employee terminations and facility rentals during 2018.

The consolidation of our 3D printing operations from our Desenzano del Garda, Italy facility into our Gersthofen, Germany facility is not expected to have a significant impact on our revenues in future periods. We expect annualized cost savings related to this consolidation of approximately \$875, with approximately \$600 in the form of cash cost savings (principally employee-related and other operating costs) and approximately \$275 in the form of reduced depreciation expense. Cost savings associated with the exit of this facility are expected to benefit cost of sales by approximately \$625 and selling, general and administrative expenses by approximately \$250. We expect to invest these cost savings into technological or process advancements that support either long-term cost benefits or revenue growth.

In March 2017, we terminated our Cooperation Agreement with Swerea SWECAST AB (“Swerea”), resulting in an exit of our PSC/EAC operations in Jönköping, Sweden, effective April 1, 2017. Also in March 2017, we agreed to a leasing agreement with Beijer Industri AB, effective April 1, 2017, related to our 3D printing machine and related equipment located on the Swerea premises, previously covered under our Cooperation Agreement with Swerea. Both of these actions were taken in connection with our continuing evaluation of our business model in an effort to both streamline our existing European operations, and to take strategic advantage of our existing relationship with Beijer

Industri AB in promoting indirect binder jet technologies in Scandinavia. There were no penalties or other adverse effects associated with our termination of our Cooperation Agreement with Swerea. There were no significant effects on our results of operations or financial position associated with these actions.

In January 2017, we committed to a plan to consolidate certain of our 3D printing operations from our North Las Vegas, Nevada facility into our Troy, Michigan and Houston, Texas facilities and exit our non-core specialty machining operations in our Chesterfield, Michigan facility. These actions were taken as a result of the accelerating adoption rate of our sand printing technology in North America which has resulted in a refocus of our operational strategy.

As a result of these actions, during 2017, we recorded charges of approximately \$1,016, including approximately \$142 associated with involuntary employee terminations, approximately \$7 associated with other exit costs and approximately \$867 associated with asset impairments. Charges associated with involuntary employee terminations and other exit costs were recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss. Charges associated with asset impairments were split between cost of sales (\$598), as a component of depreciation expense, and selling, general and administrative expenses (\$269), as a component of amortization expense, in the accompanying statement of consolidated operations and comprehensive loss. There are no additional charges expected to be incurred associated with this plan in future periods. We have settled all amounts associated with involuntary employee terminations and other exit costs.

Charges associated with asset impairments relate principally to our plan to exit our non-core specialty machining operations in our Chesterfield, Michigan facility. On April 21, 2017, we sold to a third party certain assets associated with these operations including inventories (approximately \$79), property and equipment (approximately \$2,475) and other contractual rights (approximately \$269). Total gross proceeds from the sale of these assets were approximately \$2,050. After deducting costs directly attributable to the sale of these assets (approximately \$128), we recorded an impairment loss during the three months ended March 31, 2017, of approximately \$859 split between property and equipment (\$590) and intangible assets (\$269) based on the excess of the carrying value over the estimated fair value of the related assets at March 31, 2017 (recorded to cost of sales in the accompanying statement of consolidated

operations and comprehensive loss), and a loss on disposal during the three months ended June 30, 2017, of approximately \$42 (recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss).

Separate from the transaction described above, on May 9, 2017, we sold to a third party certain property and equipment (principally land and building) associated with our North Las Vegas, Nevada facility. Total gross proceeds from the sale of these assets were approximately \$1,950. After deducting costs directly attributable to the sale of these assets (approximately \$137), we recorded a gain on disposal (recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss), of approximately \$347. Additionally, we recorded an impairment loss during 2017 of approximately \$8 associated with certain property and equipment which was abandoned in connection with our exit of our North Las Vegas, Nevada facility.

The consolidation of our 3D printing operations from our North Las Vegas, Nevada facility into our Troy, Michigan and Houston, Texas facilities is not expected to have a significant impact on our revenues in future periods. We expect annualized cost savings related to this consolidation of approximately \$600, with approximately \$570 in the form of cash cost savings (principally employee-related and other operating costs) and approximately \$30 in the form of reduced depreciation expense. All cost savings associated with this consolidation are expected to benefit cost of sales. We expect to invest these cost savings into technological or process advancements that support either long-term cost benefits or revenue growth.

We expect annualized reductions in revenue related to our exit of our non-core specialty machining operations in our Chesterfield, Michigan facility of approximately \$1,400. For 2017 revenues associated with our non-core specialty machining operations in our Chesterfield, Michigan facility were approximately \$346. We expect annualized cost savings related to this exit of approximately \$500, with approximately \$200 in the form of cash cost savings (principally employee-related and other operating costs), approximately \$200 in the form of reduced depreciation expense and approximately \$100 in the form of reduced amortization expense. Cost savings associated with the exit of this facility are expected to benefit cost of sales by approximately \$400 and selling, general and administrative expenses by approximately \$100. We expect to invest these cost savings into technological or process advancements that support either long-term cost benefits or revenue growth.

Impairment

During the three months ended December 31, 2018, as a result of continued operating losses and cash flow deficiencies, we identified a triggering event requiring a test for the recoverability of long-lived assets held and used at the asset group level. Assessing the recoverability of long-lived assets held and used requires significant judgments and estimates by management.

For purposes of testing long-lived assets for recoverability, we operate as three separate asset groups: United States, Europe and Japan. In assessing the recoverability of long-lived assets held and used, we determined the carrying amount of long-lived assets held and used to be in excess of the estimated future undiscounted net cash flows of the related assets. We proceeded to determine the fair value of our long-lived assets held and used, principally through use of the market approach. Our use of the market approach included consideration of market transactions for comparable assets. Management concluded that the fair value of long-lived assets held and used exceeded their carrying value and, as such, no impairment loss was recorded.

A significant decrease in the market price of a long-lived asset, adverse change in the use or condition of a long-lived asset, adverse change in the business climate or legal or regulatory factors impacting a long-lived asset and continued operating losses and cash flow deficiencies associated with a long-lived asset, among other indicators, could cause a future assessment to be performed which may result in an impairment of long-lived assets held and used, resulting in a

material adverse effect on our financial position and results of operations.

Financial Measures

We use several financial and operating metrics to measure our business. We use these metrics to assess the progress of our business, make decisions on where to allocate capital, time and technology investments, and assess longer-term performance within our marketplace. The key metrics are as follows:

Revenue. Our revenue consists of sales of our 3D printing machines and 3D printed and other products, materials and services.

3D printing machines. 3D printing machine revenues consist of 3D printing machine sales and leasing arrangements. Sales of 3D printing machines may also include optional equipment, materials, replacement components and services (installation, training and other services, including maintenance services and/or an extended warranty). 3D printing machine sales and leasing arrangements are influenced by a number of factors including, among other things, the adoption rate of our 3D printing technology, end-user product design and manufacturing activity, the capital expenditure budgets of end-users and potential end-users and other macroeconomic factors. Purchases or leases of our 3D printing machines, particularly our higher-end, higher-priced systems, typically involve long sales cycles. Several factors can significantly affect revenue reported for our 3D printing machines for a given period including, including a customer's capital budgeting cycle, its facility preparedness and the terms of the underlying arrangement with a customer (including certain substantive acceptance provisions) which may vary from period to period.

3D printed and other products, materials and services. 3D printed and other products, materials and services consist of sales of products printed in our global PSC/EAC network or manufactured through our specialty machining operations (through April 2017) or castings, consumable materials and replacement parts for the network of 3D printing machines installed by our global customer base and services for maintenance and certain research and development activities. Our PSCs/EACs utilize our 3D printing machine technology to print products to the specifications of customers. In addition, our PSCs/EACs also provide support and services such as pre-production collaboration prior to printing products for a customer. Sales of consumable materials, replacement parts and service maintenance contracts are linked to the aftermarket opportunities from our growing network of 3D printing machines installed by our global customer base. Research and development arrangements are a function of customer-specific needs in applying our additive manufacturing technologies.

Cost of Sales and Gross Profit. Our cost of sales consists primarily of labor (related to our global workforce), materials (for both the manufacture of 3D printing machines and for our PSC/EAC and other manufacturing operations) and overhead to produce 3D printing machines and 3D printed and other products, materials and services. Also included in cost of sales are license fees (based upon a percentage of revenue of qualifying products and processes) for the use of intellectual properties, warranty costs and other overhead associated with our production processes.

Our gross profit is influenced by a number of factors, the most important of which is the volume and mix of sales of our 3D printing machines and 3D printed and other products, materials and services.

As 3D printing machine sales are cyclical, we seek to achieve a balance in revenue from 3D printing machines and 3D printed and other products, materials and services in order to maximize gross profit while managing business risk. In addition, we expect to reduce our cost of sales over time by continued research and development and supply chain activities directed towards achieving increased efficiencies in our production processes.

Operating Expenses. Our operating expenses consist of research and development expenses and selling, general and administrative expenses.

Research and development expenses. Our research and development expenses consist primarily of salaries and related personnel expenses aimed at 3D printing machine development and materials qualification activities. Additional costs include the related software and materials, laboratory supplies, and costs for facilities and equipment. Research and development expenses are charged to operations as they are incurred. We capitalize the cost of materials, equipment and facilities that have future alternative uses in research and development projects or otherwise.

Selling, general and administrative expenses. Our selling, general and administrative expenses consist primarily of employee-related costs (salaries and benefits) of our executive officers, and sales and marketing (including sales commissions), finance, accounting, information technology and human resources personnel. Other significant general and administrative costs include the facility costs related to our United States and European headquarters and external costs for legal, accounting, consulting and other professional services.

Interest Expense. Interest expense consists of the interest cost associated with our related party revolving credit facility, outstanding long-term debt and capital lease arrangements.

Provision for Income Taxes. We are taxed as a corporation for United States federal, state, local and foreign income tax purposes. Current statutory tax rates in the jurisdictions in which we operate, the United States, Germany, Japan, Italy (through December 2018) and Sweden (through December 2017), are approximately 21.0%, 30.0%, 30.9%, 24.0% and 22.0%, respectively.

Results of Operations

Net Loss

Net loss for 2018 was \$12,667, or \$0.78 per basic and diluted share, compared with a net loss of \$20,017, or \$1.25 per basic and diluted share, for 2017. The decrease in our net loss was principally due to an increase in our revenues and gross profit, a net decrease in our operating expenses (an increase in research and development expenses offset by a decrease in selling, general and administrative expenses) and net nonoperating income (versus net nonoperating expense for the comparable period) primarily due to an approximate \$819 realized gain associated with an insurance recovery for a 3D printing machine damaged by a third party freight company while in transit (all changes further described below).

Revenue

The following table summarizes revenue by product group for each of the years ended December 31:

	2018		2017	
3D printing machines	\$36,393	56.3 %	\$29,980	51.9 %
3D printed and other products, materials				
and services	28,251	43.7 %	27,764	48.1 %
	\$64,644	100.0%	\$57,744	100.0%

Revenue for 2018 was \$64,644 compared with revenue of \$57,744 for 2017, an increase of \$6,900, or 11.9%. The increase in revenue was as a result of increases in revenue attributable to both of our product groups (3D printing machines and 3D printed and other products, materials and services). The increase in revenues from 3D printing machines resulted primarily from an increase in volume of 3D printing machines sold (56 3D printing machines sold during 2018, as compared to 41 3D printing machines sold during 2017), a favorable mix of 3D printing machines sold (as we sold 26 indirect printers during 2018, as compared to 23 indirect printers during 2017, indirect printers generally bearing a higher average selling price than direct printers) and favorable exchange rates (principally the euro versus the United States dollar). The increase in revenues from 3D printed and other products, materials and services principally resulted from an increase in revenues from our direct PSC/EAC printing operations as a result of increased customer acceptance of our binder jet technologies and an increase in consumable material and aftermarket revenues (maintenance services and replacement components for 3D printing machines) based on an increased global installed base of 3D printing machines along with favorable exchange rates (principally the euro versus the United States dollar). These increases in revenues from 3D printed and other products, materials and services were offset by decreases in product sales associated with our former specialty machining operation located in our Chesterfield, Michigan facility (approximately \$346) following the sale of certain assets associated with this operation in April 2017 and a reduction in revenues associated with our indirect PSC/EAC printing operations based on lower customer demand and the impact of our exit of our Houston, Texas facility (further discussed above).

Cost of Sales and Gross Profit

Cost of sales for 2018 was \$43,703 compared with cost of sales of \$43,362 for 2017, an increase of \$341, or 0.8%. The increase in cost of sales was primarily due to an increase in our variable cost of sales associated with our increase in revenues. Offsetting the increase in variable cost of sales was a net decrease of approximately \$999 associated with slow-moving, obsolete and lower of cost or net realizable value inventories (principally due to the difference between the \$1,460 charge associated with our Exerial 3D printing machine platform inventories recorded during the three months ended June 30, 2017 and the \$561 charge associated with our industrial microwave inventories recorded during the three months ended June 30, 2018) and a net decrease in costs associated with exit activities (further described above).

Gross profit for 2018 was \$20,941 compared with gross profit of \$14,382 for 2017. Gross profit percentage was 32.4% for 2018 compared with gross profit percentage of 24.9% for 2017. The increase in gross profit was the result of the increase in revenues net of the increase in cost of sales as further described above. This includes our recognition of five Exerial 3D printing machines during 2017 (associated revenues of approximately \$4,946), which generated lower profitability on a comparable basis to other 3D printing machine sales, such lower profitability being generally consistent with our experience related to new product or technology releases.

Research and Development

Research and development expenses for 2018 were \$10,744 compared with research and development expenses of \$9,909 for 2017, an increase of \$835, or 8.4%. The increase in research and development expenses was primarily due to increases in employee-related costs (salaries, benefits and equity-based compensation) of approximately \$537 (including approximately \$71 in employee termination costs associated with our 2018 global cost realignment) and unfavorable exchange rates (principally the euro versus the United States dollar).

Selling, General and Administrative

Selling, general and administrative expenses for 2018 were \$23,194 compared with selling, general and administrative expenses of \$24,155 for 2017, a decrease of \$961, or 4.0%. The decrease in selling, general and administrative expenses was principally due to decreases associated with equity-based compensation of approximately \$1,250 (as a

result of pre-vesting forfeitures associated with the change in our Chief Executive Officer in June 2018 and a reduction in awards issued to employees under less favorable vesting conditions) and reduction in amortization expense associated with intangible assets of approximately \$578, including the absence of an impairment of intangible assets of approximately \$269 during the three months ended March 31, 2017, in connection with our plan to exit our non-core specialty machining operations at our Chesterfield, Michigan facility. These decreases were offset by an increase in employee-related costs (salaries and benefits) of approximately \$733 (including approximately \$708 in employee termination costs associated with the change in our Chief Executive Officer and our 2018 global cost realignment, both enacted in June 2018) and unfavorable exchange rates (principally the euro versus the United States dollar).

Interest Expense

Interest expense for 2018 was \$254 compared with interest expense of \$94 for 2017, an increase of \$160, or 170.2%. The increase in interest expense was principally due to approximately \$160 in interest incurred in connection with our related party revolving credit facility (further described below) during 2018.

Other (Income) Expense — Net

Other (income) expense — net for 2018 was (\$744) compared with other expense (income) — net of \$203 for 2017. Included in other (income) expense – net for 2018 was approximately \$819 of a realized gain associated with an insurance recovery for a 3D printing machine damaged by a third party freight company while in transit. This amount was offset by a foreign exchange loss of approximately \$245 recognized on the settlement of an intercompany note previously identified as a long-term investment in connection with the dissolution of our former ExOne Italy S.r.l. subsidiary. Amounts for both periods also included interest income on

cash and cash equivalents balances and net foreign exchange (gains) losses on commercial transactions and certain intercompany transactions between subsidiaries either settled or planned for settlement in the foreseeable future.

Provision for Income Taxes

The provision for income taxes for 2018 and 2017 was \$160 and \$38, respectively. The effective tax rate for 2018 and 2017 was 1.3% (provision on a loss) and 0.2% (provision on a loss), respectively. For 2018 and 2017, the effective tax rate differed from the United States federal statutory rate (21.0% for 2018 and 34.0% for 2017) primarily due to net changes in valuation allowances for the respective periods.

We have provided a valuation allowance for our net deferred tax assets as a result of our inability to generate consistent net operating profits in jurisdictions in which we operate. As such, any benefit from deferred taxes in any of the periods presented in our consolidated financial statements has been fully offset by changes in the valuation allowance for net deferred tax assets. We continue to assess our future taxable income by jurisdiction based on our recent historical operating results, the expected timing of reversal of temporary differences, various tax planning strategies that we may be able to enact in future periods, the impact of potential operating changes on our business and our forecast results from operations in future periods based on available information at the end of each reporting period. To the extent that we are able to reach the conclusion that deferred tax assets are realizable based on any combination of the above factors in a single, or multiple, taxing jurisdictions, a reversal of the related portion of our existing valuation allowances may occur.

At December 31, 2018, our ExOne GmbH (2010-2013) and ExOne Property GmbH (2013) subsidiaries were under examination by local taxing authorities. In January 2019 this examination was concluded by the local taxing authorities without significant adjustment to previously established tax positions. As a result, during the three months ended March 31, 2019, we expect to record a reversal of previously recorded liabilities for uncertain tax positions of approximately \$1,187, of which approximately \$367 is expected to be offset against net operating loss carryforwards. We expect to record the remainder, approximately \$820, as a benefit for income taxes during the three months ended March 31, 2019.

Impact of Inflation

Our results of operations and financial condition are presented based on historical cost. While it is difficult to accurately measure the impact of inflation due to the imprecise nature of the estimates required, we believe the effects of inflation, if any, on our results of operations and financial condition are not significant.

Liquidity and Capital Resources

Liquidity

We have incurred a net loss in each of our annual periods since our inception. We incurred net losses of approximately \$12,667 and \$20,017 for 2018 and 2017, respectively. We have received cumulative unrestricted net proceeds from the sale of our common stock (through our initial public offering and subsequent secondary offerings) of approximately \$168,361 to fund our operations. Most recently, we received approximately \$595 in unrestricted net proceeds from the sale of our common stock during the three months ended March 31, 2016 through an At Market Issuance Sales Agreement (“ATM”) with FBR Capital Markets & Co. (“FBR”) and MLV & Co. LLC (“MLV”) pursuant to which FBR and MLV agreed to act as distribution agents in the sale of up to \$50,000 in the aggregate of our common stock in “at the market offerings” as defined in Rule 415 under the Securities Act. Subsequent to the filing of our registration statement on Form S-3 (No. 333-223690) in March 2018, we have not reactivated the ATM and therefore do not consider the ATM to be an active source of liquidity.

In March 2018 we entered into a three-year, \$15,000 revolving credit facility with a related party (further described below).

In June 2018 we initiated our 2018 global cost realignment program focused on a reduction in our production overhead costs and operating expenses in an effort to drive efficiency in our operations and preserve capital.

We believe that our existing capital resources will be sufficient to support our operating plan. If we anticipate that our actual results will differ from our operating plan, we believe we have sufficient capabilities to enact cost savings measures to preserve capital (in addition to the cost savings measures associated with our 2018 global cost realignment program further described above). Further, we may seek to raise additional capital to support our growth through additional debt, equity or other alternatives (including asset sales) or a combination thereof.

Related Party Revolving Credit Facility

On March 12, 2018, ExOne and its ExOne Americas LLC and ExOne GmbH subsidiaries, as guarantors (collectively, the “Loan Parties”), entered into a Credit Agreement and related ancillary agreements with LBM Holdings, LLC (“LBM”), a company controlled by S. Kent Rockwell, who was our Executive Chairman (a related party) at such date and effective June 20, 2018, became our Chairman and Chief Executive Officer, relating to a \$15,000 revolving credit facility (the “LBM Credit Agreement”) to provide additional funding for working capital and general corporate purposes. The LBM Credit Agreement provides for a term of three years (through March 12, 2021) and bears interest at a rate of one month LIBOR plus an applicable margin of 500 basis points (approximately 6.7% and 7.5% at inception and December 31, 2018, respectively). The LBM Credit Agreement requires a commitment fee of 75 basis points, or 0.75%, on the unused portion of the facility, payable monthly in arrears. In addition, an up-front commitment fee of 125 basis points, or 1.25% (approximately \$188), was required at closing. Borrowings under the LBM Credit

Agreement are required to be in minimum increments of \$1,000. ExOne may terminate or reduce the credit commitment at any time during the term of the LBM Credit Agreement without penalty. ExOne may also make prepayments against outstanding borrowings under the LBM Credit Agreement at any time without penalty. Borrowings under the LBM Credit Agreement have been collateralized by the accounts receivable, inventories and machinery and equipment of the Loan Parties. At inception of the credit facility and December 31, 2018, the total estimated value of collateral was in significant excess of the maximum borrowing capacity under the LBM Credit Agreement.

The LBM Credit Agreement contains several affirmative covenants including prompt payment of liabilities and taxes; maintenance of insurance, properties, and licenses; and compliance with laws. The LBM Credit Agreement also contains several negative covenants including restricting the incurrence of certain additional debt; prohibiting future liens (other than permitted liens); prohibiting investment in third parties; limiting the ability to pay dividends; limiting mergers, acquisitions, and dispositions; and limiting the sale of certain property and equipment of the Loan Parties. The LBM Credit Agreement does not contain any financial covenants. The LBM Credit Agreement also contains events of default, including, but not limited to, cross-default to certain other debt, breaches of representations and warranties, change of control events and breaches of covenants.

LBM was determined to be a related party based on common control by S. Kent Rockwell, who was our Executive Chairman at the time we entered into the LBM Credit Agreement and effective June 20, 2018, became our Chairman and Chief Executive Officer. Accordingly, we do not consider the LBM Credit Agreement indicative of a fair market value lending. Prior to execution, the LBM Credit Agreement was subject to review and approval by the Audit Committee of our Board of Directors (our "Board") and by a sub-committee of independent members of our Board. At the time of execution of the LBM Credit Agreement, the \$15,000 in available loan proceeds were deposited into an escrow account with an unrelated, third party financial institution acting as escrow agent pursuant to a separate Escrow Agreement by and among the parties. Loan proceeds held in escrow are available to us upon our submission to the escrow agent of a loan request. Such proceeds will not be available to LBM until payment in-full of the obligations under the LBM Credit Agreement and termination of the LBM Credit Agreement. Payments of principal and other obligations will be made to the escrow agent, while interest payments will be made directly to LBM. Provided there exists no potential default or event of default, the LBM Credit Agreement and Escrow Agreement prohibit any acceleration of repayment of any amount outstanding under the LBM Credit Agreement and prohibit termination of the LBM Credit Agreement or withdrawal from escrow of any unused portion of the LBM Credit Agreement.

There were no borrowings by us under the LBM Credit Agreement from March 12, 2018 through December 31, 2018.

We incurred approximately \$265 in debt issuance costs associated with the LBM Credit Agreement (including the aforementioned up front commitment fee paid at closing to LBM). During 2018, we recorded interest expense relating to the LBM Credit Agreement of approximately \$160. Included in interest expense for 2018 was approximately \$70, associated with amortization of debt issuance costs (resulting in approximately \$195 in remaining debt issuance costs at December 31, 2018, of which approximately \$88 was included in prepaid expenses and other current assets and approximately \$107 was included in other noncurrent assets in the accompanying consolidated balance sheet). Included in interest expense for 2018 was approximately \$90 associated with the commitment fee on the unused portion of the revolving credit facility, of which at December 31, 2018 approximately \$10 was included in accounts payable in the accompanying consolidated balance sheet. We settled all amounts payable to LBM at December 31, 2018 in January 2019.

Cash Flows

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The following table summarizes the significant components of cash flows for each of the years ended December 31 and our ending cash, cash equivalents, and restricted cash balances:

	2018	2017
Net cash used for operating activities	\$(11,843)	\$(9,673)
Net cash (used for) provided by investing activities	(1,229)	2,719
Net cash provided by (used for) financing activities	105	(68)
Effect of exchange rate changes on cash, cash equivalents, and restricted cash	(71)	1,045
Net change in cash, cash equivalents, and restricted cash	\$(13,038)	\$(5,977)

	December 31, 2018	December 31, 2017
Cash and cash equivalents	\$ 7,592	\$ 21,848
Restricted cash	1,548	330
Cash, cash equivalents, and restricted cash	\$ 9,140	\$ 22,178

Operating Activities

Net cash used for operating activities for 2018 was \$11,843 compared with net cash used for operating activities of \$9,673 for 2017. The change of \$2,170 was due to a net increase in working capital attributable to a decrease in net cash inflows from customers (principally due to the timing of cash collections on 3D printing machine sales) and an increase in net cash outflows related to

inventory production of our 3D printing machines and the timing of payments to our suppliers and vendors for our production and operating expenses. The net increase in working capital was partially offset by a decrease in our net loss (further described above).

Investing Activities

Net cash used for investing activities for 2018 was \$1,229 compared with net cash provided by investing activities of \$2,719 for 2017.

For 2018, net cash used for investing activities included approximately \$1,327 in cash outflows associated with capital expenditures. These cash outflows were offset by cash inflows of approximately \$98 in proceeds from the sale of property and equipment.

For 2017, net cash provided by investing activities included approximately \$3,706 in cash inflows associated with proceeds from the sale of property and equipment, mostly attributable to our sale of assets associated with our non-core specialty machining operation in Chesterfield, Michigan and our PSC/EAC in North Las Vegas, Nevada during the three months ended June 30, 2017. These cash inflows were offset by cash outflows of approximately \$987 for capital expenditures.

We expect our 2019 capital expenditures to be limited to spending associated with sustaining our existing operations and strategic asset acquisition and deployment (estimated spending of approximately \$1,000 to \$2,000). We also expect to receive net proceeds from the sale of our former Houston, Texas facility of approximately \$1,000 during 2019.

Financing Activities

Net cash provided by financing activities for 2018 was \$105 compared with net cash used for financing activities of \$68 for 2017.

For 2018, net cash provided by financing activities included approximately \$529 in cash inflows associated with proceeds from the exercise of employee stock options. These cash inflows were offset by cash outflows of approximately \$265 in debt issuance costs associated with our revolving credit facility with a related party (further described above) and approximately \$159 in principal payments on long-term debt and capital lease arrangements.

For 2017, net cash used for financing activities included approximately \$215 in cash outflows associated with principal payments on long-term debt and capital lease arrangements. These cash outflows were offset by cash inflows of approximately \$147 associated with proceeds from the exercise of employee stock options.

At December 31, 2018, we identified that we were not in compliance with the annual cash flow-to-debt service ratio covenant associated with our building note payable (outstanding indebtedness of approximately \$1,533 at December 31, 2018). We requested and were granted a waiver related to compliance with this annual covenant at December 31, 2018 and through December 31, 2019. Related to our 2018 non-compliance, there were no cross default provisions or related impacts on other lending or financing agreements.

Off Balance Sheet Arrangements

In the course of our normal operations, our ExOne GmbH subsidiary issues financial guarantees and letters of credit to third parties in connection with certain commercial transactions requiring security. At December 31, 2018, total outstanding financial guarantees and letters of credit issued by us were approximately \$1,136 (€992) with expiration

dates ranging from March 2019 through February 2023. At December 31, 2017, total outstanding guarantees and letters of credit issued by us were approximately \$1,224 (€1,021).

For further discussion related to financial guarantees and letters of credit issued by us, refer to Note 13 to the consolidated financial statements in Part II Item 8 of this Annual Report on Form 10-K.

Recently Issued and Adopted Accounting Guidance

Refer to Note 1 to the consolidated financial statements included in Part II Item 8 of this Annual Report on Form 10-K.

Critical Accounting Policies and Estimates

Refer to Note 1 to the consolidated financial statements included in Part II Item 8 of this Annual Report on Form 10-K.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

We are a smaller reporting company as defined by Rule 12b-2 of the Exchange Act and are not required to provide the information under this item.

Item 8. Financial Statements and Supplementary Data.

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Management's Report on Internal Control over Financial Reporting

Management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rule 13a-15(f) under the Exchange Act). Our internal control over financial reporting is designed to provide reasonable assurance to management and the board of directors regarding the preparation and fair presentation of published financial statements. Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Therefore, even those systems determined to be effective can provide only reasonable assurance with respect to financial statement preparation and presentation. We conducted an assessment of the effectiveness of our internal control over financial reporting based on the criteria established in Internal Control – Integrated Framework issued by the Committee of Sponsoring Organizations (COSO) of the Treadway Commission (2013 Framework). Based on our assessment, we believe that, as of December 31, 2018, our internal control over financial reporting is effective.

The effectiveness of internal control over financial reporting as of December 31, 2018 has been audited by Schneider Downs & Co. Inc., an independent registered public accounting firm which also audited our consolidated financial statements. Schneider Downs' attestation report on the consolidated financial statements and management's maintenance of effective internal control over financial reporting is included under the heading "Report of Independent Registered Public Accounting Firm."

/s/ S. Kent Rockwell

S. Kent Rockwell

Chief Executive Officer

/s/ Douglas D. Zemba

Douglas D. Zemba

Chief Financial Officer

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors

of The ExOne Company

Opinions on the Consolidated Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of The ExOne Company and Subsidiaries (collectively, the “Company”) as of December 31, 2018 and 2017, and the related consolidated statements of operations and comprehensive loss, changes in stockholders’ equity, and cash flows for each of the years in the two-year period ended December 31, 2018, and the related notes (collectively referred to as the consolidated financial statements). We also have audited the Company’s internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control—Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the consolidated financial position of the Company as of December 31, 2018 and 2017, and the results of its consolidated operations and its cash flows for each of the years in the two-year period ended December 31, 2018, in conformity with accounting principles generally accepted in the United States of America. Also, in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control—Integrated Framework (2013) issued by COSO.

Basis for Opinion

The Company’s management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying “Management’s Report on Internal Control Over Financial Reporting” appearing under Item 8. Our responsibility is to express an opinion on the Company’s consolidated financial statements and an opinion on the Company’s internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

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

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated 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 consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included

performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

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

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

We have served as the Company's auditor since 2016.

/s/ Schneider Downs & Co. Inc.

Schneider Downs & Co. Inc.

Pittsburgh, Pennsylvania

March 15, 2019

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The ExOne Company and Subsidiaries

Statement of Consolidated Operations and Comprehensive Loss

(in thousands, except per-share amounts)

For the years ended December 31,	2018	2017
Revenue	\$64,644	\$57,744
Cost of sales	43,703	43,362
Gross profit	20,941	14,382
Operating expenses		
Research and development	10,744	9,909
Selling, general and administrative	23,194	24,155
	33,938	34,064
Loss from operations	(12,997)	(19,682)
Other (income) expense		
Interest expense	254	94
Other (income) expense – net	(744)	203
	(490)	297
Loss before income taxes	(12,507)	(19,979)
Provision for income taxes	160	38
Net loss	\$(12,667)	\$(20,017)
Net loss per common share:		
Basic	\$(0.78)	\$(1.25)
Diluted	\$(0.78)	\$(1.25)
Comprehensive loss:		
Net loss	\$(12,667)	\$(20,017)
Other comprehensive (loss) income:		
Foreign currency translation adjustments	(1,264)	5,251
Comprehensive loss	\$(13,931)	\$(14,766)

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

The ExOne Company and Subsidiaries

Consolidated Balance Sheet

(in thousands, except share amounts)

	2018	2017
Assets		
Current assets:		
Cash and cash equivalents	\$7,592	\$21,848
Restricted cash	1,548	330
Accounts receivable – net	6,695	8,647
Inventories – net	15,930	15,430
Prepaid expenses and other current assets	2,438	1,710
Total current assets	34,203	47,965
Property and equipment – net	41,906	46,797
Intangible assets – net	—	62
Other noncurrent assets	1,573	736
Total assets	\$77,682	\$95,560
Liabilities		
Current liabilities:		
Current portion of long-term debt	\$144	\$137
Accounts payable	4,376	4,291
Accrued expenses and other current liabilities	6,049	6,096
Deferred revenue and customer prepayments	2,343	8,282
Total current liabilities	12,912	18,806
Long-term debt – net of current portion	1,364	1,508
Other noncurrent liabilities	631	37
Total liabilities	14,907	20,351
Contingencies and commitments		
Stockholders' equity		
Common stock, \$0.01 par value, 200,000,000 shares authorized, 16,234,201		
(2018) and 16,124,617 (2017) shares issued and outstanding	162	161
Additional paid-in capital	175,214	173,718
Accumulated deficit	(101,853)	(89,186)
Accumulated other comprehensive loss	(10,748)	(9,484)
Total stockholders' equity	62,775	75,209
Total liabilities and stockholders' equity	\$77,682	\$95,560

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

The ExOne Company and Subsidiaries

Statement of Consolidated Cash Flows

(in thousands)

For the years ended December 31,	2018	2017
Operating activities		
Net loss	\$(12,667)	\$(20,017)
Adjustments to reconcile net loss to net cash used for operations:		
Depreciation and amortization	5,503	6,278
Equity-based compensation	968	2,456
Amortization of debt issuance costs	75	6
Deferred income taxes	—	1
Provision (recoveries) for bad debts – net	58	(64)
Provision for slow-moving, obsolete and lower of cost or net realizable value inventories – net	1,022	2,056
Gain from disposal of property and equipment – net	(51)	(325)
Changes in assets and liabilities, excluding effects of foreign currency translation adjustments:		
Decrease (increase) in accounts receivable	1,637	(1,733)
(Increase) decrease in inventories	(3,441)	357
Increase in prepaid expenses and other assets	(335)	(856)
Increase in accounts payable	195	2,017
Increase in accrued expenses and other liabilities	181	445
Decrease in deferred revenue and customer prepayments	(4,988)	(294)
Net cash used for operating activities	(11,843)	(9,673)
Investing activities		
Capital expenditures	(1,327)	(987)
Proceeds from sale of property and equipment	98	3,706
Net cash (used for) provided by investing activities	(1,229)	2,719
Financing activities		
Payments on long-term debt	(142)	(137)
Payments on capital leases	(17)	(78)
Proceeds from exercise of employee stock options	529	147
Debt issuance costs	(265)	—
Net cash provided by (used for) financing activities	105	(68)
Effect of exchange rate changes on cash, cash equivalents, and restricted cash	(71)	1,045
Net change in cash, cash equivalents, and restricted cash	(13,038)	(5,977)
Cash, cash equivalents, and restricted cash at beginning of period	22,178	28,155
Cash, cash equivalents, and restricted cash at end of period	\$9,140	\$22,178
Supplemental disclosure of cash flow information		
Cash paid for interest	\$169	\$87
Cash paid for income taxes	\$103	\$5

Supplemental disclosure of noncash investing and financing activities

Transfer of internally developed 3D printing machines from inventories		
to property and equipment for internal use or leasing activities	\$2,194	\$2,868
Transfer of internally developed 3D printing machines from property and equipment		
to inventories for sale	\$1,042	\$3,042
Property and equipment included in assets held for sale	\$822	\$—
Property and equipment included in accounts payable	\$79	\$64
Property and equipment included in accrued expenses and other current liabilities	\$—	\$108
Property and equipment acquired through financing arrangements	\$14	\$48

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

The ExOne Company and Subsidiaries

Statement of Changes in Consolidated Stockholders' Equity

(in thousands)

	Common stock Shares	\$	Additional paid-in capital	Accumulated deficit	Accumulated other comprehensive loss	Total stockholders' equity
Balance at December 31, 2016	16,017	\$ 160	\$ 171,116	\$ (68,761)	\$ (14,735)	\$ 87,780
Cumulative-effect adjustment due to the adoption of Financial Accounting Standards Board Accounting Standards						
Update 2016-16	—	—	—	(408)	—	(408)
Net loss	—	—	—	(20,017)	—	(20,017)
Other comprehensive income	—	—	—	—	5,251	5,251
Equity-based compensation	—	1	2,455	—	—	2,456
Exercise of employee stock options	19	—	147	—	—	147
Common stock issued from equity incentive plan	89	—	—	—	—	—
Balance at December 31, 2017	16,125	161	173,718	(89,186)	(9,484)	75,209
Net loss	—	—	—	(12,667)	—	(12,667)
Other comprehensive loss	—	—	—	—	(1,573)	(1,573)
Effect of dissolution of ExOne Italy S.r.l.	—	—	—	—	309	309
Equity-based compensation	—	—	968	—	—	968
Exercise of employee stock options	67	1	528	—	—	529
Common stock issued from equity incentive plan	42	—	—	—	—	—
Balance at December 31, 2018	16,234	\$ 162	\$ 175,214	\$ (101,853)	\$ (10,748)	\$ 62,775

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

The ExOne Company and Subsidiaries

Notes to the Consolidated Financial Statements

(dollars in thousands, except per-share, share and unit amounts)

Note 1. Summary of Significant Accounting Policies

Organization

The ExOne Company (“ExOne”) is a corporation organized under the laws of the state of Delaware. ExOne was formed on January 1, 2013, when The Ex One Company, LLC, a Delaware limited liability company, merged with and into a Delaware corporation, which survived and changed its name to The ExOne Company (the “Reorganization”). As a result of the Reorganization, The Ex One Company, LLC became ExOne, the common and preferred interest holders of The Ex One Company, LLC became holders of common stock and preferred stock, respectively, of ExOne and the subsidiaries of The Ex One Company, LLC became the subsidiaries of ExOne. The consolidated financial statements include the accounts of ExOne and its wholly-owned subsidiaries, ExOne Americas LLC (United States); ExOne GmbH (Germany); ExOne Property GmbH (Germany); ExOne KK (Japan); through December 2018, ExOne Italy S.r.l. (Italy); and through December 2017, ExOne Sweden AB (Sweden). Collectively, the consolidated group is referred to as the “Company”.

On December 31, 2017, the Company completed a dissolution of its ExOne Sweden AB (Sweden) subsidiary. The purpose of this dissolution was to further simplify the Company’s legal structure. There were no significant accounting or tax related impacts associated with the dissolution of this subsidiary.

On December 28, 2018, the Company completed a dissolution of its ExOne Italy S.r.l. (Italy) subsidiary. The purpose of this dissolution was to further simplify the Company’s legal structure. In connection with the dissolution, the Company settled an intercompany note payable with ExOne Italy S.r.l. previously identified as a long-term investment in the subsidiary. This settlement resulted in the recognition of a \$245 foreign exchange loss (recorded as a component of other (income) expense – net in the accompanying statement of consolidated operations and comprehensive loss). There were no significant tax related impacts associated with the dissolution of this subsidiary.

The Company filed a registration statement on Form S-3 (No. 333-223690) with the Securities and Exchange Commission (“SEC”) on March 15, 2018. The purpose of the Form S-3 was to register, among other securities, debt securities. Subsidiaries of the Company are co-registrants with the Company (“Subsidiary Guarantors”), and the registration statement registered guarantees of debt securities by one or more of the Subsidiary Guarantors. The Subsidiary Guarantors are 100% owned by the Company and any guarantees by the Subsidiary Guarantors will be full and unconditional.

Basis of Presentation

The consolidated financial statements of the Company are prepared in conformity with accounting principles generally accepted in the United States of America (“GAAP”). All material intercompany transactions and balances have been eliminated in consolidation.

Certain amounts relating to current portion of capital leases (\$15) and capital leases – net of current portion (\$36) in the accompanying consolidated balance sheet at December 31, 2017, have been reclassified to accrued expenses and other current liabilities and other noncurrent liabilities, respectively, to conform to current period presentation.

Use of Estimates

The preparation of these consolidated financial statements requires the Company to make certain judgments, estimates and assumptions regarding uncertainties that affect the reported amounts of assets, liabilities, revenue and expenses and related disclosure of contingent assets and liabilities. Areas that require significant judgments, estimates and assumptions include accounting for accounts receivable (including the allowance for doubtful accounts); inventories (including the allowance for slow-moving and obsolete inventories); product warranty reserves; contingencies; income taxes (including the valuation allowance on certain deferred tax assets and liabilities for uncertain tax positions); equity-based compensation (including the valuation of certain equity-based compensation awards issued by the Company); and testing for impairment of long-lived assets (including the identification of asset groups by management, estimates of future cash flows of identified asset groups and fair value estimates used in connection with assessing the valuation of identified asset groups). The Company bases its estimates on historical experience and on various other assumptions that are believed to be reasonable, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates.

Foreign Currency

The local currency is the functional currency for significant operations outside of the United States. The determination of the functional currency of an operation is made based upon the appropriate economic and management indicators.

Foreign currency assets and liabilities are translated into their United States dollar equivalents based upon year end exchange rates, and are included in stockholders' equity as a component of other comprehensive income (loss). Revenues and expenses are translated at average exchange rates. Transaction gains and losses that arise from exchange rate fluctuations are charged to operations as incurred, except for gains and losses associated with certain long-term intercompany transactions between subsidiaries for which settlement is not planned or anticipated in the foreseeable future, which are included in other comprehensive income (loss) in the accompanying statement of consolidated operations and comprehensive loss.

The Company transacts business globally and is subject to risks associated with fluctuating foreign exchange rates. Approximately 54.3% and 56.7% of the consolidated revenue of the Company was derived from transactions outside the United States for 2018 and 2017, respectively. This revenue is generated primarily from wholly-owned subsidiaries operating in their respective countries and surrounding geographic areas. This revenue is primarily denominated in each subsidiary's local functional currency, including the euro and Japanese yen.

Revenue Recognition

The Company derives revenue from the sale of 3D printing machines and 3D printed and other products, materials and services. Revenue is recognized by the Company when persuasive evidence of an arrangement exists, delivery has occurred (generally when title and risk and rewards of ownership have transferred to the customer) or services have been rendered, selling price is fixed or determinable and collectability is reasonably assured.

The Company enters into arrangements that may provide for multiple deliverables to a customer. Sales of 3D printing machines may also include optional equipment, materials, replacement components and services (installation, training and other services, including maintenance services and/or an extended warranty). The Company identifies all products and services that are to be delivered separately under an arrangement and allocates revenue to each based on their relative fair value. Fair values are generally established based on the prices charged when sold separately by the Company (vendor specific objective evidence). The allocated revenue for each deliverable is then recognized ratably based on relative fair values of the components of the sale. In the absence of vendor specific objective evidence or third party evidence in leading to a relative fair value for a sale component, the Company's best estimate of selling price is used. The Company also evaluates the impact of undelivered items on the functionality of delivered items for each sales transaction and, where appropriate, defers revenue on delivered items when that functionality has been affected. Functionality is determined to be met if the delivered products or services represent a separate earnings process.

The Company's arrangements for 3D printing machines generally include substantive customer acceptance provisions for which the Company must determine whether it can objectively demonstrate that either company-specific or customer-specific criteria identified in such provisions have been met prior to recognizing revenue on the transaction. Revenue is generally deferred on all such arrangements until formal acceptance is provided from the customer.

The Company generally provides customers with a standard twelve month warranty on its 3D printing machines. The standard warranty is not treated as a separate service because the standard warranty is an integral part of the sale of the 3D printing machine. At the time of sale, a liability is recorded (with an offset to cost of sales) based upon the expected cost of replacement parts and labor to be incurred over the life of the standard warranty. Following the standard warranty period, the Company offers its customers optional maintenance service contracts or extended warranties. Deferred maintenance service revenues are generally recognized when the maintenance services are performed since the Company has historical evidence that indicates that the costs of performing the services under the contract are not incurred on a straight-line basis.

The Company sells equipment with embedded software to its customers. The embedded software is not sold separately and it is not a significant focus of the Company's marketing effort. The Company does not provide post-contract customer support specific to the software or incur significant costs that are within the scope of Financial Accounting Standards Board ("FASB") guidance on accounting for software to be leased or sold. Additionally, the functionality that the software provides is marketed as part of the overall product. The software embedded in the equipment is incidental to the equipment as a whole such that the FASB guidance referenced above is not applicable. Sales of these products are recognized in accordance with FASB guidance on accounting for multiple-element arrangements.

Shipping and handling costs billed to customers are included in revenue in the accompanying statement of consolidated operations and comprehensive loss. Costs incurred by the Company associated with shipping and handling are included in cost of sales in the accompanying statement of consolidated operations and comprehensive loss.

In assessing collectability as part of the revenue recognition process, the Company considers a number of factors in its evaluation of the creditworthiness of the customer, including past due amounts, past payment history, and current economic conditions. If it is determined that collectability cannot be reasonably assured, the Company will defer recognition of revenue until collectability is assured. For 3D printing machines, the Company's terms of sale vary by transaction. To reduce credit risk in connection with 3D printing machine sales, the Company may, depending upon the circumstances, require customers to furnish letters of credit or bank guarantees or to provide advanced payment (either partial or in full). Prepayments received from customers are reported as deferred revenue and customer prepayments in the accompanying consolidated balance sheet. For 3D printed and other products and materials, the Company's terms of sale generally require payment within 30 to 60 days after delivery, although the Company also recognizes that longer payment periods are customary in certain countries where it transacts business. Service arrangements are generally billed in accordance with specific contract terms and are typically billed in advance or in proportion to performance of the related services.

The Company has entered into certain contracts for the sale of its products and services with the federal government under fixed-fee, cost reimbursable and time and materials arrangements. With respect to cost reimbursable arrangements with the federal government, the Company generally bills for products and services in accordance with provisional rates as determined by the Company. To the extent that provisional rates billed under these contracts differ from actual experience, a billing adjustment (through revenue) is made in the period in which the difference is identified (generally upon completion of its annual Incurred Cost Submission filing as required by the federal government). For 2018 and 2017, revenues and any adjustments related to these contracts were not significant.

Cash and Cash Equivalents

The Company considers all highly liquid instruments with maturities when purchased of three months or less to be cash equivalents. The Company's policy is to invest cash in excess of short-term operating and debt-service requirements in such cash equivalents. These instruments are stated at cost, which approximates fair value because of the short maturity of the instruments. The Company maintains cash balances with financial institutions located in the United States, Germany and Japan. The Company places its cash with high quality financial institutions and believes its risk of loss is limited; however, at times, account balances may exceed international and federally insured limits. The Company has not experienced any losses associated with these cash balances.

Accounts Receivable and Net Investment in Sales-Type Leases

Accounts receivable and net investment in sales-type leases are reported at their net realizable value. The Company carries its investment in sales-type leases based on discounting the minimum lease payments by the interest rate implicit in the lease and less an allowance for doubtful accounts. The Company's estimate of the allowance for doubtful accounts related to accounts receivable and net investment in sales-type leases is based on historical write-off and collections experience, current credit conditions, the age of the related balances and economic factors that may affect a customer's ability to pay. Based upon review of these factors, and management's analysis and judgment, the Company records a specific allowance for that customer's accounts receivable or net investment in sales-type lease balance to reduce the outstanding accounts receivable or net investment in sales-type lease balance to the amount expected to be collected. The allowance is re-evaluated and adjusted periodically as additional information is received that impacts the allowance amount reserved. At December 31, 2018 and 2017, the allowance for doubtful accounts associated with the Company's accounts receivable was approximately \$225 and \$1,193, respectively. At December 31, 2018 and 2017, there was no allowance for doubtful accounts associated with the Company's net investment in sales-type leases. During 2018 and 2017, the Company recorded a net provision (recoveries) for bad debts associated with accounts receivable of approximately \$58 and (\$64), respectively (such amounts recorded as a component of selling, general and administrative expense in the accompanying statement of consolidated operations and comprehensive loss). The remaining change to the allowance for doubtful accounts associated with the Company's accounts receivable for 2018 and 2017 primarily relates to the reversal of previously recorded allowances in connection with the direct write-off of the related accounts receivable balance as future collections were determined to be remote.

Inventories

The Company values all of its inventories at the lower of cost, as determined on the first-in, first-out method or net realizable value. Overhead is allocated to work in process and finished goods based upon normal capacity of the Company's production facilities. Fixed overhead associated with production facilities that are being operated below normal capacity are recognized as a period expense rather than being capitalized as a product cost. An allowance for slow-moving and obsolete inventories is provided based on historical consumption experience, anticipated product demand and product design changes. These provisions reduce the cost basis of the respective inventories and are recorded as a charge to cost of sales.

Property and Equipment

Property and equipment are recorded at cost and depreciated on a straight-line basis over the estimated useful lives of the related assets, generally three to forty years. Leasehold improvements are amortized on a straight-line basis over the shorter of their estimated useful lives or the estimated or contractual lives of the related leases. Gains or losses from the sale of assets are recognized upon disposal or retirement of the related assets. Repairs and maintenance are charged to expense as incurred.

The Company evaluates long-lived assets held and used for impairment whenever events or changes in circumstances indicate that the carrying amount of such assets (asset group) may not be recoverable. Recoverability of assets is determined by comparing the estimated undiscounted net cash flows of the operations related to the assets (asset group) to their carrying amount. An impairment loss would be recognized when the carrying amount of the assets (asset group) exceeds the estimated undiscounted net cash flows. The amount of the impairment loss to be recorded is calculated as the excess of carrying value of assets (asset group) over their fair value. The determination of what constitutes an asset group, the associated undiscounted net cash flows, the fair value of assets (asset group) and the estimated useful lives of assets require significant judgments and estimates by management. No impairment loss related to held and used assets was recorded by the Company during 2018 or 2017.

The Company evaluates long-lived assets held for sale for impairment when the associated long-lived asset (asset group) is first determined to meet the held for sale criteria and in each reporting period thereafter until a disposal is executed or a change in plan occurs. A long-lived asset (asset group) is first determined to meet the held for sale criteria when: management, having the authority to approve the action, commits to a plan to sell the long-lived asset (asset group); the long-lived asset (asset group) is available for immediate sale in its present condition subject only to terms that are usual and customary for sales of such long-lived assets (asset groups); an active program to locate a buyer and other actions required to complete the plan to sell the long-lived asset (asset group)

have been initiated; the sale of the long-lived asset (asset group) is probable, and transfer of the long-lived asset (asset group) is expected to qualify for recognition as a completed sale, within one year; the long-lived asset (asset group) is being actively marketed for sale at a price that is reasonable in relation to its current fair value; and actions required to complete the plan indicate that it is unlikely that significant changes to the plan will be made or that the plan will be withdrawn.

In connection with the Company's exit of its Houston, Texas facility (Note 5), the Company reclassified approximately \$822 in property and equipment (principally land and building) associated with certain long-lived assets meeting required criteria as held for sale (included in prepaid expenses and other current assets in the accompanying consolidated balance sheet at December 31, 2018).

Product Warranty Reserves

Substantially all of the Company's 3D printing machine sales are covered by a standard twelve month warranty. Generally, at the time of sale, a liability is recorded (with an offset to cost of sales) based upon the expected cost of replacement parts and labor to be incurred over the life of the standard warranty. Expected cost is estimated using historical experience for similar products. The Company periodically assesses the adequacy of the product warranty reserves based on changes in these factors and records any necessary adjustments if actual experience indicates that adjustments are necessary. Future claims experience could be materially different from prior results because of the introduction of new, more complex products, a change in the Company's warranty policy in response to industry trends, competition or other external forces, or manufacturing changes that could impact product quality. In the event that the Company determines that its current or future product repair and replacement costs exceed estimates, an adjustment to these reserves would be charged to cost of sales in the period such a determination is made.

Income Taxes

The provision for income taxes is determined using the asset and liability approach of accounting for income taxes. Under this approach, the provision for income taxes represents income taxes paid or payable (or received or receivable) for the current year plus the change in deferred taxes during the year. Deferred taxes represent the future tax consequences expected to occur when the reported amounts of assets and liabilities are recovered or paid, and result from differences between the financial and tax bases of assets and liabilities and are adjusted for changes in tax rates and tax laws when enacted. Valuation allowances are established when necessary to reduce deferred tax assets to the amount expected to be realized.

The Company's foreign subsidiaries are taxed as corporations under the taxing regulations of those respective countries. As a result, the accompanying statement of consolidated operations and comprehensive loss includes a provision for income taxes related to these foreign jurisdictions. Any undistributed earnings are intended to be permanently reinvested in the respective subsidiaries.

The Company recognizes the income tax benefit from an uncertain tax position only if it is more likely than not that the income tax position will be sustained on examination by the taxing authorities based upon the technical merits of the position. The income tax benefits recognized in the consolidated financial statements from such positions are then measured based upon the largest amount that has a greater than 50% likelihood of being realized upon settlement. Income tax benefits that do not meet the more likely than not criteria are recognized when effectively settled, which generally means that the statute of limitations has expired or that the appropriate taxing authority has completed its examination even though the statute of limitations remains open. Interest and penalties related to uncertain tax positions are recognized as part of the provision for income taxes and are accrued beginning in the period that such interest and penalties would be applicable under relevant tax law until such time that the related income tax benefits are recognized.

Taxes on Revenue Producing Transactions

Taxes assessed by governmental authorities on revenue producing transactions, including sales, excise, value added and use taxes, are recorded on a net basis (excluded from revenue) in the accompanying statement of consolidated operations and comprehensive loss.

Research and Development

The Company is involved in research and development of new methods and technologies relating to its products. Research and development expenses are charged to operations as they are incurred. The Company capitalizes the cost of certain materials, equipment and facilities that have alternative future uses in research and development projects or otherwise.

Advertising

Advertising costs are charged to expense as incurred, and were not significant for 2018 or 2017.

Defined Contribution Plan

The Company sponsors a defined contribution savings plan under section 401(k) of the Internal Revenue Code. Under the plan, participating employees in the United States may elect to defer a portion of their pre-tax earnings, up to the Internal Revenue Service's annual contribution limit. During 2018 and 2017 the Company made discretionary matching contributions of 50% of the first 8% of employee contributions, subject to certain Internal Revenue Service limitations. Discretionary matching contributions made by the Company during 2018 and 2017 were approximately \$320 and \$303, respectively.

Equity-Based Compensation

The Company recognizes compensation expense for equity-based grants using the straight-line attribution method in which the expense is recognized ratably over the requisite service period based on the grant date fair value of the related award. Forfeitures of pre-vesting equity-based grants are recognized as they are incurred and result in an offset to equity-based compensation expense in the period of recognition. Fair value of equity-based awards is estimated on the date of grant using the Black-Scholes option pricing model.

Recently Adopted Accounting Guidance

On January 1, 2018, the Company adopted FASB Accounting Standards Update (“ASU”) 2017-09, “Compensation – Stock Compensation: Scope of Modification Accounting.” This ASU requires registrants to apply modification accounting unless three specific criteria are met. The three criteria are: the fair value of the award is the same before and after the modification, the vesting conditions are the same before and after the modification and the classification as a debt or equity award is the same before and after the modification. Management has determined that the adoption of this ASU did not have an impact on the consolidated financial statements of the Company.

On January 1, 2017, the Company adopted FASB ASU 2016-16, “Income Taxes: Intra-Entity Transfers of Assets Other Than Inventory.” This ASU modifies existing guidance and is intended to reduce diversity in practice with respect to the accounting for the income tax consequences of intra-entity transfers of assets. The ASU indicates that the former exception to income tax accounting that requires companies to defer the income tax effects of certain intercompany transactions would apply only to intercompany inventory transactions. That is, the exception no longer applies to intercompany sales and transfers of other assets (e.g., property and equipment or intangible assets). Under the former exception, income tax expense associated with intra-entity profits in an intercompany sale or transfer of assets was eliminated from earnings. Instead, that cost was deferred and recorded on the balance sheet (e.g., as a prepaid asset) until the assets left the consolidated group. Similarly, the entity was prohibited from recognizing deferred tax assets for the increases in tax bases due to the intercompany sale or transfer. A modified retrospective basis of adoption was required for this ASU. As a result, a cumulative-effect adjustment of approximately \$408 has been recorded to accumulated deficit on January 1, 2017, in connection with this adoption.

Recently Issued Accounting Guidance

The Company considers the applicability and impact of all ASUs issued by the FASB. Recently issued ASUs not listed below either were assessed and determined to be not applicable or are currently expected to have no impact on the consolidated financial statements of the Company.

In August 2016, the FASB issued ASU 2016-15, “Statement of Cash Flows: Classification of Certain Cash Receipts and Cash Payments.” This ASU is intended to reduce diversity in practice in how certain cash receipts and payments are presented and classified in the statement of cash flows. The standard provides guidance in a number of situations including, among others, settlement of zero-coupon bonds, contingent consideration payments made after a business combination, proceeds from the settlement of insurance claims, and distributions received from equity method investees. The ASU also provides guidance for classifying cash receipts and payments that have aspects of more than one class of cash flows. This guidance became effective for the Company on January 1, 2019. Management has determined that the adoption of this ASU will not have an effect on the consolidated financial statements of the Company.

In June 2016, the FASB issued ASU 2016-13, “Financial Instruments – Credit Losses.” This ASU added a new impairment model (known as the current expected credit loss (“CECL”) model) that is based on expected losses rather than incurred losses. Under the new guidance, an entity recognizes as an allowance its estimate of expected credit

losses. The CECL model applies to most debt instruments, trade receivables, lease receivables, financial guarantee contracts, and other loan commitments. The CECL model does not have a minimum threshold for recognition of impairment losses and entities will need to measure expected credit losses on assets that have a low risk of loss. These changes become effective for the Company on January 1, 2020. Management is currently evaluating the potential impact of these changes on the consolidated financial statements of the Company.

In February 2016, the FASB issued ASU 2016-02, "Leases." This ASU requires lessees to recognize a right-of-use asset and lease liability on the consolidated balance sheet for leases classified as operating leases. For leases with a term of 12 months or less, a lessee is permitted to make an accounting policy election by class of underlying asset not to recognize a right-of-use asset and lease liability. Additionally, when measuring assets and liabilities arising from a lease, optional payments should be included only if the lessee is reasonably certain to exercise an option to extend the lease, exercise a purchase option, or not exercise an option to terminate the lease. A right-of-use asset represents an entity's right to use the underlying asset for the lease term, and a lease liability represents an entity's obligation to make lease payments. Currently, an asset and liability only are recorded for leases classified as capital leases (financing leases). The measurement, recognition, and presentation of expenses and cash flows arising from leases by a lessee remains the same. This guidance became effective for the Company on January 1, 2019. In connection with the adoption of this guidance, the Company has completed an assessment resulting in an accumulation of all of its leasing arrangements and has validated the information for accuracy and completeness. Upon adoption of the new lease guidance, management expects to record a right-of-use asset and lease liability, each in the amount of approximately \$400, on the Company's consolidated balance sheet for various types of operating leases, including certain machinery and other equipment and vehicles. This amount is equivalent to the aggregate future minimum lease payments on a discounted basis. The Company has also elected to apply the package of transitional practical expedients of the new lease guidance by allowing the Company to not: (1) reassess if expired or existing contracts are, or contain, leases; (2) reassess lease classification for any expired or existing leases; and (3) reassess initial direct costs for any existing leases. Additionally, in July 2018, the FASB issued guidance to provide for an alternative transition method to the new lease guidance, whereby an entity can choose to not reflect the impact of the new lease guidance in the prior periods included in its consolidated

financial statements. The Company plans to utilize this alternative transition method in connection with its adoption on January 1, 2019.

In May 2014, the FASB issued ASU 2014-09, "Revenue from Contracts with Customers." This ASU created a comprehensive framework for all entities in all industries to apply in the determination of when to recognize revenue and, therefore, supersedes virtually all existing revenue recognition requirements and guidance. This framework is expected to provide a consistent and comparable methodology for revenue recognition. The core principle of the guidance is that an entity should recognize revenue to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. To achieve this principle, an entity should apply the following steps: identify the contract(s) with a customer, identify the performance obligations in the contract(s), determine the transaction price, allocate the transaction price to the performance obligations in the contract(s), and recognize revenue when, or as, the entity satisfies a performance obligation. In August 2015, the FASB issued ASU 2015-14, "Revenue from Contracts with Customers: Deferral of the Effective Date," which deferred the effective date of this guidance for the Company until January 1, 2019. The Company adopted this guidance on January 1, 2019, using the modified retrospective approach. Revenue from the Company's sale of 3D printing machines and 3D printed and other products, materials and services continues to generally be recognized when the related machines, products or materials are delivered or accepted by the Company's customers or as the related services are performed by the Company. As such, the adoption of this guidance did not have a material impact on the Company's financial position or results of operations. The Company expects to include the enhanced disclosures required by this guidance in its consolidated financial statements for the three months ended March 31, 2019.

Note 2. Liquidity

The Company has incurred a net loss in each of its annual periods since its inception. As shown in the accompanying statement of consolidated operations and comprehensive loss, the Company incurred a net loss of approximately \$12,667 and \$20,017 for 2018 and 2017, respectively. At December 31, 2018, the Company had approximately \$7,592 in unrestricted cash and cash equivalents.

Since its inception, the Company has received cumulative unrestricted net proceeds from the sale of its common stock (through its initial public offering and subsequent secondary offerings) of approximately \$168,361 to fund its operations. Most recently, the Company received approximately \$595 in unrestricted net proceeds from the sale of its common stock during the three months ended March 31, 2016 through an At Market Issuance Sales Agreement ("ATM") with FBR Capital Markets & Co. ("FBR") and MLV & Co. LLC ("MLV") pursuant to which FBR and MLV agreed to act as distribution agents in the sale of up to \$50,000 in the aggregate of ExOne common stock in "at the market offerings" as defined in Rule 415 under the Securities Act of 1933, as amended (the "Securities Act"). Subsequent to the filing of its registration statement on Form S-3 (No. 333-223690) in March 2018, the Company has not reactivated the ATM and therefore does not consider the ATM to be an active source of liquidity.

In March 2018 the Company entered into a three-year, \$15,000 revolving credit facility with a related party (Note 14) to provide additional funding for working capital and general corporate purposes.

In June 2018 the Company initiated a 2018 global cost realignment program focused on a reduction in the Company's production overhead costs and operating expenses in an effort to drive efficiency in its operations and preserve capital.

Management believes that the Company's existing capital resources will be sufficient to support the Company's operating plan. If management anticipates that the Company's actual results will differ from its operating plan, management believes it has sufficient capabilities to enact cost savings measures to preserve capital (in addition to the costs savings measures associated with the Company's 2018 global cost realignment program further described above).

The Company may also seek to raise additional capital to support its growth through additional debt, equity or other alternatives (including asset sales) or a combination thereof.

Note 3. Accumulated Other Comprehensive Loss

The following table summarizes changes in the components of accumulated other comprehensive loss:

For the years ended December 31,	2018	2017
Foreign currency translation adjustments		
Balance at beginning of period	\$(9,484)	\$(14,735)
Other comprehensive (loss) income before reclassifications	(1,573)	5,251
Amounts reclassified from accumulated other comprehensive loss	309	—
Balance at end of period	\$(10,748)	\$(9,484)

Foreign currency translation adjustments consist of the effect of translation of functional currency financial statements (denominated in the euro and Japanese yen) to the reporting currency of the Company (United States dollar) and certain long-term intercompany transactions between subsidiaries for which settlement is not planned or anticipated in the foreseeable future. For 2018, foreign currency translation adjustments also included approximately \$245 in a foreign exchange loss recognized in connection with the settlement of an intercompany note payable with ExOne Italy S.r.l. previously identified as a long-term investment in the subsidiary (Note 1) and approximately \$64 associated with the dissolution of the related subsidiary (both amounts recognized in other (income) expense – net in the accompanying statement of consolidated operations and comprehensive loss). There were no tax impacts associated with such reclassifications.

Other than the amounts identified above, no amounts were reclassified to earnings for any of the periods presented. There were no tax impacts related to income tax rate changes for any of the periods presented.

Note 4. Loss Per Share

The Company presents basic and diluted loss per common share amounts. Basic loss per common share is calculated by dividing net loss available to common stockholders by the weighted average number of common shares outstanding during the applicable period. Diluted loss per share is calculated by dividing net loss available to common stockholders by the weighted average number of common shares and common equivalent shares outstanding during the applicable period.

As the Company incurred a net loss during 2018 and 2017, basic average common shares outstanding and diluted average common shares outstanding were the same because the effect of potential shares of common stock, including stock options (621,986 — 2018 and 674,470 — 2017) and unvested restricted stock issued (67,001 — 2018 and 52,502 — 2017), was anti-dilutive.

The information used to compute basic and diluted net loss per common share was as follows:

For the years ended December 31,	2018	2017
Net loss	\$(12,667)	\$(20,017)
Weighted average shares outstanding (basic and diluted)	16,176,415	16,062,424
Net loss per common share:		
Basic	\$(0.78)	\$(1.25)
Diluted	\$(0.78)	\$(1.25)

Note 5. Restructuring

Houston, Texas

In August 2018 the Company committed to a plan to consolidate certain of its three-dimensional (“3D”) printing operations from its Houston, Texas facility into its Troy, Michigan facility. These actions were taken as part of the Company’s efforts to optimize its business model and maximize its facility utilization. During 2018, the Company recorded a charge of approximately \$28 split between cost of sales (\$15) and selling, general and administrative expense (\$13) associated with involuntary employee terminations related to this plan. During 2018, the Company recorded an additional charge of approximately \$1 (to cost of sales) associated with asset impairments related to this plan. There are no additional charges expected to be incurred associated with this plan in future periods. The Company settled all amounts associated with involuntary employee terminations during 2018.

Desenzano del Garda, Italy

In December 2017 the Company committed to a plan to consolidate certain of its 3D printing operations from its Desenzano del Garda, Italy facility into its Gersthofen, Germany facility. These actions were taken as part of the Company’s efforts to optimize its business model and maximize its facility utilization. During 2017, the Company recorded a charge of approximately \$72 split between cost of sales (\$19) and selling, general and administrative expense (\$53) associated with involuntary employee terminations related to this plan. During 2018, the Company recorded additional charges of approximately \$258 associated with other exit costs (\$17) and asset impairments

(\$241) related to this plan. In addition, during 2018, the Company recorded a gain from disposal of certain property and equipment of approximately \$51 (recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss). Charges associated with other exit costs recorded during 2018 were recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss. Charges associated with asset impairments recorded during 2018 were recorded to cost of sales as a component of depreciation expense in the accompanying statement of consolidated operations and comprehensive loss. Other exit costs relate to the remaining facility rent due under a non-cancellable operating lease following the cessation of operations at the facility in January 2018. Asset impairment charges relate to certain leasehold improvements associated with the exited facility and other equipment which was abandoned by the Company. There are no additional charges expected to be incurred associated with this plan in future periods. The Company settled all amounts associated with involuntary employee terminations and facility rentals during 2018.

North Las Vegas, Nevada and Chesterfield, Michigan

In January 2017, the Company committed to a plan to consolidate certain of its 3D printing operations from its North Las Vegas, Nevada facility into its Troy, Michigan and Houston, Texas facilities and exit its non-core specialty machining operations in its Chesterfield, Michigan facility. These actions were taken as a result of the accelerating adoption rate of the Company's sand printing technology in North America which has resulted in a refocus of the Company's operational strategy.

As a result of these actions, during 2017, the Company recorded charges of approximately \$1,016, including approximately \$142 associated with involuntary employee terminations, approximately \$7 associated with other exit costs and approximately \$867 associated with asset impairments. Charges associated with involuntary employee terminations and other exit costs were recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss. Charges associated with asset impairments were split between cost of sales (\$598), as a component of depreciation expense, and selling, general and administrative expenses (\$269), as a component of amortization expense, in the accompanying statement of consolidated operations and

comprehensive loss. There are no additional charges expected to be incurred associated with this plan in future periods. The Company has settled all amounts associated with involuntary employee terminations and other exit costs.

Charges associated with asset impairments relate principally to the Company's plan to exit its non-core specialty machining operations in its Chesterfield, Michigan facility. On April 21, 2017, the Company sold to a third party certain assets associated with these operations including inventories (approximately \$79), property and equipment (approximately \$2,475) and other contractual rights (approximately \$269). Total gross proceeds from the sale of these assets were approximately \$2,050. After deducting costs directly attributable to the sale of these assets (approximately \$128), the Company recorded an impairment loss during the three months ended March 31, 2017, of approximately \$859 split between property and equipment (\$590) and intangible assets (\$269) based on the excess of the carrying value over the estimated fair value of the related assets at March 31, 2017 (recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss), and a loss on disposal during the three months ended June 30, 2017, of approximately \$42 (recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss).

Separate from the transaction described above, on May 9, 2017, the Company sold to a third party certain property and equipment (principally land and building) associated with its North Las Vegas, Nevada facility. Total gross proceeds from the sale of these assets were approximately \$1,950. After deducting costs directly attributable to the sale of these assets (approximately \$137), the Company recorded a gain on disposal (recorded to cost of sales in the accompanying statement of consolidated operations and comprehensive loss), of approximately \$347. Additionally, the Company recorded an impairment loss during 2017 of approximately \$8 associated with certain property and equipment which was abandoned in connection with the Company's exit of its North Las Vegas, Nevada facility.

Note 6. Impairment

During the three months ended December 31, 2018, as a result of continued operating losses and cash flow deficiencies, the Company identified a triggering event requiring a test for the recoverability of long-lived assets held and used at the asset group level. Assessing the recoverability of long-lived assets held and used requires significant judgments and estimates by management.

For purposes of testing long-lived assets for recoverability, the Company operates as three separate asset groups: United States, Europe and Japan. In assessing the recoverability of long-lived assets held and used, the Company determined the carrying amount of long-lived assets held and used to be in excess of the estimated future undiscounted net cash flows of the related assets. The Company proceeded to determine the fair value of its long-lived assets held and used, principally through use of the market approach. The Company's use of the market approach included consideration of market transactions for comparable assets. Management concluded that the fair value of long-lived assets held and used exceeded their carrying value and, as such, no impairment loss was recorded.

A significant decrease in the market price of a long-lived asset, adverse change in the use or condition of a long-lived asset, adverse change in the business climate or legal or regulatory factors impacting a long-lived asset and continued operating losses and cash flow deficiencies associated with a long-lived asset, among other indicators, could cause a future assessment to be performed which may result in an impairment of long-lived assets held and used, resulting in a material adverse effect on the financial position and results of operations of the Company.

Note 7. Cash, Cash Equivalents, and Restricted Cash

The following provides a reconciliation of cash, cash equivalents, and restricted cash as reported in the accompanying consolidated balance sheet to the same such amounts shown in the accompanying statement of consolidated cash

flows at December 31:

	2018	2017
Cash and cash equivalents	\$7,592	\$21,848
Restricted cash	1,548	330
Total cash, cash equivalents, and restricted cash shown in the statement of consolidated cash flows	\$9,140	\$22,178

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Restricted cash at December 31, 2018 includes approximately \$1,044 associated with cash collateral required by a German bank for short-term financial guarantees issued by ExOne GmbH in connection with certain commercial transactions requiring security (Note 13). Restricted cash at December 31, 2018 and 2017 includes approximately \$504 and \$330, respectively, associated with cash collateral required by a United States bank to offset certain short-term, unsecured lending commitments associated with the Company's corporate credit card program. Each of the balances described are considered legally restricted by the Company.

Note 8. Inventories

Inventories consisted of the following at December 31:

	2018	2017
Raw materials and components	\$7,747	\$7,171
Work in process	5,147	4,630
Finished goods	3,036	3,629
	\$15,930	\$15,430

Raw materials and components consist of consumable materials and component parts and subassemblies associated with 3D printing machine manufacturing and support activities. Work in process consists of 3D printing machines and other products in varying stages of completion. Finished goods consist of 3D printing machines and other products prepared for sale in accordance with customer specifications.

At December 31, 2018 and 2017, the allowance for slow-moving and obsolete inventories was approximately \$4,143 and \$3,437, respectively, and has been reflected as a reduction to inventories (principally raw materials and components).

During the three months ended June 30, 2018, the Company recorded a charge of approximately \$561 to cost of sales in the accompanying statement of consolidated operations and comprehensive loss attributable to certain industrial microwave inventories based on a sustained absence of demand for such curing solutions and a decision by the Company to discontinue future manufacturing of such industrial microwaves.

During the three months ended June 30, 2017, the Company recorded a charge of approximately \$1,460 to cost of sales in the accompanying statement of consolidated operations and comprehensive loss attributable to certain raw material and component inventories (principally machine frames and other fabricated components) associated with the Company's Exerial 3D printing machine platform based on decisions made by the Company during the period related to certain design changes to the underlying platform (rendering certain elements of the previous design obsolete).

During 2018 and 2017, the Company recorded net charges of approximately \$29 and \$271, respectively, to cost of sales in the accompanying statement of consolidated operations and comprehensive loss associated with certain raw materials and components and work in process inventories for which cost was determined to exceed net realizable value.

Note 9. Long-Lived Assets

Property and Equipment

Property and equipment consisted of the following at December 31:

	2018	2017	Economic Life (in years)
Land	\$7,024	\$7,205	N/A
Buildings and related improvements	25,895	27,785	5 - 40
Machinery and equipment	20,667	22,034	3 - 20
Other	7,121	6,772	3 - 20
	60,707	63,796	
Less: Accumulated depreciation	(19,306)	(17,739)	
	41,401	46,057	
Construction-in-progress	505	740	
Property and equipment - net	\$41,906	\$46,797	

Machinery and equipment includes assets leased by the Company of approximately \$101 and \$85 at December 31, 2018 and 2017, respectively.

Machinery and equipment includes assets leased to customers (principally 3D printing machines and related equipment) under operating lease arrangements of approximately \$2,345 and \$2,254 at December 31, 2018 and 2017, respectively. The carrying value of these assets was approximately \$1,264 and \$1,620 at December 31, 2018 and 2017, respectively.

Minimum future rentals of machinery and equipment under non-cancellable arrangements at December 31, 2018, were as follows:

2019	\$687
2020	148
2021	48
2022	—
2023	—
Thereafter	—
	\$883

Depreciation expense was approximately \$5,439 and \$5,637 for 2018 and 2017, respectively. Depreciation expense for 2017 includes approximately \$598 in accelerated depreciation (impairment) associated with the Company's consolidation of its 3D printing operations from its North Las Vegas, Nevada facility into its Troy, Michigan and Houston, Texas facilities and exit of its specialty machining operations in Chesterfield, Michigan (Note 5).

Intangible Assets

Intangible assets consisted of the following at December 31:

2018	Gross Carrying		Net
	Amount	Accumulated Amortization	
Unpatented technology	\$ 1,388	\$ (1,388)	\$ —
Trade names	30	(30)	—
	\$ 1,418	\$ (1,418)	\$ —

2017	Gross Carrying		Net
	Amount	Accumulated Amortization	
Unpatented technology	\$ 1,453	\$ (1,392)	\$61
Trade names	31	(30)	1
	\$ 1,484	\$ (1,422)	\$62

Amortization expense related to the intangible assets was approximately \$64 and \$641 for 2018 and 2017, respectively. Amortization expense related to the intangible assets for 2017 includes approximately \$269 in accelerated amortization (impairment) associated with the Company's exit of its specialty machining operations in Chesterfield, Michigan (Note 5).

Note 10. Net Investment in Sales-Type Leases

The Company's net investment in sales-type leases consisted of the following at December 31:

2018	2017
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Future minimum lease payments receivable	\$1,969	\$1,100
Less: Unearned interest income	(316)	(159)
Net investment in sales-type leases	\$1,653	\$941

At December 31, 2018, the Company's net investment in sales-type leases was included in accounts receivable (\$302) and other noncurrent assets (\$1,351) in the accompanying consolidated balance sheet. At December 31, 2017, the Company's net investment in sales-type leases was included in accounts receivable (\$205) and other noncurrent assets (\$736) in the accompanying consolidated balance sheet.

Future minimum lease payments due from customers under sales-type leases as of December 31, 2018 were as follows:

2019	\$409
2020	382
2021	382
2022	382
2023	414
Thereafter	—
	\$1,969

During 2018 and 2017, interest income associated with sales-type leases (recorded to revenue in the accompanying statement of consolidated operations and comprehensive loss) was approximately \$48 and \$28, respectively.

Note 11. Accrued Expenses and Other Current Liabilities

Accrued expenses and other current liabilities consisted of the following at December 31:

	2018	2017
Accrued payroll and related costs	\$1,895	\$2,044
Product warranty reserves	1,670	1,300
Liability for uncertain tax positions	820	858
Accrued license fees	721	397
Accrued professional fees	215	223
Value-added taxes payable	140	28
Accrued sales commissions	123	307
Accrued property taxes	108	99
Income taxes payable	90	32
Other	267	808
	\$6,049	\$6,096

Note 12. Product Warranty Reserves

The following table summarizes changes in product warranty reserves (such amounts reflected in accrued expenses and other current liabilities in the accompanying consolidated balance sheet):

For the years ended December 31,	2018	2017
Balance at beginning of period	\$1,300	\$1,115
Provisions for new issuances	1,803	1,288
Payments	(960)	(701)
Reserve adjustments	(434)	(500)
Foreign currency translation adjustments	(39)	98
Balance at end of period	\$1,670	\$1,300

Note 13. Contingencies and Commitments

Contingencies

On March 1, 2018, the Company's ExOne GmbH subsidiary notified Voxeljet AG that it has materially breached a 2003 Patent and Know-How Transfer Agreement and asserted its rights to set-off damages as a result of the breaches against the annual license fee due by the Company under the agreement. At this time, the Company cannot reasonably estimate a contingency, if any, related to this matter.

On July 1, 2017, the Company (through its ExOne GmbH subsidiary) entered into a Settlement Agreement with Kocel Foundry Limited (also known as Kocel CSR Casting Company, Limited) and Kocel Group (Hong Kong) Limited (collectively, “Kocel”) relating to settlement of the arbitration case (no. 100019-2017) administered by the Swiss Chambers’ Arbitration Institution Notice of Arbitration, as filed by the Company on January 25, 2017. Among other things, the Settlement Agreement provided for a cash payment from ExOne GmbH to Kocel of approximately \$811 and a settlement and release of claims related to a sales agreement between the parties for certain 3D printing machines and related equipment (the “Sales Agreement”). Based on the terms of the Settlement Agreement, including the final acceptance by Kocel of the 3D printing machines and related equipment, and relief from further obligation, liability or warranty for both parties (excluding certain intellectual property considerations), the Company recorded revenue of approximately \$2,762 associated with the Sales Agreement (net of the cash payment made by ExOne GmbH to Kocel, such payment made on July 5, 2017) and the related cost of sales, during the three months ended September 30, 2017.

The Company is subject to various litigation, claims, and proceedings which have been or may be instituted or asserted from time to time in the ordinary course of business. Management does not believe that the outcome of any pending or threatened matters will have a material adverse effect, individually or in the aggregate, on the financial position, results of operations or cash flows of the Company.

Financial Guarantees and Letters of Credit

In the normal course of its operations, ExOne GmbH issues financial guarantees and letters of credit to third parties in connection with certain commercial transactions requiring security. ExOne GmbH maintains a credit facility agreement with a German bank which provides for various short-term financings in the form of overdraft credit, financial guarantees, letters of credit and collateral security for commercial transactions for approximately \$1,400 (€1,300). In addition, ExOne GmbH may use the credit facility agreement for short-term, fixed-rate loans in minimum increments of approximately \$100 (€100) with minimum terms of at least thirty days. The overdraft credit interest rate is fixed at 10.2% while the interest rate associated with commercial transactions requiring security

(financial guarantees, letters of credit or collateral security) is fixed at 1.75%. The credit facility agreement has an indefinite term and is subject to cancellation by either party at any time upon repayment of amounts outstanding or expiration of commercial transactions requiring security. There is no commitment fee associated with the credit facility agreement. There are no negative covenants associated with the credit facility agreement. The credit facility agreement has been guaranteed by the Company. At December 31, 2018 and 2017, there were no outstanding borrowings in the form of overdraft credit or short-term loans under the credit facility agreement. At December 31, 2018, total outstanding financial guarantees and letters of credit issued by ExOne GmbH under the credit facility agreement were approximately \$1,044 (€912) with expiration dates ranging from March 2019 through November 2019. At December 31, 2017, total outstanding guarantees and letters of credit issued by ExOne GmbH under the credit facility agreement were approximately \$1,128 (€941).

In addition to amounts issued by ExOne GmbH under the credit facility agreement, during 2017, ExOne GmbH entered into a separate agreement with the same German bank for additional capacity for a financial guarantee associated with a commercial transaction requiring security. Terms of the separate agreement were substantially similar to those of the existing credit security agreement except that the requirement for cash collateral was waived by the German bank as it also represents the counterparty in the related transaction. At December 31, 2017, the outstanding financial guarantee issued by ExOne GmbH under this separate agreement was approximately \$96 (€80) with an expiration date of June 2022.

Leases

The Company leases machinery and other equipment and vehicles under operating lease arrangements (with initial terms greater than twelve months), expiring in various years through 2026.

Future minimum lease payments of operating lease arrangements (with initial terms greater than twelve months) at December 31, 2018, were approximately as follows:

2019	\$170
2020	111
2021	76
2022	67
2023	12
Thereafter	5
	\$441

Rent expense under operating lease arrangements was approximately \$235 and \$358 for 2018 and 2017, respectively.

Note 14. Related Party Revolving Credit Facility

On March 12, 2018, ExOne and its ExOne Americas LLC and ExOne GmbH subsidiaries, as guarantors (collectively, the “Loan Parties”), entered into a Credit Agreement and related ancillary agreements with LBM Holdings, LLC (“LBM”), a company controlled by S. Kent Rockwell, who was the Executive Chairman of the Company (a related party) at such date and effective June 20, 2018, became the Chairman and Chief Executive Officer of the Company, relating to a \$15,000 revolving credit facility (the “LBM Credit Agreement”) to provide additional funding for working capital and

general corporate purposes. The LBM Credit Agreement provides for a term of three years (through March 12, 2021) and bears interest at a rate of one month LIBOR plus an applicable margin of 500 basis points (approximately 6.7% and 7.5% at inception and December 31, 2018, respectively). The LBM Credit Agreement requires a commitment fee of 75 basis points, or 0.75%, on the unused portion of the facility, payable monthly in arrears. In addition, an up-front commitment fee of 125 basis points, or 1.25% (approximately \$188), was required at closing. Borrowings under the LBM Credit Agreement are required to be in minimum increments of \$1,000. ExOne may terminate or reduce the credit commitment at any time during the term of the LBM Credit Agreement without penalty. ExOne may also make prepayments against outstanding borrowings under the LBM Credit Agreement at any time without penalty. Borrowings under the LBM Credit Agreement have been collateralized by the accounts receivable, inventories and machinery and equipment of the Loan Parties. At inception of the credit facility and December 31, 2018, the total estimated value of collateral was in significant excess of the maximum borrowing capacity under the LBM Credit Agreement.

The LBM Credit Agreement contains several affirmative covenants including prompt payment of liabilities and taxes; maintenance of insurance, properties, and licenses; and compliance with laws. The LBM Credit Agreement also contains several negative covenants including restricting the incurrence of certain additional debt; prohibiting future liens (other than permitted liens); prohibiting investment in third parties; limiting the ability to pay dividends; limiting mergers, acquisitions, and dispositions; and limiting the sale of certain property and equipment of the Loan Parties. The LBM Credit Agreement does not contain any financial covenants. The LBM Credit Agreement also contains events of default, including, but not limited to, cross-default to certain other debt, breaches of representations and warranties, change of control events and breaches of covenants.

LBM was determined to be a related party based on common control by S. Kent Rockwell, who was the Executive Chairman of the Company at the time the Company entered into the LBM Credit Agreement and effective June 20, 2018, became the Chairman and

Chief Executive Officer of the Company. Accordingly, the Company does not consider the LBM Credit Agreement indicative of a fair market value lending. Prior to execution, the LBM Credit Agreement was subject to review and approval by the Audit Committee of the Board of Directors (the "Board") and by a sub-committee of independent members of the ExOne Board. At the time of execution of the LBM Credit Agreement, the \$15,000 in available loan proceeds were deposited into an escrow account with an unrelated, third party financial institution acting as escrow agent pursuant to a separate Escrow Agreement by and among the parties. Loan proceeds held in escrow are available to the Company upon its submission to the escrow agent of a loan request. Such proceeds will not be available to LBM until payment in-full of the obligations under the LBM Credit Agreement and termination of the LBM Credit Agreement. Payments of principal and other obligations will be made to the escrow agent, while interest payments will be made directly to LBM. Provided there exists no potential default or event of default, the LBM Credit Agreement and Escrow Agreement prohibit any acceleration of repayment of any amount outstanding under the LBM Credit Agreement and prohibit termination of the LBM Credit Agreement or withdrawal from escrow of any unused portion of the LBM Credit Agreement.

There were no borrowings by the Company under the LBM Credit Agreement from March 12, 2018 (inception) through December 31, 2018.

The Company incurred approximately \$265 in debt issuance costs associated with the LBM Credit Agreement (including the aforementioned up front commitment fee paid at closing to LBM). During 2018, the Company recorded interest expense relating to the LBM Credit Agreement of approximately \$160. Included in interest expense for 2018 was approximately \$70 associated with amortization of debt issuance costs (resulting in approximately \$195 in remaining debt issuance costs at December 31, 2018, of which \$88 was included in prepaid expenses and other current assets and \$107 was included in other noncurrent assets in the accompanying consolidated balance sheet). Included in interest expense for 2018 was approximately \$90 associated with the commitment fee on the unused portion of the revolving credit facility, of which at December 31, 2018 approximately \$10 was included in accounts payable in the accompanying consolidated balance sheet. Amounts payable to LBM at December 31, 2018 were settled by the Company in January 2019.

Note 15. Long-Term Debt

Long-term debt consisted of the following at December 31:

	2018		2017			
	Unamortized Debt Issuance		Unamortized Debt Issuance			
	Principal	Costs	Net	Principal	Costs	Net
Building note payable	\$ 1,533	\$ (25)	\$ 1,508	\$ 1,675	\$ (30)	\$ 1,645
Less: Amount due within one year	(149)	5	(144)	(142)	5	(137)
	\$ 1,384	\$ (20)	\$ 1,364	\$ 1,533	\$ (25)	\$ 1,508

Terms of the building note payable include monthly payments of approximately \$18 including interest at 4.00% through May 2017, and subsequently, monthly payments of approximately \$19 including interest at the monthly average yield on United States Treasury Securities plus 3.25% for the remainder of the term through May 2027. The

building note payable is collateralized by the Company’s facility located in North Huntingdon, Pennsylvania which had a carrying value of approximately \$5,128 at December 31, 2018.

At December 31, 2018, the Company identified that it was not in compliance with the annual cash flow-to-debt service ratio covenant associated with the building note payable. The Company requested and was granted a waiver related to compliance with this annual covenant at December 31, 2018 and through December 31, 2019. Related to the 2018 non-compliance, there were no cross default provisions or related impacts on other lending or financing agreements.

Future maturities of long-term debt at December 31, 2018, were approximately as follows:

2019	\$ 149
2020	157
2021	166
2022	173
2023	182
Thereafter	706
	\$1,533

Note 16. Equity-Based Compensation

On January 24, 2013, the Board adopted the 2013 Equity Incentive Plan (the “Plan”). In connection with the adoption of the Plan, 500,000 shares of common stock were reserved for issuance pursuant to the Plan, with automatic increases in such reserve available each year annually on January 1 from 2014 through 2023 equal to the lesser of 3.0% of the total outstanding shares of common stock as of December 31 of the immediately preceding year or, a number of shares of common stock determined by the Board, provided that

the maximum number of shares authorized under the Plan did not exceed 1,992,241 shares, subject to certain adjustments. The maximum number of shares authorized under the Plan was reached on January 1, 2017. At December 31, 2018, 1,024,185 shares remained available for future issuance under the Plan.

Stock options and restricted stock issued by the Company under the Plan are generally subject to service conditions resulting in annual vesting on the anniversary of the date of grant over a period typically ranging between one and three years. Certain stock options and restricted stock issued by the Company under the Plan vest immediately upon issuance. Stock options issued by the Company under the Plan have contractual lives which expire over a period typically ranging between five and ten years from the date of grant subject to continued service to the Company by the participant.

On February 7, 2018, the Compensation Committee of the Board adopted the 2018 Annual Incentive Program (the “Program”) as a subplan under the Plan. The Program provided an opportunity for performance-based compensation to senior executive officers of the Company, among others. The target annual incentive for each Program participant was expressed as a percentage of base salary and was conditioned on the achievement of certain financial goals (as approved by the Compensation Committee of the Board) or a combination of financial and non-financial goals. The Compensation Committee of the Board retained negative discretion over amounts payable under the Program. For 2018, the total target amount payable under the Program was approximately \$1,423, with certain amounts to be settled with participants in cash, equity or a combination thereof. During 2018, total compensation expense associated with the Program was approximately \$460, split between cost of sales (\$91), research and development (\$127) and selling general and administrative expenses (\$242) in the accompanying statement of consolidated operations and comprehensive loss, of which approximately \$167 is expected to be settled in equity by the Company.

The following table summarizes the total equity-based compensation expense recognized by the Company:

	2018	2017
Equity-based compensation expense recognized:		
Stock options	\$357	\$1,503
Restricted stock	433	953
Other ^(a)	178	—
Total equity-based compensation expense before income taxes	968	2,456
Benefit for income taxes ^(b)	—	—
Total equity-based compensation expense net of income taxes	\$968	\$2,456

(a) Other represents expense associated with the Program and other employee contractual amounts to be settled in equity.

(b) The benefit for income taxes from equity-based compensation for each of the periods presented has been determined to be \$0 based on valuation allowances against net deferred tax assets.

At December 31, 2018, total future compensation expense related to unvested awards yet to be recognized by the Company was approximately \$682 for stock options and \$273 for restricted stock. Total future compensation expense related to unvested awards yet to be recognized by the Company is expected to be recognized over a weighted-average remaining vesting period of approximately 1.2 years.

The fair value of stock options was estimated on the date of grant using the Black-Scholes option pricing model with the following assumptions:

	2018	2017
Weighted average fair value per stock option	\$2.23 - \$4.16	\$3.28 - \$5.75
Volatility	54.05% - 63.67%	61.68% - 67.92%
Average risk-free interest rate	2.45% - 2.98%	1.40% - 1.94%
Dividend yield	0.00%	0.00%
Expected term (years)	2.5 - 3.3	2.5 - 5.5

For certain stock option awards, volatility is estimated based on the historical volatility of the Company when the expected term of the award is less than the period for which the Company has been publicly traded. For certain stock option awards, volatility is estimated based on the historical volatilities of certain peer group companies when the expected term of the award exceeds the period for which the Company has been publicly traded. The average risk-free rate is based on a weighted average yield curve of risk-free interest rates consistent with the expected term of the awards. Expected dividend yield is based on historical dividend data as well as future expectations. Expected term is calculated using the simplified method as the Company does not have sufficient historical exercise experience upon which to base an estimate.

The activity for stock options was as follows:

	2018			2017		
	Number of Stock Options	Weighted Average Exercise Price	Weighted Average Grant Date Fair Value	Number of Stock Options	Weighted Average Exercise Price	Weighted Average Grant Date Fair Value
Outstanding at beginning of period	674,470	\$ 11.58	\$ 6.41	314,303	\$ 15.62	\$ 9.38
Stock options granted	258,100	\$ 8.01	\$ 3.43	389,000	\$ 8.16	\$ 3.89
Stock options exercised	(67,083)	\$ 7.89	\$ 3.85	(18,500)	\$ 7.91	\$ 3.40
Stock options forfeited	(135,169)	\$ 9.48	\$ 5.18	(1,167)	\$ 15.74	\$ 9.60
Stock options expired	(108,332)	\$ 13.28	\$ 7.58	(9,166)	\$ 17.59	\$ 10.77
Outstanding at end of period	621,986	\$ 10.66	\$ 5.52	674,470	\$ 11.58	\$ 6.41
Stock options exercisable						
at end of period	409,914	\$ 11.89	\$ 6.44	421,960	\$ 12.95	\$ 7.39
Stock options expected to vest						
at end of period	212,072	\$ 8.27	\$ 3.76	252,510	\$ 9.28	\$ 4.78

At December 31, 2018, intrinsic value associated with stock options exercisable was approximately \$3. At December 31, 2018, there was no intrinsic value associated with stock options expected to vest. The weighted average remaining contractual term of stock options exercisable and stock options expected to vest at December 31, 2018, was approximately 4.7 and 4.9 years, respectively. Stock options with an aggregate intrinsic value of approximately \$586 were exercised by employees during 2018, resulting in proceeds to the Company from the exercise of stock options of approximately \$529. Stock options with an aggregate intrinsic value of approximately \$218 were exercised by employees during 2017, resulting in proceeds to the Company from the exercise of stock options of approximately \$147. The Company received no income tax benefit related to stock option exercises in either period.

The activity for restricted stock was as follows:

	For the years ended December 31, 2018		For the years ended December 31, 2017	
	Shares of	Weighted Average Grant Date Fair Value	Shares of	Weighted Average Grant Date Fair Value
Outstanding at beginning of period	52,502	\$ 11.07	94,171	\$ 14.29
Restricted stock granted	57,000	\$ 7.39	60,000	\$ 9.01

Restricted stock vested	(42,501)	\$ 10.51	(89,002)	\$ 12.67
Restricted stock forfeited	—	\$ —	(12,667)	\$ 13.95
Outstanding at end of period	67,001	\$ 8.30	52,502	\$ 11.07
Restricted stock expected to vest at end of period	67,001	\$ 8.30	52,502	\$ 11.07

Restricted stock vesting during 2018 and 2017 had a fair value of approximately \$326 and \$801, respectively.

Note 17. Income Taxes

The components of loss before taxes were as follows:

	2018	2017
United States	\$(16,262)	\$(18,064)
Foreign	3,755	(1,915)
Loss before income taxes	\$(12,507)	\$(19,979)

The provision for income taxes consisted of the following:

	2018			2017		
	Current	Deferred	Total	Current	Deferred	Total
United States	\$18	\$ —	\$18	\$ —	\$ —	\$ —
Foreign	142	—	142	37	1	38
Provision for income taxes	\$160	\$ —	\$160	\$37	\$ 1	\$ 38

A reconciliation of the provision for income taxes at the United States statutory rate to the effective rate of the Company for the years ended December 31 was as follows:

	2018	2017
United States statutory rate (21.0% for 2018 and 34.0% for 2017)	\$(2,626)	\$(6,793)
Effect of foreign disregarded entity	(129)	(199)
Taxes on foreign operations	259	35
Net change in valuation allowances	917	8,017
Indebtedness income not subject to income tax	—	(1,208)
Effect of intercompany asset transfers	—	(182)
Permanent differences and other	1,739	368
Provision for income taxes	\$160	\$38
Effective tax rate	(1.3)%	(0.2)%

In December 2017, the Tax Cuts and Jobs Act (the “Tax Act”) was enacted into law. The Tax Act reduces the corporate income tax rate from 34.0% to 21.0% and generally modifies certain United States income tax deductions and the United States taxation of certain foreign earnings, among other changes. The Company is required to recognize the effect of tax law changes in the period of enactment. As a result of the Tax Act, the Company re-measured its United States deferred tax assets and liabilities as well as its valuation allowance against its net United States deferred tax assets at December 31, 2017. In December 2017, the SEC staff issued Staff Accounting Bulletin No. 118: Income Tax Accounting Implications of the 2017 Tax Cuts and Jobs Act, which allows the Company to record provisional amounts during a measurement period not to extend beyond one year of the enactment date. No provisional amounts were recorded by the Company due to the valuation allowance on United States net deferred tax assets, and the accounting related to the Tax Act is now complete as of December 31, 2018.

The components of deferred income tax assets and liabilities consisted of the following at December 31:

	2018	2017
Deferred tax assets		
Accounts receivable	\$46	\$311
Inventories	1,077	1,024
Accrued expenses and other current liabilities	489	549
Net operating loss carryforwards	24,419	22,864
Tax credit carryforwards	676	676
Other	1,059	1,495
Valuation allowance	(26,563)	(25,690)
Total deferred tax assets	1,203	1,229
Deferred tax liabilities		
Property and equipment	703	689
Other	501	541
Total deferred tax liabilities	1,204	1,230
Net deferred tax liabilities ^(a)	\$1	\$1

(a) At December 31, 2018 and 2017, net deferred tax liabilities were reflected in other noncurrent liabilities in the consolidated balance sheet.

The Company has provided a valuation allowance for its net deferred tax assets as a result of the Company not generating consistent net operating profits in jurisdictions in which it operates. As such, any benefit from deferred taxes in any of the periods presented has been fully offset by changes in the valuation allowance for net deferred tax assets. The Company continues to assess its future taxable income by jurisdiction based on recent historical operating results, the expected timing of reversal of temporary differences, various tax planning strategies that the Company may be able to enact in future periods, the impact of potential operating changes on the business and forecast results from operations in future periods based on available information at the end of each reporting period. To the extent that the Company is able to reach the conclusion that its net deferred tax assets are realizable based on any combination of the above factors in a single, or in multiple, taxing jurisdictions, a reversal of the related portion of the Company's existing valuation allowances may occur.

The following table summarizes changes to the Company's valuation allowances for the years ended December 31:

	2018	2017
Balance at beginning of period	\$25,690	\$25,177
Net increases in allowances	1,247	8,017
Tax Act rate change adjustment	—	(7,670)
Foreign currency translation and other adjustments	(374)	166
Balance at end of period	\$26,563	\$25,690

At December 31, 2018, the Company had approximately \$85,674 in net operating loss carryforwards, subject to certain limitations, \$70,100 of which expire from 2033 to 2037, and \$15,574 of which do not expire, and \$676 in tax credit carryforwards which expire in 2023, to offset the future taxable income of its United States subsidiary. At December 31, 2018, the Company had approximately \$3,162 in net operating loss carryforwards which expire from 2019 through 2026, to offset the future taxable income of its Japanese subsidiary. At December 31, 2018, the Company had approximately \$18,303 in net operating loss carryforwards, which do not expire, to offset the future taxable income of its German subsidiary.

The Company has a liability for uncertain tax positions related primarily to certain intercompany transactions.

A reconciliation of the beginning and ending amount of unrecognized tax benefits (including accrued interest and penalties) at December 31 was as follows:

	2018	2017
Balance at beginning of period	\$1,775	\$1,217
Additions based on tax positions related to the current year	60	219
Additions for tax positions of prior years	—	5
Reductions for tax positions of prior years	(606)	—
Settlements	—	(5)
Foreign currency translation adjustments	(43)	339
Balance at end of period	\$1,186	\$1,775

The Company includes interest and penalties related to income taxes as a component of the provision for income taxes in the accompanying statement of consolidated operations and comprehensive loss (there were no such interest or penalties included in the provision for income taxes in 2018 or 2017).

At December 31, 2018 and 2017, there were approximately \$820 and \$858, respectively, in unrecognized tax benefits (including accrued interest and penalties) that if recognized would affect the annual effective tax rate (such amounts were included in accrued expenses and other current liabilities in the accompanying consolidated balance sheet at December 31, 2018 and 2017, respectively).

During 2018, in connection with its periodic re-assessment of its uncertain tax positions, the Company determined that the uncertain tax positions related to its ExOne KK (Japan) subsidiary no longer met the more likely than not criteria, and as a result, the related liability was reversed in-full. No amount was recorded as a component of the provision for income taxes due to existing net operating loss carryforwards.

The Company files income tax returns in the United States, Germany, Japan, Italy (through 2018) and Sweden (through 2017). The following table summarizes tax years remaining subject to examination for each of the Company's subsidiaries at December 31, 2018:

	Tax Years
	Remaining Subject
Jurisdiction	to Examination
United States	2015-2018
Germany	2010-2018
Japan	2017-2018
Italy	2014-2018
Sweden	2015-2017

At December 31, 2018, the Company's ExOne GmbH (2010-2013) and ExOne Property GmbH (2013) subsidiaries were under examination by local taxing authorities in Germany. In January 2019 this examination was concluded by the local taxing authorities in Germany without significant adjustment to previously established tax positions. As a result, during the three months ended March 31, 2019, the Company expects to record a reversal of its previously recorded liabilities for uncertain tax positions of approximately \$1,187, of which approximately \$367 is expected to be offset against net operating loss carryforwards. The Company expects to record the remainder, approximately \$820, as a benefit for income taxes during the three months ended March 31, 2019.

Note 18. Fair Value Measurements

Fair value 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 at the measurement date. When determining the fair value measurements for assets and liabilities which are required to be recorded at fair value, the Company considers the principal or most advantageous market in which the Company would transact and the market-based risk measurements or assumptions that market participants would use in pricing the asset or liability, such as inherent risk, transfer restrictions and credit risk.

The Company applies the following fair value hierarchy, which prioritizes the inputs used to measure fair value into three levels and bases the categorization within the hierarchy upon the lowest level of input that is available and significant to the fair value measurement:

Level 1 Observable inputs such as quoted prices in active markets for identical investments that the Company has the ability to access.

Level 2 Inputs include:

Quoted prices for similar assets or liabilities in active markets;

Quoted prices for identical or similar assets or liabilities in inactive markets;

Inputs, other than quoted prices in active markets, that are observable either directly or indirectly; and

Inputs that are derived principally from, or corroborated by, observable market data by correlation or other means.

Level 3 Inputs that are generally unobservable and typically reflect management's estimates of assumptions that market participants would use in pricing the asset or liability.

The Company is required to disclose its estimate of the fair value of material financial instruments, including those recorded as assets or liabilities in its consolidated financial statements, in accordance with GAAP.

During the three months ended March 31, 2017, the Company entered into two separate foreign exchange forward contracts with a German bank in an effort to hedge the variability of certain foreign exchange risks between the euro (the functional currency of the Company's ExOne GmbH subsidiary) and British pound sterling (the currency basis for cash flows resulting from a commercial sales arrangement with a customer). The first of the two foreign exchange forward contracts was entered into and settled (in connection with cash received from the customer) during the three months ended March 31, 2017, resulting in a realized gain on settlement of approximately \$16 (€15). The second of the two foreign exchange forward contracts was settled on August 31, 2017, resulting in a realized gain on settlement of approximately \$14 (€12). Neither of the contracts was designated as a hedging instrument and accordingly, realized and unrealized gains (losses) for all periods have been recorded to other (income) expense – net in the accompanying statement of consolidated operations and comprehensive loss. The Company has classified both contracts as Level 2 fair value measurements.

The carrying values and fair values of other financial instruments (assets and liabilities) not required to be recorded at fair value were as follows:

	December 31, 2018		December 31, 2017	
	Carrying	Fair	Carrying	Fair
	Value	Value	Value	Value
Cash and cash equivalents	\$7,592	\$7,592	\$21,848	\$21,848
Restricted cash	\$1,548	\$1,548	\$330	\$330
Debt issuance costs ^(a)	\$195	\$—	\$—	\$—
Current portion of long-term debt ^(b)	\$144	\$149	\$137	\$142
Long-term debt - net of current portion ^(b)	\$1,364	\$1,384	\$1,508	\$1,533

(a) Represents debt issuance costs associated with the Company's related party revolving credit facility (Note 14) of which \$88 was included in prepaid expenses and other current assets and \$107 was included in other noncurrent assets in the accompanying consolidated balance sheet at December 31, 2018.

(b) Carrying values at December 31, 2018 and 2017 are net of unamortized debt issuance costs of approximately \$20 and \$25, respectively.

The carrying amounts of cash and cash equivalents, restricted cash and current portion of long-term debt approximate fair value due to their short-term maturities. The fair value of long-term debt – net of current portion has been estimated by management based on the consideration of applicable interest rates (including certain instruments at variable or floating rates). Cash and cash equivalents and restricted cash are classified in Level 1; current portion of long-term debt and long-term debt – net of current portion are classified in Level 2.

Note 19. Concentration of Credit Risk

During 2018 and 2017, the Company conducted a significant portion of its business with a limited number of customers, though not necessarily the same customers for each respective period. During 2018 and 2017, the Company's five most significant customers represented approximately 16.5% and 20.5% of total revenue, respectively. At December 31, 2018 and 2017, accounts receivable from the Company's five most significant customers were approximately \$2,344 and \$4,199, respectively.

Note 20. Related Party Transactions

Revenues

During 2017, sales of products and/or services to related parties were approximately \$33. None of the transactions met a threshold requiring review and approval by the Audit Committee of the Board of Directors in accordance with Company policy. There were no sales of products and/or services to related parties during 2018.

There were no amounts due from related parties at December 31, 2018 or 2017.

Expenses

During 2018 and 2017, purchases of products and/or services from related parties were approximately \$27 and \$14, respectively. Purchases of products and/or services by the Company during 2018 and 2017 included website design services and leased office space from related parties under common control by S. Kent Rockwell, who is the Chairman and Chief Executive Officer of the Company and prior to June 20, 2018, was the Executive Chairman of the Company. None of the transactions met a threshold requiring review and approval by the Audit Committee of the Board in accordance with Company policy.

Amounts due to related parties at both December 31, 2018 and 2017 were approximately \$1 and are reflected in accounts payable in the accompanying consolidated balance sheet.

The Company also receives the benefit of the corporate use of an airplane from a related party under common control by S. Kent Rockwell, who is the Chairman and Chief Executive Officer of the Company and prior to June 20, 2018, was the Executive Chairman of the Company, for no consideration. The Company estimates the fair market value of the benefits received during 2018 was approximately \$8. There were no such benefits received during 2017.

Other

Refer to Note 14 for further discussion relating to a revolving credit facility with a related party entered into in March 2018.

Note 21. Other (Income) Expense – Net

Other (income) expense – net consisted of the following:

	2018	2017
Gain on settlement of insurance claim	\$(819)	\$(1)
Interest income	(39)	(56)
Foreign currency losses – net	93	199
Bank fees	95	122
Other – net	(74)	(61)
	\$(744)	\$203

For 2018, gain on settlement of insurance claim represented approximately \$819 of a realized gain associated with an insurance recovery for a 3D printing machine damaged by a third party freight company while in transit. For 2018, foreign currency losses – net included approximately \$245 of a foreign exchange loss associated with settlement of an intercompany note payable with ExOne Italy S.r.l. previously identified as a long-term investment in the subsidiary (Note 1).

Note 22. Segment, Product and Geographic Information

The Company manages its business globally in a singular operating segment in which it develops, manufactures and markets 3D printing machines, 3D printed and other products, materials and services. Geographically, the Company conducts its business through wholly-owned subsidiaries in the United States, Germany, Japan, Italy (through December 2018) and Sweden (through December 2017).

Revenue by product group for the year ended December 31 was as follows:

	2018	2017
3D printing machines	\$36,393	\$29,980
3D printed and other products, materials and services	28,251	27,764
	\$64,644	\$57,744

Geographic information for revenue for the year ended December 31 was as follows (based on the country where the sale originated):

	2018	2017
United States	\$29,514	\$25,008
Germany	27,084	27,497
Japan	8,027	4,115
Italy ^(a)	19	917
Sweden ^(b)	—	207
	\$64,644	\$57,744

(a) In December 2017 the Company committed to a plan to consolidate certain of its 3D printing operations from its Desenzano del Garda, Italy facility into its Gersthofen, Germany facility (Note 5). Operations at the Desenzano del Garda, Italy facility effectively ceased during the three months ended March 31, 2018 and in December 2018, the Company completed the dissolution of its ExOne Italy S.r.l. subsidiary.

(b) In March 2017 the Company terminated its Cooperation Agreement with Swerea SWECAST AB (“Swerea”), resulting in an exit of its PSC/EAC operations in Jönköping, Sweden, effective April 1, 2017. Also in March 2017 the Company agreed to an operating lease agreement with Beijer Industri AB, effective April 1, 2017, related to the 3D printing machine and related equipment located on the Swerea premises, previously covered under the Cooperation Agreement with Swerea. For 2017 revenues considered to be originated from Sweden are limited to the PSC/EAC operations which ceased on April 1, 2017. Revenues associated the operating lease agreement with Beijer Industri AB subsequent to April 1, 2017, are considered to be originated from Germany.

Geographic information for long-lived assets at December 31 was as follows (based on the physical location of assets):

	2018	2017
United States	\$13,603	