3D SYSTEMS CORP
Form 10-K
February 28, 2019

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

FORM 10-K

x ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2018
OR
TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the transition period from ____________to____________

Commission File No. 001-34220

3D SYSTEMS CORPORATION
(Exact Name of Registrant as Specified in Its Charter)

DELAWARE	95-4431352
(State or Other Jurisdiction of Incorporation or Organization)	(I.R.S. Employer Identification No.)
333 THREE D SYSTEMS CIRCLE ROCK HILL, SOUTH CAROLINA	29730
(Address of Principal Executive Offices)	(Zip Code)

(Registrant's Telephone Number, Including Area Code): (803) 326-3900

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

Title of each class	Name of each exchange on which registered
Common stock, par value $0.001 per share	The New York Stock Exchange

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

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Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes x 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 x

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

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§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 x 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 an emerging growth company. See the definitions of “large accelerated filer,” “accelerated filer,” “smaller reporting company” and “emerging growth company” in Rule 12b-2 of the Exchange Act. (Check one):

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

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

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

APPLICABLE ONLY TO CORPORATE ISSUERS:

The aggregate market value of the registrant’s common stock held by non-affiliates of the registrant on June 30, 2018 was $1,466,778,357. For purposes of this computation, it has been assumed that the shares beneficially held by directors and executive officers of the registrant were “held by affiliates.” This assumption is not to be deemed an admission by these persons that they are affiliates of the registrant.

Indicate the number of shares outstanding of each of the issuer’s classes of common stock, as of the latest practicable date.
Shares of Common Stock, par value $0.001, outstanding as of February 15, 2019 was 114,340,207.

DOCUMENTS INCORPORATED BY REFERENCE: Portions of the registrant’s definitive proxy statement for its 2019 Annual Meeting of Stockholders are incorporated by reference into Part III of this Form 10-K.

3D SYSTEMS CORPORATION
Annual Report on Form 10 K for the
Year Ended December 31, 2018

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This Annual Report on Form 10-K ("Form 10-K") contains forward-looking statements, within the meaning of the Private Securities Litigation Reform Act of 1995, that involve risks and uncertainties. Many of the forward-looking statements are located in Part II, Item 7 of this Form 10-K under the heading "Management's Discussion and Analysis of Financial Condition and Results of Operations." Forward-looking statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from historical results or from any future results expressed or implied by such forward-looking statements. In many cases, you can identify forward-looking statements by terms such as "believes," "belief," "expects," "may", "will", "estimates," "intends," "anticipates," or "plans" or the negative of these terms or other comparable terminology. Forward-looking statements are based upon management's beliefs, assumptions and current expectations concerning future events and trends, using information currently available, and are necessarily subject to uncertainties, many of which are outside our control. Although we believe that the expectations reflected in the forward-looking statements are reasonable, forward-looking statements are not, and should not be relied upon as a guarantee of future performance or results, nor will they necessarily prove to be accurate indications of the times at or by which any such performance or results will be achieved. A number of important factors could cause actual results to differ materially from those expressed in or implied by the forward-looking statements. Factors that could cause such differences include, but are not limited to, those discussed in Part I, Item 1A of this Form 10-K under the heading "Risk Factors." All subsequent written and oral forward-looking statements attributable to the Company or to individuals acting on our behalf are expressly qualified in their entirety by this discussion. The Company assumes no obligation to revise or update any forward-looking statements for any reason, except as required by law.

PART I

Item 1. Business

General

3D Systems Corporation ("3D Systems" or the "Company" or "we" or "us") is a holding company incorporated in Delaware in 1993 that markets our products and services through subsidiaries in North America and South America (collectively referred to as "Americas"), Europe and the Middle East (collectively referred to as "EMEA") and the Asia Pacific region ("APAC"). We provide comprehensive 3D printing solutions, including 3D printers for plastics and metals, materials, software, on demand manufacturing services and digital design tools. Our solutions support advanced applications in a wide range of industries and verticals, including healthcare, aerospace, automotive and durable goods.

Customers can use our 3D solutions to design and manufacture complex and unique parts, eliminate expensive tooling, produce parts locally or in small batches and reduce lead times and time to market. A growing number of customers are shifting from prototyping applications to also using 3D printing for production. We believe this shift will be further driven by our continued advancement and innovation of 3D printing solutions that improve durability, repeatability, productivity and total cost of operations.

Our precision healthcare capabilities include simulation; Virtual Surgical Planning ("VSP™"); and printing of medical and dental devices, anatomical models, and surgical guides and instruments. We have over 30 years of experience and expertise which have proven vital to our development of end-to-end solutions that enable customers to optimize product designs, transform workflows, bring innovative products to market and drive new business models.

Products

We offer a comprehensive range of 3D printers, materials, software, haptic design tools, 3D scanners and virtual surgical simulators.

3D Printers and Materials

Our 3D printers transform digital data input generated by 3D design software, CAD software or other 3D design tools, into printed parts using several unique print engines that employ proprietary, additive layer by layer building processes with a variety of materials. We offer a broad range of 3D printing technologies including Stereolithography (“SLA”), Selective Laser Sintering (“SLS”), Direct Metal Printing (“DMP”), MultiJet Printing (“MJP”) and ColorJet Printing (“CJP”), which are discussed in more detail below.

Our printers utilize a wide range of materials, the majority of which are proprietary materials that we develop, blend and market. Our comprehensive range of materials includes plastic, nylon, metal, composite, elastomeric, wax, polymeric dental materials and Class IV bio-compatible materials. We augment and complement our portfolio of engineered materials with materials that we purchase or develop with third parties under private label and distribution arrangements.

We work closely with our customers to optimize the performance of our materials in their applications. Our expertise in materials science and formulation, combined with our processes, software and equipment, enables us to provide unique and highly specialized materials and help our customers select the material that best meets their needs with optimal cost and performance results.

As part of our solutions approach, our currently offered printers, with the exception of direct metal printers, have built-in intelligence to make them integrated, closed systems. For these integrated printers, we furnish materials specifically designed for use in those printers which are packaged in smart cartridges and utilize material delivery systems. These integrated materials are designed to enhance system functionality, productivity, reliability and materials shelf life, in addition to providing our customers with a built-in quality management system and a fully integrated workflow solution.

SLA Printers

Our SLA 3D printers cure liquid resin materials with light or a laser to produce durable plastic parts with surface smoothness, high resolution, edge definition and tolerances that rival the accuracy of machined or molded plastic parts. We offer SLA printers with a wide range of materials, sizes and price points, which are designed for prototyping, end-use part production, casting patterns, molds, tooling, fixtures and medical models.

Figure 4™, a light-based SLA platform, also sometimes referred to as digital light processing ("DLP"), is an ultra-fast additive manufacturing technology with a discrete module design. This design allows a range of products and configurations to meet customer needs from a stand-alone product to modular products to fully-automated solutions. Figure 4 is capable of manufacturing parts in hybrid materials (multi-mode polymerization) that offer toughness, durability, biocompatibility, high temperature deflection and elastomeric properties. Figure 4 is also the first additive manufacturing product which can achieve six sigma repeatability. These capabilities enable new end-use applications in healthcare, dental, durable goods, automotive, aerospace and other verticals.

For SLA printers, we offer a variety of liquid resin materials, primarily under the Accura® brand name. The resins are designed to mimic specific, engineered thermoplastics and provide a wide range of characteristics, including tough, durable, clear, castable, polypropylene-like, ABS-like, high-temperature resistant and Class IV bio-compatible materials. We also offer dental materials for light-based SLA 3D printers under our NextDent™ brand name.

SLS Printers

Our SLS 3D printers use a laser beam to melt and fuse powder-based nylon, engineered plastic and composite materials to produce very strong and durable parts. Customer uses of our SLS printers include functional test models and end-use parts, such as housings, machinery components, ducting, tooling, jigs and fixtures and medical devices and personalized surgery kits and guides.

Our proprietary SLS materials include a range of flexible and rigid plastics, nylons and composite materials marketed under the DuraForm®, LaserForm® and CastForm™ brand names. These materials are available in a variety of lightweight, tough, versatile, high temperature, flexible and durable formulations.

DMP Printers

Our DMP solutions use a laser beam to sinter powders in a variety of metals to produce fully dense parts with outstanding purity, surface finish and resolution. We offer DMP solutions that can process a wide range of materials and powders, including materials with very fine granularity and proven manufacturing applications. We sell DMP systems in various sizes and configurations. Certain models are optimized for specific metals, including titanium, stainless steel and nickel super alloys. Our DMP printers are used in medical and dental implants, aerospace, automotive and hi-tech and industrial applications, such as conformal cooling, enhanced fluid flow and other complex, lightweight parts.

We offer metal powder materials for our DMP printers, including titanium, stainless steels, tool steels, super alloys, non-ferrous alloys, precious metals and aluminum.

MJP Printers

Our MJP 3D printers utilize jetting head technology to deliver precise, tough parts with exceptional resolution in plastic, wax, elastomeric and engineered materials that we sell under the VisiJet® brand name. Our MJP printers offer the capability to print in real wax as well as rigid and flexible plastics and multiple materials in one build, making them ideal for mechanical functional testing, rapid tooling, jigs and fixtures, casting and foundry patterns and medical models.

CJP Printers

Our CJP 3D printers produce parts from our VisiJet branded, powder-based ceramic-like materials. CJP printers build high-definition, full-color parts that can be sanded, drilled, infiltrated, painted and electroplated, which further expands the options available for finished part characteristics. CJP printers are ideal for producing models used in mechanical design, healthcare, architecture, education, entertainment and packaging applications.

Software and Related Products

We provide digital design tools, including software, scanners and haptic devices. We offer solutions for product design, mold and die design, 3D scan-to-print, reverse engineering, production machining, metrology and inspection. These products are designed to enable a seamless workflow for customers, and are marketed under our Geomagic®, Cimatron® and GibbsCAM® brand names. We also offer 3D Sprint and 3DXpert, proprietary software to prepare and optimize CAD data and manage the additive manufacturing processes. These software products provide automated support building and placement, build platform management and print queue management capabilities.

Other Products

We offer 3D virtual reality simulators and simulator modules for medical applications. These 3D simulators are sold under our Simbionix™ brand name and offer clinicians a realistic, hands-on experience to master critical skills, prepare for upcoming procedures and create patient specific simulations and operating room environments through augmented reality and virtual reality. We also provide digitizing scanners for medical and mechanical applications.

Services

Maintenance and Training Services

We provide a variety of customer services, local application support and field support on a worldwide basis for our products, including installation of new printers at customers’ sites, maintenance agreements, periodic hardware upgrades and software updates. We also provide services to assist our customers and partners in developing new applications for our technologies, to facilitate the use of our technology for specific applications, to train customers on the use of our printers and to maintain our printers at customers’ sites.

We provide these services, spare parts and field support either directly or through a network of reseller partners. We employ customer-support sales engineers to support our worldwide customer base, and we are continuing to strengthen and enhance our partner network and service offerings.

Our 3D printers are sold with a warranty period ranging from 90 days to one year. After the warranty period, we generally offer service contracts that enable our customers to continue service and maintenance coverage. These service contracts are offered with various levels of support and options, and are priced accordingly. Our service engineers provide regularly scheduled preventive maintenance visits to customer sites, we provide training to our partners to enable them to perform these services, and we are adding remote monitoring and maintenance capabilities through our 3DConnect software.

From time to time, we also offer upgrade kits for certain of our printers that enable our existing customers to take advantage of new or enhanced printer capabilities. In some cases, we have discontinued upgrade support and maintenance agreements for certain of our older legacy printers.

On Demand Solutions

We provide on demand manufacturing services through facilities worldwide in the Americas, EMEA and APAC. We provide a broad range of prototyping, production and finishing capabilities for precision plastic and metal parts and tooling with a wide range of additive and traditional manufacturing processes.

In addition to the sales of parts to customers, we, and our partners, utilize our on demand services as a sales and lead generation tool. Third party preferred service providers also use our on demand manufacturing service as their comprehensive order-fulfillment center, and customers can use our facilities as fulfillment centers in disaster recovery plans. We also provide professional 3D scanning, printing and parts production related to the entertainment industry through our Gentle Giant™ brand.

Software Services

In addition to our software license products described above, we offer software maintenance, which includes updates and support for our software products. Our software is sold with maintenance service that generally covers a period of one year. After this initial period, we offer single and multi-year maintenance contracts that enable our customers to continue coverage. These software service contracts typically include free software updates and various levels of technical support.

Healthcare Services

As part of our precision healthcare services, we provide surgical planning, modeling, prototyping and manufacturing services. We offer printing and finishing of medical and dental devices, anatomical models and surgical guides and tools, as well as modeling, design and planning services, including virtual surgical planning, VSP™. We also provide service and maintenance for our surgical simulator products.

Global Operations

We operate in the Americas, EMEA and APAC regions, and market our products and services in those areas as well as to other parts of the world.

In maintaining operations outside the United States (the "U.S."), we expose our business to risks inherent in such operations, including currency exchange rate fluctuations. Information on foreign exchange risk appears in Part I, Item 1A, "Risk Factors", Part II, Item 7A, "Quantitative and Qualitative Disclosures about Market Risk" and Part II, Item 8, "Financial Statements and Supplementary Data," of this Form 10-K.

Marketing and Customers

Our sales and marketing strategy focuses on an integrated approach that is directed at providing comprehensive solutions designed to meet customer needs. We use a full range of marketing and lead generation tools to promote our products and services on a worldwide basis. Our marketing department supports our global sales organization and distribution channels by providing marketing materials, targeted marketing campaigns, sales leads and demand generation activities.

We sell our solutions globally through a direct sales force, partner channel and in certain geographies, appointed distributors. Our go-to-market and sales organization includes regional general managers, channel managers, direct sales people and application engineers and other support staff throughout the Americas, EMEA and APAC, who are responsible for the sale of products and services and for the management of our network of channel partners.

Additionally, our application engineers provide pre-sales and post-sales support, assist customers with leveraging our latest solutions and production techniques and help identify new applications and sales opportunities. Our on demand manufacturing service also expands our customer relationships and enables lead generation for future sales.

Our customers include major companies as well as small and midsize businesses in a broad range of industries, including medical, dental, automotive, aerospace, durable goods, government, defense, technology, jewelry, electronics, education, consumer goods, energy and others. For the year ended December 31, 2018, one customer accounted for approximately 13% of our consolidated revenue. We expect to maintain our relationship with this customer. No single customer accounted for more than 10% of our consolidated revenue for the years ended December 31, 2017 or 2016.

Production and Supplies

At our Rock Hill, South Carolina location, we assemble MJP, SLS, CJP and certain models of our SLA 3D printers, as well as other equipment related to these printers. We assemble certain models of our DMP printers in our Leuven, Belgium and Riom, France facilities. We produce our Simbionix branded 3D simulators in Airport City, Israel.

We outsource certain SLA and DMP printer assembly and refurbishment activities to selected design, engineering and manufacturing companies in the U.S., Belgium and Taiwan. We purchase finished printers from these suppliers pursuant to forecasts and customer orders that we supply to them. These suppliers also carry out quality control procedures on our printers prior to their shipment to customers. As part of these activities, these suppliers have responsibility for procuring the components and sub-assemblies either from us or third-party suppliers. While the outsourced suppliers of our printers have responsibility for the supply chain and inventory of components for the printers they assemble, the components, parts and sub-assemblies that are used in our printers are generally available from several potential suppliers.

We produce materials at our facilities in Rock Hill, South Carolina, Marly, Switzerland and Soesterberg, Netherlands. We also have arrangements with third parties who blend certain materials according to our specifications that we sell under our own brand names, and we purchase certain materials from third parties for resale to our customers.

Our equipment assembly and materials blending activities, on demand manufacturing services and certain research and development activities are subject to compliance with applicable federal, state and local provisions regulating the storage, use and discharge of materials into the environment. We believe that we are in compliance, in all material respects, with such regulations as currently in effect, and we expect continued compliance with them will not have a material adverse effect on our capital expenditures, results of operations or consolidated financial position.

Research and Development

The 3D printing industry continues to experience rapid technological change and developments in hardware, software and materials. Consequently, we have ongoing research and development programs to develop new products and to enhance our portfolio of products and services, as well as to improve and expand the capabilities of our solutions. Our efforts are often augmented by development arrangements with research institutions, customers, suppliers, assembly and design firms, engineering companies, materials companies and other partners.

In addition to our internally developed technology platforms, we have acquired products and technologies developed by others by acquiring business entities that held ownership rights to such products and technologies. In other instances, we have licensed or purchased the intellectual property rights of technologies developed by third parties through agreements that may obligate us to pay a license fee or royalty, typically based upon a dollar amount per unit or a percentage of the revenue generated by such products.

Intellectual Property

We regard our technology platforms and materials as proprietary and seek to protect them through copyrights, patents, trademarks and trade secrets. At December 31, 2018 and 2017 we held 1,250 and 1,171 patents worldwide, respectively. At December 31, 2018 and 2017, we had 295 and 271 pending patent applications worldwide, respectively. The principal issued patents covering aspects of our various technologies will expire at varying times through the year 2027.

In addition, we are a party to various licenses that have had the effect of broadening the range of the patents, patent applications and other intellectual property available to us.

We have also entered into licensing or cross-licensing arrangements with various companies in the U.S. and other countries that enable those companies to utilize our technologies in their products or that enable us to use their technologies in our products. Under certain of these licenses, we are entitled to receive, or we are obligated to pay, royalties for the sale of licensed products in the U.S. or in other countries. The amount of such royalties was not material to our results of operations or financial position for the three-year period ended December 31, 2018.

We believe that, while our patents and licenses provide us with a competitive advantage, our success also depends on our marketing, business development, applications know-how and ongoing research and development efforts. Accordingly, we believe the expiration of any of the patents, patent applications or licenses discussed above would not be material to our business or financial position.

Competition

We compete with other suppliers of 3D printers, materials, software and healthcare solutions as well as with suppliers of conventional manufacturing solutions. We compete with these suppliers for customers as well as channel partners for certain of our products. We also compete with businesses and service bureaus that use such equipment to produce models, prototypes, molds and end-use parts. Development of new technologies or techniques not encompassed by the patents that we own or license may result in additional future competition.

Our competitors operate both globally and regionally, and many of them have well-recognized brands and product lines. Additionally, certain of our competitors are well established and may have greater financial resources than us.

We believe principal competitive factors include technology capabilities, materials, process and application know-how, total cost of operation of solution, product reliability and the ability to provide a full range of products and services to meet customer needs. We believe that our future success depends on our ability to provide high quality solutions, introduce new products and services to meet evolving customer needs and market opportunities, and extend our technologies to new applications. Accordingly, our ongoing research and development programs are intended to enable us to continue technology advancement and develop innovative new solutions for the marketplace.

Employees

At December 31, 2018, we had 2,620 full-time and part-time employees, compared to 2,666 at December 31, 2017. None of our U.S. employees are covered by collective bargaining agreements, however, some of our employees outside the U.S. are subject to local statutory employment and labor arrangements. We have not experienced any material work stoppages and believe that our relations with our employees are satisfactory.

Available Information

Our website address is www.3DSystems.com. The information contained on our website is neither a part of, nor incorporated by reference into, this Form 10-K or any other document that we file with or furnish to the Securities and Exchange Commission (“SEC”). We make available free of charge through our website our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, amendments to those reports and other documents that we file with the SEC, as soon as reasonably practicable after we electronically file them with, or furnish them to, the SEC.

Many of our corporate governance materials, including our Code of Conduct, Code of Ethics for Senior Financial Executives and Directors, Corporate Governance Guidelines, current charters of each of the standing committees of the Board of Directors and our corporate charter documents and by-laws are available on our website.

Executive Officers

The information appearing in the table below sets forth the position or positions held by each of our executive officers and his age as of February 28, 2019. All of our executive officers serve at the pleasure of the Board of Directors. There are no family relationships among any of our executive officers or directors.

Name and Current Position	Age as of February 28, 2019
Vyomesh I. Joshi	
President and Chief Executive Officer	64
Charles W. Hull	
Executive Vice President and Chief Technology Officer	79
Andrew M. Johnson	
Executive Vice President, Chief Legal Officer and Secretary	44
Herbert Koeck	
Executive Vice President, Global Go To Market	58
Kevin P. McAlea	

Executive Vice President and General Manager, Metals and Healthcare	60
John N. McMullen	
Executive Vice President, Chief Financial Officer	60
Philip C. Schultz	
Executive Vice President, Operations	56

Mr. Joshi was appointed the Company's President and Chief Executive Officer, effective April 1, 2016. Prior to joining the Company, Mr. Joshi worked at Hewlett-Packard Company ("HP") from 1980 until his retirement on March 21, 2012. From 2001 to 2012, he was Executive Vice President of HP's Imaging and Printing Group, following two decades of research, engineering and management in HP's imaging and printing systems. In addition to his service on our Board of Directors, Mr. Joshi currently serves on the Board of Directors of Harris Corporation and formerly served on the Board of Directors at Yahoo! Inc. and Wipro Ltd.

Mr. Hull is a founder of the Company and has served on our Board of Directors since 1993. He has served as Chief Technology Officer since 1997 and as Executive Vice President since 2000. He has also previously served in various other executive capacities at the Company since 1986, including Chief Executive Officer, Vice Chairman of the Board of Directors and President and Chief Operating Officer.

Mr. Johnson has served as Executive Vice President and Chief Legal Officer since November 2014. He served as Interim President and Chief Executive Officer, Chief Legal Officer and Secretary from October 2015 to April 2016 and as Vice President, General Counsel and Secretary from April 2012 to November 2014. Previously, he served as Assistant General Counsel and Assistant Secretary.

Mr. Koeck currently serves as Executive Vice President, Global Go To Market. He joined the Company in September 2016 as General Manager for 3D Systems Europe, Middle East, Africa and India. Mr. Koeck worked at HP from 1987 to 2016, where he served as Managing Director Hewlett-Packard Europe/Middle East and Africa and Senior Vice President for HP's combined Printing and PC business in the same region from 2013 to 2016.

Dr. McAlea currently serves as Executive Vice President and General Manager, Metals & Healthcare. Dr. McAlea joined the Company in 2001 and has served in various executive positions since that time.

Mr. McMullen joined the Company as Executive Vice President, Chief Financial Officer in July 2016. From 2014 to 2016, he was Chief Financial Officer of Eastman Kodak Company, a technology company focused on imaging. Before that, Mr. McMullen had a 32 year career at HP and its acquired companies, including positions as Senior Vice President of Finance and Corporate Treasurer of HP, Chief Financial Officer of HP's Imaging and Printing Group and Vice President of Finance and Strategy for Compaq's Worldwide Sales and Services Group.

Mr. Schultz has served as Executive Vice President, Operations, since December 2018. He served as Senior Vice President, On Demand Solutions from September 2016 to December 2018. From 2014 to 2016, Mr. Schultz served as the Business Administrator for a non-profit, Grace Lutheran Church and Christian School. Previously, he served as Senior Vice President and General Manager of FoxConn from 2009 to 2014. Prior to that, Mr. Schultz held multiple roles at HP during a 25-year career.

Item 1A. Risk Factors

The risks and uncertainties described below are not the only risks that we face. Additional risks not currently known to us or that we currently deem not to be material also may impair our business operations, results of operations and financial condition. If any of the risks described below or if any other risks not currently known to us or that we currently deem not to be material actually occurs, our business, results of operations and financial condition could be materially adversely affected. In that event, the trading price of our common stock could decline, and you could lose all or part of your investment in our common stock.

We face significant competition in many aspects of our business, which could cause our revenue and gross profit margins 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 and software for models, prototypes, other three-dimensional objects and end-use parts as well as producers of materials and services for this equipment. Some of our existing and potential competitors are researching, designing, developing and marketing other types of competitive equipment and software, materials and services. Certain of these competitors may have financial, marketing, manufacturing, distribution and other resources substantially greater than ours.

We also expect that future competition may arise from the development of allied or related techniques for equipment and 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 and from improvements to existing materials and equipment technologies.

Some of our patents have recently expired and others will expire in coming years. Upon expiration of those patents, our competitors may introduce products using the technology previously protected by the expired patents and those products may have lower prices than those of our products. To compete, we may need to reduce our prices for those products, which could adversely affect our revenues, margins and profitability. Additionally, the expiration of our patents could reduce barriers to entry into additive manufacturing, which could result in the reduction of our sales and earnings potential. If competitors using technology previously protected by our expired patents were to introduce products of inferior quality, our potential customers may view the technology negatively, which would have an adverse effect on our image and reputation and on our ability to compete with systems using other additive fabrication technologies.

We intend 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, we may lose revenue and demand for our products. We also incur significant costs associated with the investment in our product development activities in furtherance of our strategy that may not result in increased revenue or demand for our products and that could negatively affect our operating results.

We believe that our future success depends on our ability to deliver products and services that meet changing technology and customer needs.

Our business may be affected by rapid technological change, changes in user and customer requirements and preferences, frequent new product and service introductions embodying new technologies and the emergence of new standards and practices, any of which could render our existing products and proprietary technology obsolete. Accordingly, our ongoing research and development programs are intended to enable us to maintain technological leadership. We believe that to remain competitive we must continually enhance and improve the functionality and features of our products, services and technologies. However, there is a risk that we may not be able to:

- Develop or obtain leading technologies useful in our business;
- Enhance our existing products;
- Develop new products, services and technologies that address the increasingly sophisticated and varied needs of prospective customers, particularly in the area of printer speeds and materials functionality;
- Respond to technological advances and emerging industry standards and practices on a cost-effective and timely basis; or
- Recruit or retain key technology employees.

If we are unable to meet changing technology and customer needs, our competitive position, revenue, results of operations and financial condition could be adversely affected.

If we do not generate net cash flow from operations and if we are unable to raise additional capital, our financial condition could be adversely affected and we may not be able to execute our growth strategy.

We cannot assure you that we will generate cash from operations or other potential sources to fund future working capital needs and meet capital expenditure requirements.

If we are unable to generate such cash flow, we may be required to adopt one or more alternatives, such as selling assets, restructuring or incurring additional debt or obtaining additional equity capital on terms that may be onerous or highly dilutive. Our ability to obtain additional capital or refinance any indebtedness will depend on, among other things, the capital markets, our financial condition at such time and the terms and conditions of any such financing or indebtedness. We may not be able to engage in any of these activities or engage in these activities on desirable terms, which could result in a default on our debt obligations.

The lack of additional capital resulting from any inability to generate cash flow from operations or to raise equity or debt financing could force us to substantially curtail or cease operations and would, therefore, have an adverse effect on our business and financial condition. Furthermore, we cannot assure you that any necessary funds, if available, would be available on attractive terms or that they would not have a significantly dilutive effect on our existing stockholders. If our financial condition were to worsen and we become unable to attract additional equity or debt financing or enter into other strategic transactions, we would not be able to execute our growth strategy and we could become insolvent or be forced to declare bankruptcy.

Our business could be adversely impacted in the event of a failure of our information technology infrastructure or adversely impacted by a successful cyber-attack.

We have experienced cyber security threats, threats to our information technology infrastructure and unauthorized attempts to gain access to our sensitive information. Prior cyber-attacks directed at us have not had a material impact on our business or financial results; however, this may not continue to be the case in the future. Cyber security assessment analyses undertaken by us have identified and prioritized steps to enhance our cyber security safeguards. We have implemented additional security measures and processes in the last year which enhance our ability to detect and respond to a cyber-attack. We have increased our cyber breach insurance and implemented company-wide cyber security awareness training. Despite the implementation of these new safeguards, there can be no assurance that we will adequately protect our information or that we will not experience any future successful attacks. The threats we face vary from attacks common to most industries to more advanced and persistent, highly organized adversaries who target us because of the products and services we provide. If we are unable to protect sensitive information, our customers or governmental authorities could question the adequacy of our threat mitigation and detection processes and procedures. Due to the evolving nature of these security threats, however, the impact of any future incident cannot be predicted.

We may be required to expend significant additional resources to modify our cyber security protective measures, to investigate and remediate vulnerabilities or other exposures or to make required notifications, and we may be subject to litigation and financial losses. These costs related to cyber or other security threats or disruptions may not be fully insured or indemnified by other means. Occurrence of any of these events could adversely affect our internal operations, the services we provide to our customers, our financial results or our reputation; or such events could result in the loss of competitive advantages derived from our research and development efforts or other intellectual property or early obsolescence of our products and services.

We are subject to U.S. and other anti-corruption laws, trade controls, economic sanctions and similar laws and regulations. Our failure to comply with these laws and regulations could subject us to civil, criminal and administrative penalties and harm our reputation.

Doing business on a worldwide basis requires us to comply with the laws and regulations of the U.S. government and various foreign jurisdictions. These laws and regulations place restrictions on our operations, trade practices, partners and investments.

In particular, our operations are subject to U.S. and foreign anti-corruption and trade control laws and regulations, such as the Foreign Corrupt Practices Act (“FCPA”) and United Kingdom Bribery Act (the “Bribery Act”), export controls and economic sanctions programs, including those administered by the U.S. Treasury Department’s Office of Foreign Assets Control (“OFAC”), the State Department's Directorate of Defense Trade Controls (“DDTC”) and the Bureau of Industry and Security (“BIS”) of the Department of Commerce. As a result of doing business in foreign countries and with foreign customers, we are exposed to a heightened risk of violating anti-corruption and trade control laws and sanctions regulations.

As part of our business, we may deal with state-owned business enterprises, the employees of which are considered foreign officials for purposes of the FCPA's prohibition on providing anything of value to foreign officials for the purposes of obtaining or retaining business or securing any improper business advantage. In addition, the provisions of the Bribery Act extend beyond bribery of foreign public officials and also apply to transactions with individuals that a government does not employ. Some of the international locations in which we operate lack a developed legal system and have higher than normal levels of corruption. Our continued expansion outside the U.S., including in Brazil, China, India and developing countries, and our development of new partnerships and joint venture relationships worldwide, could increase the risk of FCPA, OFAC or Bribery Act violations in the future.

As an exporter, we must comply with various laws and regulations relating to the export of products and technology from the U.S. and other countries having jurisdiction over our operations. In the U.S., these laws include the International Traffic in Arms Regulations ("ITAR") administered by the DDTC, the Export Administration Regulations ("EAR") administered by the BIS and trade sanctions against embargoed countries and destinations administered by OFAC. The EAR governs products, parts, technology and software which present military or weapons proliferation concerns, so-called "dual use" items, and ITAR governs military items listed on the United States Munitions List. Prior to shipping certain items, we must obtain an export license or verify that license exemptions are available. Any failures to comply with these laws and regulations could result in fines, adverse publicity and restrictions on our ability to export our products, and repeat failures could carry more significant penalties.

Violations of anti-corruption and trade control laws and sanctions regulations are punishable by civil penalties, including fines, denial of export privileges, injunctions, asset seizures, debarment from government contracts and revocations or restrictions of licenses, as well as criminal fines and imprisonment and could harm our reputation, create negative shareholder sentiment and affect our share value. We have established policies and procedures designed to assist our compliance with applicable U.S. and international anti-corruption and trade control laws and regulations, including the FCPA, the Bribery Act and trade controls and sanctions programs administered by OFAC, the DDTC and BIS, and have trained our employees to comply with these laws and regulations. However, there can be no assurance that all of our employees, consultants, agents or other associated persons will not take actions in violation of our policies and these laws and regulations. Additionally, there can be no assurance that our policies and procedures will effectively prevent us from violating these regulations in every transaction in which we may engage or provide a defense to any alleged violation. In particular, we may be held liable for the actions that our joint venture partners take inside or outside of the United States, even though our partners may not be subject to these laws. Such a violation, even if our policies prohibit it, could have an adverse effect on our reputation, business, financial condition and results of operations. In addition, various state and municipal governments, universities and other investors maintain prohibitions or restrictions on investments in companies that do business with sanctioned countries, persons and entities, which could adversely affect our reputation, business, financial condition and results of operations.

The costs and effects of litigation, investigations or similar matters involving us or our subsidiaries, or adverse facts and developments related thereto, could materially affect our business, operating results and financial condition.

We may be involved from time to time in a variety of litigation, investigations, inquiries or similar matters arising out of our business, including those described in Note 22 to the Consolidated Financial Statements. We cannot predict the outcome of these or any other legal matters. In the future, we may need to record litigation reserves with respect to these matters because our insurance may not cover all claims that may be asserted against us. Should the ultimate judgments or settlements in any litigation or investigation significantly exceed our insurance coverage, they could have a material adverse effect on our business, financial condition and results of operations.

We disclosed potential violations of U.S. export controls laws to BIS and DDTC, and the Company is reviewing its export control, trade sanctions, and government contracting compliance risks and potential violations.

In October 2017, we received an administrative subpoena from BIS requesting the production of records in connection with possible violations of U.S. export control laws, including with regard to our Quickparts.com, Inc. subsidiary. In addition, while collecting information responsive to the above-referenced subpoena, we identified potential violations of ITAR administered by DDTC and potential violations of the Export Administration Regulations administered by BIS. On June 8, 2018 and thereafter, we submitted voluntary disclosures to BIS and DDTC identifying numerous potentially unauthorized exports of technical data, which supplemented an initial notice of voluntary disclosure that we submitted to DDTC in February 2018. We are conducting an internal review of our export control, trade sanctions, and government contracting compliance risks and potential violations; implementing associated compliance enhancements; and cooperating with DDTC and BIS, as well as the U.S. Departments of Justice, Defense and Homeland Security. Although we cannot predict the ultimate resolution of these matters, we have incurred and expect to continue to incur significant legal costs and other expenses in connection with responding to the U.S. government agencies.

Throughout 2018, we implemented new compliance procedures to identify and prevent potential violations of export controls laws, trade sanctions, and government contracting laws and regulations. As a result of these compliance enhancements, we identified additional potential violations of ITAR, and submitted related voluntary disclosures to DDTC. As we continue to implement additional compliance enhancements throughout 2019, we may discover additional potential violations of export controls laws, trade sanctions, and/or government contracting laws in the future. If we identify any additional potential violations, we will submit voluntary disclosures to the relevant agencies and cooperate with such agencies on any related investigations.

If the U.S. government finds that we have violated one or more export controls laws, trade sanctions, or government contracting laws, we could be subject to various civil or criminal penalties. By statute, these penalties can include but are not limited to fines, which by statute may be significant, denial of export privileges, and suspension or debarment from participation in U.S. government contracts. We may also be subject to contract claims based upon such violations. Any assessment of penalties or other liabilities incurred in connection with these matters could harm our reputation and customer relationships, create negative investor sentiment, and affect our share value. In connection with any resolution, we may also be required to undertake additional remedial compliance measures and program monitoring. We cannot at this time predict when the U.S. government agencies will conclude their investigations or determine an estimated cost, if any, or range of costs, for any penalties, fines or other liabilities to third parties that may be incurred in connection with these matters.

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 own intellectual property rights, the acquisition of third-party intellectual property rights or disputes related to the validity or alleged infringement of third-party intellectual property rights, including patent rights, we have been, and may in the future be, subject to claims, negotiations or complex, protracted litigation. Intellectual property disputes and litigation may be costly and can be disruptive to our business operations by diverting attention and energies of management and key technical personnel, and by increasing our costs of doing business. Although we have successfully defended or resolved past litigation and disputes, we may not prevail in any ongoing or future litigation and disputes, which could adversely affect our results of operations and financial condition.

Third-party intellectual property claims asserted against us could subject us to significant liabilities, require us to enter into royalty and licensing arrangements on unfavorable terms, prevent us from assembling or licensing certain of our products, subject us to injunctions restricting our sale of products, cause severe disruptions to our operations or the marketplaces in which we compete or require us to satisfy indemnification commitments with our customers, including contractual provisions under various license arrangements. In addition, we may incur significant costs in acquiring the necessary third-party intellectual property rights for use in our products. Any of these could seriously harm our business.

We may not be able to protect our intellectual property rights and confidential information, including our digital content, from third-party infringers or unauthorized copying, use or disclosure.

Although we defend our intellectual property rights and endeavor to combat unlicensed copying and use of our digital content and intellectual property rights through a variety of techniques, preventing unauthorized use or infringement of our rights (“piracy attacks”) is inherently difficult. If our intellectual property becomes subject to piracy attacks, our business may be harmed.

Additionally, we endeavor to protect the secrecy of our digital content, confidential information and trade secrets. If unauthorized disclosure of our trade secrets occurs, we could potentially lose trade secret protection. The loss of trade secret protection could make it easier for third parties to compete with our products by copying previously confidential features, which could adversely affect our business, results of operations, revenue and operating margins. We also seek to protect our confidential information and trade secrets through the use of non-disclosure agreements. However, there is a risk that our confidential information and trade secrets may be disclosed or published without our authorization, and in these situations it may be difficult and/or costly for us to enforce our rights.

Our uneven sales cycle makes planning and inventory management difficult and future financial results less predictable.

Our quarterly sales often have reflected a pattern in which a disproportionate percentage of each quarter’s total sales occurs towards the end of the quarter, in particar for sales of hardware. This uneven sales pattern makes predicting net revenue, earnings, cash flow from operations and working capital for each financial period difficult, increases the risk of unanticipated variations in our quarterly results and financial condition and places pressure on our inventory management and logistics systems. If predicted demand is substantially greater than orders, there may be excess inventory. Alternatively, if orders substantially exceed predicted demand, we may not be able to fulfill all of the orders received in each quarter and such orders may be cancelled. Depending on when they occur in a quarter, developments such as an information systems failure, component pricing movements, component shortages or global logistics disruptions could adversely impact our inventory levels and results of operations in a manner that is disproportionate to the number of days in the quarter affected.

The variety of products that we sell could cause significant quarterly fluctuations in our gross profit margins, and those fluctuations in margins could cause fluctuations in operating income or loss and net income or loss.

We continuously work to expand and improve our products, materials and services offerings, geographic areas in which we operate and the distribution channels we use to reach various target product applications and customers. This variety of products, applications, channels and regions involves a range of gross profit margins that can cause substantial quarterly fluctuations in gross profit and gross profit margins depending upon the mix of product shipments from quarter to quarter. Additionally, the introduction of new products or services may further heighten quarterly fluctuations in gross profit and gross profit margins due to manufacturing ramp-up and start-up costs. We may experience significant quarterly fluctuations in gross profit margins or operating income or loss due to the impact of the mix of products, channels or geographic areas in which we sell our products from period to period.

We derive a significant portion of our revenue from business conducted outside the U.S. and are subject to the risks of doing business outside the U.S.

We face many risks inherent in conducting business activities outside the U.S. that, unless managed properly, may adversely affect our profitability, including our ability to collect amounts due from customers. While most of our operations outside the U.S. are conducted in highly developed countries, our operations could be adversely affected by, among others, the following:

- Unexpected changes in laws, regulations and policies of non-U.S. governments relating to investments and operations, as well as U.S. laws affecting the activities of U.S. companies abroad;

- Changes in regulatory requirements, including export controls, tariffs and embargoes, other trade restrictions, competition, corporate practices and data privacy concerns;

- Political policies, political or civil unrest, terrorism or epidemics and other similar outbreaks;

- Fluctuations in currency exchange rates;

- Limited protection for the enforcement of contract and intellectual property rights in some countries;

- Difficulties in staffing and managing foreign operations;

- Operating in countries with a higher incidence of corruption and fraudulent business practices;

- Potentially adverse changes in taxation; and

- Other factors, depending upon the specific country in which we conduct business.

These uncertainties may make it difficult for us and our customers to accurately plan future business activities and may lead our customers in certain countries to delay purchases of our products and services. More generally, these geopolitical, social and economic conditions could result in increased volatility in global financial markets and economies.

The consequences of terrorism or armed conflicts are unpredictable, and we may not be able to foresee events that could have an adverse effect on our market opportunities or our business. We are uninsured for losses and interruptions caused by terrorism, acts of war and similar events.

While the geographic areas outside the U.S. in which we operate are generally not considered to be highly inflationary, our foreign operations are sensitive to fluctuations in currency exchange rates arising from, among other things, certain intercompany transactions that are generally denominated, for example, in U.S. dollars rather than their respective functional currencies.

Moreover, our operations are exposed to market risk from changes in interest rates and foreign currency exchange rates and commodity prices, which may adversely affect our results of operations and financial condition. We seek to minimize these risks through regular operating and financing activities and, when we consider it to be appropriate, through the use of derivative financial instruments. However, our efforts to minimize our exposure to market risks from changes in interest rates, foreign currency exchange rates and commodity prices may prove to be insufficient or unsuccessful.

We depend on our supply chain for components and sub-assemblies used in our 3D printers and other products and for raw materials used in our materials. If these relationships were to terminate or be disrupted, our business could be disrupted while we locate alternative suppliers and our expenses may increase.

We have outsourced the assembly of certain of our printers to third party suppliers. In addition, we purchase components and sub-assemblies for our printers from third-party suppliers, and we purchase raw materials that are used in our materials, as well as certain of those materials, from third-party suppliers.

While there are several potential suppliers of the components, parts and sub-assemblies for our products, we currently choose to use only one or a limited number of suppliers for several of these components, including our lasers, materials and certain jetting components. Our reliance on a single or limited number of suppliers involves many risks, including, among others, the following:

- Potential shortages of some key components;
- Disruptions in the operations of these suppliers;
- Product performance shortfalls; and
- Reduced control over delivery schedules, assembly capabilities, quality and costs.

While we believe that we can obtain all the components necessary for our products from other manufacturers, we require any new supplier to become “qualified” pursuant to our internal procedures, which could involve evaluation processes of varying durations. We generally have our printers and other products assembled based on our internal forecasts and the supply of raw materials, assemblies, components and finished goods from third parties, which are subject to various lead times. In addition, at any time, certain suppliers may decide to discontinue production of an assembly, component or raw material that we use. Any unanticipated change in the sources of our supplies, or unanticipated supply limitations, could increase production or related costs and consequently reduce margins.

If our forecasts exceed actual orders, we may hold large inventories of slow-moving or unusable parts, which could have an adverse effect on our cash flow, profitability and results of operations. Inversely, we may lose orders if our forecast is low and we are unable to meet demand.

We have engaged selected design and manufacturing companies to assemble certain of our printers. In carrying out these outsourcing activities, we face a number of risks, including, among others, the following:

- The risk that the parties that we retain to perform assembly activities may not perform in a satisfactory manner;
- The risk of disruption in the supply of printers or other products to our customers if such third parties either fail to perform in a satisfactory manner or are unable to supply us with the quantity of printers or other products that are needed to meet then current customer demand; and
- The risk of insolvency of suppliers, as well as the risks that we face, as discussed above, in dealing with a limited number of suppliers.

Our operations could suffer if we are unable to attract and retain key management or other key employees.

Our success depends upon the continued service and performance of our senior management and other key personnel. Our senior executive team is critical to the management of our business and operations, as well as to the development and execution of our strategy. High demand exists for senior management and other key personnel (including scientific, technical and sales personnel) in the 3D printing industry, and there can be no assurance that we will be able to retain such personnel. We experience intense competition for qualified personnel.

While we intend to continue to provide competitive compensation packages to attract and retain key personnel and engage in regular succession planning for these positions, some of our competitors for these employees have greater resources and more experience, making it difficult for us to compete successfully for key personnel. If we cannot attract and retain sufficiently qualified technical employees for our research and development and manufacturing operations, we may be unable to develop and commercialize new products or new applications for existing products. Furthermore, possible shortages of key personnel, including engineers, in the regions surrounding our facilities could require us to pay more to hire and retain key personnel, thereby increasing our costs.

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We rely on our management information systems for inventory management, distribution and other key functions. If our information systems fail to adequately perform these functions, or if we experience an interruption in their operation, our business and operating results could be adversely affected.

The efficient operation of our business is dependent on our management information systems. We rely on our management information systems to, among other things, effectively manage our accounting and financial functions, including maintaining our internal controls; to manage our manufacturing and supply chain processes; and to maintain our research and development data. The failure of our management information systems to perform properly could disrupt our business and product development, which may result in decreased sales, increased overhead costs, excess or obsolete inventory, and product shortages, causing our business and operating results to suffer. Although we take steps to secure our management information 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 theft, loss, damage and interruption from a number of potential sources and events, including unauthorized access or security breaches, natural or man-made disasters, cyber-attacks, computer viruses, power loss or other disruptive events. Our reputation and financial condition could be adversely affected if, as a result of a significant cyber event or otherwise, our operations are disrupted or shut down; our confidential, proprietary information is stolen or disclosed; we incur costs or are required to pay fines in connection with stolen customer, employee, or other confidential information; we must dedicate significant resources to system repairs or increase cyber security protection; or we otherwise incur significant litigation or other costs.

Our products and services may experience quality problems from time to time that can result in decreased sales and operating margin, product returns, product liability, warranty or other claims that could result in significant expenses and harm to our reputation.

We sell complex hardware and software products, materials and services that can contain undetected design and manufacturing defects or errors when first introduced or as enhancements are released that, despite testing, are not discovered until after the product has been installed and used by customers. Sophisticated software and applications, such as those sold by us, may contain “bugs” that can unexpectedly interfere with the software’s intended operation. Defects may also occur in components and products we purchase from third parties. There can be no assurance we will be able to detect and fix all defects in the hardware, software, materials and services we sell. Failure to do so could result in lost revenue, product returns, product liability, delayed market acceptance of those products and services, claims from distributors, end-users or others, increased end-user service and support costs, and significant warranty claims and other expenses to correct the defects, diversion of management time and attention and harm to our reputation.

Regulation in the areas of privacy, data protection and information security could increase our costs and affect or limit our business opportunities and how we collect and/or use personal information.

As privacy, data protection and information security laws, including data localization laws, are interpreted and applied, compliance costs may increase, particularly in the context of ensuring that adequate data protection and data transfer mechanisms are in place. In recent years, there has been increasing regulatory enforcement and litigation activity in the areas of privacy, data protection and information security in the U.S. and in various countries in which we operate.

In addition, state and federal legislators and/or regulators in the U.S. and other countries in which we operate are increasingly adopting or revising privacy, data protection and information security laws that potentially could have significant impact on our current and planned privacy, data protection and information security-related practices, our collection, use, sharing, retention and safeguarding of consumer and/or employee information, and some of our current or planned business activities. New legislation or regulation could increase our costs of compliance and business operations and could reduce revenues from certain business initiatives. Moreover, the application of existing or new laws to existing technology and practices can be uncertain and may lead to additional compliance risk and cost.

Compliance with current or future privacy, data protection and information security laws relating to consumer and/or employee data could result in higher compliance and technology costs and could restrict our ability to provide certain products and services, which could materially and adversely affect our profitability. Our failure to comply with privacy, data protection and information security laws could result in potentially significant regulatory and/or governmental investigations and/or actions, litigation, fines, sanctions, ongoing regulatory monitoring, customer attrition, decreases in the use or acceptance of our products and services and damage to our reputation and our brand.

Global economic, political and social conditions and financial markets may harm our ability to do business, adversely affect our sales, costs, results of operations and cash flow.

We are subject to global economic, political and social conditions that may cause customers to delay or reduce technology purchases due to economic downturns, difficulties in the financial services sector and credit markets, geopolitical uncertainties, tariffs and other macroeconomic factors affecting spending behavior. We face risks that may arise from financial difficulties experienced by our suppliers, resellers or customers, including, among others, the following:

- Customers or partners to whom we sell our products and services may face financial difficulties or may become insolvent, which could lead to our inability to obtain payment of accounts receivable that those customers may owe;

- Customers and potential customers may experience deterioration of their businesses, which may result in the delay or cancellation of plans to purchase our products;

- Key suppliers of raw materials, finished products or components used in the products that we sell may face financial difficulties or may become insolvent, which could lead to disruption in the supply of printers, materials or spare parts to our customers; and

- The inability of customers, including resellers, suppliers and contract manufacturers, to obtain credit financing to finance purchases of our products and raw materials used to build those products.

Changes in, or interpretation of, tax rules and regulations may impact our effective tax rate and future profitability.

We are a U.S. based, multinational company subject to taxation in multiple U.S. and foreign tax jurisdictions. Our future effective tax rates could be adversely affected by changes in statutory tax rates or interpretation of tax rules and regulations in jurisdictions in which we do business, changes in the amount of revenue or earnings in the countries with varying statutory tax rates, or by changes in the valuation of deferred tax assets and liabilities. The U.S. Tax Cuts and Jobs Act (“Tax Act”) is one such example of recent legislation that impacts the effective tax rate and tax posture of the Company. For additional details see Note 20 to the Consolidated Financial Statements.

In addition, we are subject to audits and examinations of previously filed income tax returns by the Internal Revenue Service and other domestic and foreign tax authorities. We regularly assess the potential impact of such examinations to determine the adequacy of our provision for income taxes and have reserved for potential adjustments that we expect may result from the current examinations. We believe such estimates to be reasonable; however, there is no assurance that the final determination of any examination will not have an adverse effect on our operating results and financial position.

We have made, and may make in the future, strategic acquisitions and divestitures that may involve significant risks and uncertainties. We may not realize the anticipated benefits of past or future acquisitions and integration of these acquisitions may disrupt our business and divert management attention. Likewise, our potential future divestitures may be unsuccessful and negatively impact our business.

From time to time, we evaluate acquisition candidates that fit our business objectives. Acquisitions involve certain risks and uncertainties, including, among others, the following:

- Difficulty in integrating newly acquired businesses and operations in an efficient and cost-effective manner, which may also impact our ability to realize the potential benefits associated with the acquisition;

- The risk that significant unanticipated costs or other problems associated with integration may be encountered;
- The challenges in achieving strategic objectives, cost savings and other anticipated benefits;
- The risk that our marketplaces do not evolve as anticipated and that the technologies acquired do not prove to be those needed to be successful in the marketplaces that we serve;
- The risk that we assume significant liabilities that exceed the limitations of any applicable indemnification provisions or the financial resources of any indemnifying party;
- The inability to maintain a relationship with key customers, vendors and other business partners of the acquired businesses;

- The difficulty in maintaining controls, procedures and policies during the transition and integration;
- The potential loss of key employees of the acquired businesses;
- The risk of diverting management attention from our existing operations;
- Difficulties in coordinating geographically disparate organizations and corporate cultures and integrating management personnel with different business backgrounds;
- The potential failure of the due diligence process to identify significant problems, liabilities or other challenges of an acquired company or technology;
- The risk that we incur significant costs associated with such acquisition activity that may negatively impact our operating results before the benefits of such acquisitions are realized, if at all;
- The entry into marketplaces where we have no or limited direct prior experience and where competitors have stronger marketplace positions;
- The exposure to litigation or other claims in connection with our assuming claims or litigation risks from terminated employees, customers, former shareholders or other third parties; and
- The risk that historical financial information may not be representative or indicative of our results as a combined company.

Historically, we have grown organically and from acquisitions, and we intend to continue to grow. Our infrastructure will require, among other things, continued development of our financial and management controls and management information systems, management of our sales channel, continued capital expenditures, the ability to attract and retain qualified management personnel and the training of new personnel. We cannot be sure that our infrastructure, systems, procedures, business processes and managerial controls will be adequate to support the growth in our operations. Any delays in, or problems associated with, implementing, or transitioning to, new or enhanced systems, procedures, or controls to accommodate and support the requirements of our business and operations and to effectively and efficiently integrate acquired operations may adversely affect our ability to meet customer requirements, manage our product inventory, and record and report financial and management information on a timely and accurate basis. These potential negative effects could prevent us from realizing the benefits of an acquisition transaction or other growth opportunity.

Likewise, we have in the past, and may in the future, divest certain business operations. Divestitures involve a number of risks, including the diversion of management's attention, significant costs and expenses, goodwill and other intangible asset impairment charges, the loss of customer relationships and cash flow, and the disruption of operations in the affected business. Failure to timely complete or consummate a divestiture may negatively affect valuation of the affected business or result in restructuring charges.

In the event an unsuccessful acquisition or divestiture, our competitive position, revenues, results of operations and financial condition could be adversely affected.

Changes in business conditions may cause goodwill and other intangible assets to become impaired.

Goodwill is subject to an impairment test on an annual basis and when circumstances indicate that an impairment is more likely than not. Such circumstances include a significant adverse change in the business climate or a decision to dispose of a business or product line. We face some uncertainty in our business environment due to a variety of challenges, including changes in customer demand. We may experience unforeseen circumstances that adversely affect the value of our goodwill or intangible assets and trigger an evaluation of the amount of the recorded goodwill and intangible assets. Future write-offs of goodwill or other intangible assets as a result of an impairment in the business could materially adversely affect our results of operations and financial condition.

We may be subject to product liability claims, which could result in material expense, diversion of management time and attention and damage to our business reputation.

The sale and support of our products entails the risk of product liability claims. From time to time, we may become subject to product liability claims that could lead to significant expenses. The risk may be heightened when we provide products into certain markets, such as healthcare, aerospace and automotive industries.

This risk of product liability claims may also be greater due to the use of certain hazardous chemicals used in the production of certain of our products, including irritants, harmful chemicals and chemicals dangerous to the environment. We may also be subject to claims that our products have been, or may be used to, create parts that are not in compliance with legal requirements or that infringe on the intellectual property rights of others.

We attempt to include 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 and other issues. However, the nature and extent of these limitations vary from customer to customer. Their effect is subject to a variety of legal limitations and it is possible that these limitations may not be effective as a result of unfavorable judicial decisions or laws enacted in the future.

Any claim brought against us, regardless of its merit, could result in significant expense, diversion of management time and attention, damage to our business reputation and failure to retain existing customers or to attract new customers. Although we maintain product liability insurance, such insurance is subject to deductibles and there is no guarantee that such insurance will be available or adequate to protect against all such claims. Costs or payments made in connection with product liability claims could adversely affect our financial condition and results of operations.

Our business involves the use of hazardous materials, and we must comply with environmental, health and safety laws and regulations, which can be expensive and restrict how we do business.

Our business involves the blending, controlled storage, use and disposal of hazardous materials. We and our suppliers are subject to federal, state, local and foreign laws and regulations governing the use, manufacture, storage, handling and disposal of these hazardous materials. Although we believe the safety procedures we utilized for handling and disposing of these materials comply with the standards prescribed by these laws and regulations, we cannot eliminate the risk of accidental contamination or injury from these materials. In the event of an accident, local, state, federal or foreign authorities may curtail the use of these materials and interrupt our business operations. If we are subject to any liability as a result of activities involving hazardous materials, our business and financial condition may be adversely affected and our reputation may be harmed.

Our common stock price has been and may continue to be volatile.

The market price of our common stock has experienced, and may continue to experience, considerable volatility. Between January 1, 2017 and December 31, 2018, the trading price of our common stock has ranged from a low of $7.92 per share to a high of $23.70 per share. Numerous factors could have a significant effect on the price of our common stock, including those described or referred to in this "Risk Factors" section of this Form 10-K, as well as, among other things:

- Our perceived value in the securities markets;
- Overall trends in the stock market;
- Announcements of changes in our forecasted operating results or the operating results of one or more of our competitors;
- The impact of changes in our results of operations, our financial condition or our prospects;
- Future sales of our common stock or other securities (including any shares issued in connection with earn-out obligations for any past or future acquisition);

- Market conditions for providers of products and services such as ours;
- Executive level management uncertainty or change;
- Changes in recommendations or revenue or earnings estimates by securities analysts; and
- Announcements of acquisitions by us or one of our competitors.

Item 1B.Unresolved Staff Comments

None.

Item 2. Properties

Our headquarters is located in Rock Hill, South Carolina. As of December 31, 2018, we owned minimal facilities and we leased approximately 1.1 million square feet, primarily located in the U.S., as summarized below.

	Square Feet (in thousands)							
	Americas		EMEA		APAC		TOTAL	
	Leased	Owned	Leased	Owned	Leased	Owned	Leased	Owned
Primary Function Category:								
Corporate headquarters	80	—	—	—	—	—	80	—
Manufacturing and warehouse	343	—	183	—	—	—	526	—
Research and development	167	—	—	—	28	—	195	—
Services	118	101	119	—	32	—	269	101
Sales, general and other administrative	—	—	12	—	—	—	12	—
Total square feet	708	101	314	—	60	—	1,082	101

Our headquarters also serves as a research and development site. Other major research and development locations include Cary, North Carolina; San Diego, California; Seoul, Korea; Tel Aviv, Israel; Valencia, California and Wilsonville, Oregon, among others. We believe our existing facilities and equipment are in good operating condition and are suitable for our business in the manner that it is currently conducted. We expect to continue to make investments in capital equipment as needed to meet anticipated demand for our products. See “Item 1. Business – Production and Supplies” and Notes 13 and 21 to the Consolidated Financial Statements for further discussion of our facilities.

Item 3. Legal Proceedings

Information relating to legal proceedings is included in Note 22 to the Consolidated Financial Statements in Item 8, which is incorporated by reference into this item 3.

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

Our common stock is listed on the New York Stock Exchange ("NYSE") under the trading symbol "DDD."

For information regarding securities authorized for issuance under our equity compensation plans, see Note 15 to the Consolidated Financial Statements contained in Item 8. We did not make any unregistered sales of equity securities in 2018.

As of February 15, 2019, our outstanding common stock was held by approximately 1,100 stockholders of record. This figure does not reflect the beneficial ownership of shares held in the nominee name.

Dividends

We do not currently pay, and have not paid, any dividends on our common stock, and we currently intend to retain any future earnings for use in our business. Any future determination as to the declaration of dividends on our common stock will be made at the discretion of the Board of Directors and will depend on our earnings, operating and financial condition, capital requirements and other factors deemed relevant by the Board of Directors, including the applicable requirements of the Delaware General Corporation Law, which provides that dividends are payable only out of surplus or current net profits.

The payment of dividends on our common stock may be restricted by the provisions of credit agreements or other financing documents that we may enter into or the terms of securities that we may issue from time to time. Currently, no such agreements or documents limit our declaration of dividends or payments of dividends, other than our $200.0 million 5-year term and revolving senior secured credit facility, which limits the amount of cash dividends that we may pay in any one fiscal year to $30.0 million.

Issuance of Unregistered Securities and Issuer Purchases of Equity Securities

We did not repurchase any of our equity securities during the year ended 2018, except for unvested restricted stock awards repurchased or forfeited pursuant to our 2004 and 2015 Incentive Stock Plans. For information regarding the securities authorized for issuance under our equity compensation plans, see "Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters – Equity Compensation Plans" under Part III, Item 12 of this Form 10-K. Also see Note 15 to the Consolidated Financial Statements.

Issuer purchases of equity securities

	Total number of shares (or units) purchased		Average price paid per share (or unit)		Total number of shares (or units) purchased as part of publicly announced plans or programs	Maximum number (or approximate dollar value) of shares (or units) that may yet be purchased under the plans or programs
January 1, 2018 - January 31, 2018	12,433		9.69		—	$ —
February 1, 2018 - February 28, 2018	98,456		9.11		—	—
March 1, 2018 - March 31, 2018	3,966		11.51		—	—
April 1, 2018 - April 30, 2018	29,165		11.14		—	—
May 1, 2018 - May 31, 2018	48,711		12.66		—	—
June 1, 2018 - June 30, 2018	1,990		13.60		—	—
July 1, 2018 - July 31, 2018	113,978		13.09		—	—
August 1, 2018 - August 31, 2018	121,424		18.93		—	—
September 1, 2018 - September 30, 2018	6,449		18.69		—	—
October 1, 2018 - October 31, 2018	18,100		15.80		—	—
November 1, 2018 - November 31, 2018	43,526		12.65		—	—
December 1, 2018 - December 30, 2018	63,582		12.12		—	—
Total	561,780	(a)	$ 13.25	(b)	—	$ —

(a) Represents shares of common stock surrendered to the Company for payment of tax withholding obligations in connection with the vesting of restricted stock.

(b) The average price paid reflects the average market value of shares withheld for tax purposes.

Stock Performance Graph

The graph below shows, for the five years ended December 31, 2018, the cumulative total return on an investment of $100 assumed to have been made on December 31, 2013 in our common stock. For purposes of the graph, cumulative total return assumes the reinvestment of all dividends. The graph compares such return with those of comparable investments assumed to have been made on the same date in (a) the NYSE Composite Index, (b) the S&P 500 Information Technology Index (c) the S&P Mid-Cap 400 Index and (d) the S&P Small-Cap 600 Index which are published market indices with which we are sometimes compared.

Although total return for the assumed investment assumes the reinvestment of all dividends on December 31 of the year in which such dividends were paid, we paid no cash dividends on our common stock during the periods presented.

COMPARISON OF 5-YEAR CUMULATIVE TOTAL RETURN*
* Fiscal years ending December 31.

	12/13	12/14	12/15	12/16	12/17	12/18
3D Systems Corporation	$ 100	$ 35	$ 9	$ 14	$ 9	$ 11
NYSE Composite Index	100	107	103	115	137	125
S&P 500 Information Technology Index	100	120	127	145	201	201
S&P Mid-Cap 400 Index	100	110	107	130	151	134
S&P Small-Cap 600 Index [(a)]	100	106	104	131	149	136

(a) The Company was moved from the S&P Mid-Cap 400 Index to the S&P Small-Cap 600 Index during the reporting period ending December 31, 2018 due the Company's change in market capitalization.

Item 6. Selected Financial Data

The selected consolidated financial data set forth below for the five years ended December 31, 2018 have been derived from our historical Consolidated Financial Statements. You should read this information together with Management’s Discussion and Analysis of Financial Condition and Results of Operations, and our Consolidated Financial Statements and the notes thereto included in this Form 10-K.

	Year ended December 31,				
(in thousands, except per share amounts)	2018	2017	2016	2015	2014
Consolidated Statement of (Loss) Income Data:					
Consolidated Revenue:					
Products	$259,124	$222,750	$238,011	$271,078	$297,781
Materials	170,091	168,846	156,839	150,740	158,859
Services	258,445	254,473	238,115	244,345	197,012
Total	687,660	646,069	632,965	666,163	653,652
Gross profit	324,394	304,839	309,751	291,809	317,434
Impairment of goodwill and other intangible assets [a]	—	—	—	537,179	—
(Loss) income from operations	(43,191)	(53,973)	(38,420)	(641,924)	26,315
Net (loss) income	(45,263)	(65,323)	(39,265)	(663,925)	11,946
Net (loss) income available to common stockholders	(45,505)	(66,191)	(38,419)	(655,492)	11,637
Net (loss) income available to common stockholders per share:					
Basic and diluted	$(0.41)	$(0.59)	$(0.35)	$(5.85)	$0.11
Consolidated Balance Sheet Data:					
Working capital	$233,414	$231,293	$302,545	$286,996	$432,864
Total assets	825,832	896,764	849,153	891,959	1,530,310
Current portion of debt and capitalized lease obligations	654	644	572	529	684
Long-term debt	25,000	—	—	—	—
Long-term portion of capitalized lease obligations	6,392	7,078	7,587	8,187	8,905
Total stockholders' equity	575,987	615,948	626,700	654,646	1,294,125
Other Data:					
Depreciation and amortization	$59,293	$62,041	$60,535	$83,069	$55,188
Interest expense	1,188	919	1,282	2,011	1,227
Capital expenditures	40,694	30,881	16,567	22,399	22,727

(a) During the year ended December 31, 2015, non-cash, non-tax deductible Goodwill impairment charges equal to $382,271 and $61,388 were recorded for the Americas and EMEA, respectively, resulting from the annual impairment testing. Additionally during the year ended December 31, 2015, a non-cash Intangible asset charge equal to $93,520 was recorded arising from the Company's other intangible asset impairment testing.

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

The following discussion and analysis should be read together with the selected consolidated financial data and our Consolidated Financial Statements and notes thereto included in this Form 10-K. Certain statements contained in this discussion may constitute forward looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. 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 discussed more fully in this Form 10-K. See "Forward-Looking Statements" and "Risk Factors" in Part I, Item 1A.

Overview and Strategy

We provide comprehensive 3D printing solutions, including 3D printers, materials, software, on demand manufacturing services and digital design tools. Our solutions support advanced applications in a wide range of industries and key verticals including healthcare, aerospace, automotive and durable goods. Our precision healthcare capabilities include simulation, Virtual Surgical Planning ("VSP™"), and printing of medical and dental devices, models, surgical guides and instruments. Our experience and expertise have proven vital to our development of an ecosystem and end-to-end digital workflow solutions which enable customers to optimize product designs, transform workflows, bring innovative products to market and drive new business models.

We are pursuing a strategy focused on offering a comprehensive ecosystem that provides solutions aimed at healthcare, dental, aerospace, automotive and durable goods verticals to address professional and industrial applications. We believe a shift in 3D printing from prototyping to also using additive manufacturing for production is underway. We are focused on innovation and new products to drive expansion into 3D production through improving durability, reliability, repeatability and total cost of operations of 3D printing solutions.

We have launched new 3D printers with increased speeds and capabilities as well as introduced materials with improved strength, durability, elasticity and high temperature capabilities, developments we believe are well suited for advanced and demanding applications. We have also expanded and strengthened our software portfolio to help enhance our customers' workflows from digitize to design to simulate to manufacture, inspect and manage. We plan to continue to invest in development of hardware, software, materials and services to provide comprehensive solutions in plastics and metals to address significant market opportunities with a use-case by use-case approach, focusing on solving specific customer applications and needs within our targeted vertical markets.

To execute this strategy, we are focusing on an operating framework and go-to-market model that drives sustainable, long-term growth and profitability. We are balancing investments to support process improvements, infrastructure enhancements and focused innovation to transform the Company, while also driving an appropriate cost structure. We expect to be able to support growth by prioritizing and focusing our resources, leveraging our technology and domain expertise and maintaining and expanding strong customer and partner relationships. As with any growth strategy, there can be no assurance that we will succeed in accomplishing our strategic initiatives.

Recent Developments

Throughout 2018, we launched several next generation additive manufacturing solutions, a range of materials and new software releases. In February 2018, we introduced the NextDent 5100, a Figure 4-based 3D printer specifically designed for dental labs, which we believe is a breakthrough product for digital dentistry in terms of cost and capabilities. At the same time, we launched several new materials, bringing the total number to 30 dental-specific materials for the NextDent 5100. Additionally we launched the FabPro 1000, a low cost, high productivity DLP-based 3D printer designed for dental and jewelry production as well as high functionality and throughput, industrial prototyping. We began shipping our next generation SLS printer, the ProX SLS 6100, with six production-grade materials to deliver superior part quality with greater efficiency and lower total cost of operation versus competitors. We launched the ProJet MJP 2500 IC designed to eliminate the cost and time of tooling and storage with 3D printed wax patterns that can be used seamlessly in existing foundry casting processes. We also commercialized Figure 4 stand alone and production solutions, innovative, high-speed production solutions capable of six sigma repeatability and matching injection molding part quality.

In June 2018, we announced a strategic partnership with GF Machining Solutions ("GF"), one of the world’s leading providers of complete solutions to the precision machining industry and to manufacturers of precision components. We believe this partnership greatly enhances our metals printing distribution, scalability and automation. In September 2018, we debuted the DMP Factory 500, the first joint solution developed as part of our partnership with GF. The DMP Factory 500 is optimized for scalability, repeatable high quality parts, high throughput and low total cost of operation with the ability to print the largest part diameter available today. We also began shipping the DMP Flex 350 and DMP Factory 350, designed for volume production of critical components for industrial applications such as aerospace, healthcare, and transportation. Our DMP solutions offer durable and removable print modules, powder management modules, a broad range of metals materials and fully integrated 3DXpert software to help streamline the production of parts. All of the new products above were commercially available by December 31, 2018.

2018 Summary

Total consolidated revenue for the year ended December 31, 2018 increased by 6.4%, or $41.6 million, to $687.7 million, compared to $646.1 million for the year ended December 31, 2017. These results reflect an increase in printers, materials and services revenue, as further discussed below.

For the year ended December 31, 2018 revenue from printers increased 24.5% to $153.7 million compared to $123.4 million in the prior year.

Healthcare revenue includes sales of products, materials and services for healthcare-related applications, including simulation, training, planning, 3D printing of anatomical models, surgical guides and instruments and medical and dental devices. For the year ended December 31, 2018, healthcare revenue increased by 19.5%, to $225.5 million, and made up 32.8% of total revenue, compared to $188.7 million, or 29.2% of total revenue, for the year ended December 31, 2017. The increase in healthcare revenue is driven by growth in products, including printers, materials and services, including virtual surgical planning and contract manufacturing services.

For the year ended December 31, 2018, total software revenue, including haptics and scanners, from products and services increased 5.0% to $96.3 million, and made up 14.0% of total revenue, compared to $91.7 million, or 14.2% of total revenue for the year ended December 31, 2017.

Gross profit for the year ended December 31, 2018 increased by 6.4%, or $19.6 million, to $324.4 million, compared to $304.8 million for the year ended December 31, 2017. Gross profit margin was 47.2% for the years ended December 31, 2018 and 2017.

Operating expenses for the year ended December 31, 2018 increased by 2.4%, or $8.8 million, to $367.6 million, compared to $358.8 million for the year ended December 31, 2017. Selling, general and administrative expenses for the year ended December 31, 2018 increased by 3.1%, or $8.1 million, to $272.3 million, compared to $264.2 million for the year ended December 31, 2017, predominantly due to our investments in new product launches, go-to-market and IT infrastructure.

Research and development expenses for the year ended December 31, 2018 increased by 0.7%, or $0.7 million, to $95.3 million, compared to $94.6 million for the year ended December 31, 2017, predominantly due to investments related to the launch of several new products throughout 2018.

Our operating loss for the year ended December 31, 2018 was $43.2 million, compared to an operating loss of $54.0 million for the year ended December 31, 2017.

For the years ended December 31, 2018 and 2017, we generated $4.8 million and $26.1 million of cash from operations, respectively, as further discussed below. In total, our unrestricted cash balance at December 31, 2018 and 2017 was $110.0 million and $136.3 million, respectively. The lower cash balance was the result of our investments in go-to-market, IT infrastructure, new product launches, and higher legal expenses related to compliance and regulatory matters and payments related to previous litigation settlements.

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Results of Operations for 2018, 2017 and 2016

Comparison of revenue by geographic region

2018 compared to 2017

The following table sets forth the change in revenue by geographic region for the years ended December 31, 2018 and 2017:

Table 1

(Dollars in thousands)	Americas		EMEA		Asia Pacific		Total	
Revenue – 2017	$333,776	51.7 %	$220,357	34.1 %	$91,936	14.2%	$646,069	100 %
Change in revenue:								
Volume	28,915	8.7 %	18,458	8.4 %	10,995	12.0%	58,368	9.0 %
Price/Mix	(20,978)	(6.3)%	(8,047)	(3.7)%	4,864	5.3 %	(24,161)	(3.7)%
Foreign currency translation	(948)	(0.3)%	6,694	3.0 %	1,638	1.8 %	7,384	1.1 %
Net change	6,989	2.1 %	17,105	7.7 %	17,497	19.1%	41,591	6.4 %
Revenue – 2018	$340,765	49.6 %	$237,462	34.5 %	$109,433	15.9%	$687,660	100 %

Consolidated revenue increased 6.4%, predominantly driven by higher sales volume across all geographic regions, including recently commercialized new 3D printers, partially offset by an unfavorable impact of price/mix in the Americas and EMEA regions, which was driven by product mix, and the unfavorable impact of foreign currency. The increased sales volume across all
geographic regions is due to higher demand from healthcare customers as well as a range of customers across other key verticals. The negative price/mix impact across the Americas and EMEA regions is driven by higher sales of lower priced printer models and mix of materials sales.

For the years ended December 31, 2018 and 2017, revenue from operations outside the U.S., including Latin America, EMEA and APAC, was 51.6% and 50.1% of total revenue, respectively.

2017 compared to 2016

The following table sets forth the change in revenue by geographic region for the years ended December 31, 2017 and 2016:

Table 2

(Dollars in thousands)	Americas		EMEA		Asia Pacific		Total	
Revenue – 2016	$340,885	53.9 %	$193,141	30.5 %	$98,939	15.6 %	$632,965	100 %
Change in revenue:								
Volume	3,808	1.1 %	25,240	13.1 %	11,281	11.4 %	40,329	6.4 %
Price/Mix	(11,420)	(3.4)%	(2,515)	(1.3)%	(17,809)	(18.0)%	(31,744)	(5.0)%
Foreign currency translation	503	0.1 %	4,491	2.3 %	(475)	(0.5)%	4,519	0.7 %
Net change	(7,109)	(2.2)%	27,216	14.1 %	(7,003)	(7.1)%	13,104	2.1 %
Revenue – 2017	$333,776	51.7 %	$220,357	34.1 %	$91,936	14.2 %	$646,069	100 %

Consolidated revenue increased 2.1%, driven by higher sales volume in the EMEA and Asia Pacific regions as well as the favorable impact of foreign currency, offset by a shift in product mix and average selling price across all geographic regions. The increase in revenue in the EMEA region primarily reflects higher sales volume, including the addition of Vertex and NextDent branded dental materials, and the favorable impact of foreign currency, partially offset by a shift in product mix and average selling price. The decrease in revenue in the Americas and Asia Pacific regions are primarily due to a shift in product mix and average selling price, partially offset by an increase in sales volume in the Asia Pacific region.

For the years ended December 31, 2017 and 2016, revenue from operations outside the U.S., including Latin America, EMEA and APAC, was 50.1% and 47.9% of total revenue, respectively.

Comparison of revenue by class

We earn revenue from the sale of products, materials and services. The products category includes 3D printers, healthcare simulators and digitizers, as well as software, 3D scanners and haptic devices. The materials category includes a wide range of materials to be used with our 3D printers, the majority of which are proprietary, as well as acquired conventional dental materials. The services category includes warranty and maintenance on 3D printers and simulators, software maintenance, on demand manufacturing solutions and healthcare services.

Due to the relatively high price of certain 3D printers and a corresponding lengthy selling cycle and relatively low unit volume of the higher priced printers in any particular period, a shift in the timing and concentration of orders and shipments from one period to another can affect reported revenue in any given period. Revenue reported in any particular period is also affected by timing of revenue recognition under rules prescribed by U.S. generally accepted accounting principles ("GAAP").

In addition to changes in sales volumes and the impact of revenue from acquisitions, there are two other primary drivers of changes in revenue from one period to another: (1) the combined effect of changes in product mix and average selling prices, sometimes referred to as price and mix effects, and (2) the impact of fluctuations in foreign currencies. As used in this Management's Discussion and Analysis, the price and mix effects relate to changes in revenue that are not able to be specifically related to changes in unit volume.

2018 compared to 2017

The following table sets forth the change in revenue by class for the years ended December 31, 2018 and 2017.

Table 3

(Dollars in thousands)	Products		Materials		Services		Totals	
Revenue – 2017	$222,750	34.5 %	$168,846	26.1 %	$254,473	39.4%	$646,069	100.0 %
Change in revenue:								
Volume	43,208	19.4	13,870	8.2	1,290	0.5	58,368	9.0
Price/Mix	(8,656)	(3.9)	(15,505)	(9.2)	—	—	(24,161)	(3.7)
Foreign currency translation	1,822	0.8	2,880	1.7	2,682	1.1	7,384	1.1
Net change	36,374	16.3	1,245	0.7	3,972	1.6	41,591	6.4
Revenue – 2018	$259,124	37.7 %	$170,091	24.7 %	$258,445	37.6%	$687,660	100.0 %

Consolidated revenue increased 6.4%, predominantly driven by higher sales volume across all revenue categories, including the
impact of new printers launched in 2018, and the favorable impact of foreign currency, partially offset by a shift in sales mix which impacted average selling price for both products and materials.

Products revenue increased due to higher demand from healthcare and a wide range of other key verticals and for products across our portfolio, including the recently commercialized new products; partially offset by changes in sales mix which impacted average selling prices, including the impact of higher sales of lower priced printers. Revenue from printers increased 24.5% to $153.7 million for the year ended December 31, 2018 compared to $123.4 million in the prior year. For the year ended December 31, 2018, software revenue included in the products category, including scanners and haptic devices, contributed $51.7 million, an increase of 8.2%, compared to $47.8 million for the year ended December 31, 2017.

The increase in materials revenue for the year ended December 31, 2018 primarily reflects demand for materials driven by healthcare and industrial customers for our core and new materials, coupled with a favorable impact from foreign currency. The unfavorable price/mix impact is primarily driven by mix of sales during the year, including the impacts of product mix, geographic sales mix and volume purchase pricing.

The increase in services revenue for the year ended December 31, 2018 was primarily driven by growth in healthcare, on demand manufacturing and software services revenue. Despite headwinds related to export compliance and changes in on demand outsourcing procedures and strategy in the second half of 2018, on demand manufacturing services revenue increased 2.2% to $107.1 million for the year ended December 31, 2018, compared to $104.7 million for the year ended December 31, 2017. For the years ended December 31, 2018 and 2017, software revenue included in the services category contributed $44.6 million and $43.9 million, respectively.

2017 compared to 2016

The following table sets forth the change in revenue by class for the years ended December 31, 2017 and 2016.

Table 4

(Dollars in thousands)	Products		Materials		Services		Totals	
Revenue – 2016	$238,011	37.6 %	$156,839	24.8 %	$238,115	37.6%	$632,965	100 %
Change in revenue:								
Volume	(2,316)	(1.0)	27,501	17.5	15,144	6.4	40,329	6.4
Price/Mix	(15,979)	(6.7)	(15,765)	(10.1)	—	—	(31,744)	(5.0)
Foreign currency translation	3,034	1.3	271	0.2	1,214	0.5	4,519	0.7
Net change	(15,261)	(6.4)	12,007	7.6	16,358	6.9	13,104	2.1
Revenue – 2017	$222,750	34.5 %	$168,846	26.1 %	$254,473	39.4%	$646,069	100 %

Consolidated revenue increased 2.1%, driven by increased sales volume in both materials and services as well as the favorable impact of foreign currency, offset by a shift in product mix and average selling prices.

Products revenue decreased due to changes in product mix and average selling prices, including a shift in demand for lower priced printers and a moderate decrease in sales volume. For the years ended December 31, 2017 and 2016, revenue from printers contributed $123.4 million and $133.3 million, respectively. Software revenue included in the products category, including scanners and haptic devices, contributed $47.8 million and $44.5 million for the years ended December 31, 2017 and 2016, respectively.

The increase in materials revenue reflects continued utilization by the installed base and demand from healthcare customers, including acquired Vertex and NextDent dental materials. This increased demand was partially offset by a decrease related to a shift in product mix and average selling prices.

Services revenue increased primarily due to higher demand for healthcare services. For the years ended December 31, 2017 and 2016, revenue from on demand manufacturing services contributed $104.6 million and $104.4 million, respectively. For the years ended December 31, 2017 and 2016, software services revenue contributed $43.9 million and $43.2 million, respectively.

Gross profit and gross profit margins

2018 compared to 2017

The following table sets forth gross profit and gross profit margins for the years ended December 31, 2018 and 2017.

Table 5

	Year Ended December 31,							
	2018		2017		Change in Profit		Change in Gross Profit Margin	
(Dollars in thousands)	Gross Profit	Gross Profit Margin	Gross Profit	Gross Profit Margin	$	%	Percentage Points	%
Products	$79,928	30.8 %	$52,136	23.4 %	$27,792	53.3 %	7.4	31.6 %
Materials	119,494	70.3 %	123,014	72.9 %	(3,520)	(2.9)%	(2.6)	(3.6)%
Services	124,972	48.4 %	129,689	51.0 %	(4,717)	(3.6)%	(2.6)	(5.1)%

Total	$	324,394	47.2	%	$	304,839	47.2	%	$	19,555	6.4	%	—	— %

The increase in total consolidated gross profit is due to the increase in product sales, primarily higher sales of printers. In addition, the inventory adjustment discussed below had a negative impact on margins in the comparable period for the prior year.

Products gross profit margin increased, primarily due to inventory adjustments totaling $12.9 million in 2017 that were a result of a comprehensive review of our portfolio and inventory and related primarily to legacy plastics printers, refurbished and used metals printers and parts having minimal or no use over extended periods, and a small increase in gross profit margin as a result of ongoing supply chain cost reduction efforts. Gross profit margin for materials decreased, reflecting the unfavorable impact of mix driven by geographic sales mix and product mix. Gross profit margin for services decreased, driven by lower on demand manufacturing margin which was partially offset by improved margins for software and maintenance services. On demand manufacturing services gross profit margin decreased to 35.9% for the year ended December 31, 2018, compared to 43.1% for the year ended December 31, 2017 due to mix of sales and lower utilization as we invested in several facilities globally to upgrade and expand capacity while at the same time exiting certain other facilities.

2017 compared to 2016

The following table sets forth gross profit and gross profit margins for the years ended December 31, 2017 and 2016.

Table 6

	Year Ended December 31,							
	2017		2016		Change in Gross Profit		Change in Gross Profit Margin	
(Dollars in thousands)	Gross Profit	Gross Profit Margin	Gross Profit	Gross Profit Margin	$	%	Percentage Points	%
Products	$52,136	23.4 %	$62,998	26.5 %	$(10,862)	(17.2)%	(3.1)	(11.7)%
Materials	123,014	72.9 %	121,030	77.2 %	1,984	1.6 %	(4.3)	(5.6)%
Services	129,689	51.0 %	125,723	52.8 %	3,966	3.2 %	(1.8)	(3.4)%
Total	$304,839	47.2 %	$309,751	48.9 %	$(4,912)	(1.6)%	(1.7)	(3.5)%

The decrease in total consolidated gross profit is predominantly driven by changes in product mix. Also contributing to the decrease were the inventory adjustments totaling $12.9 million in 2017 versus adjustments of $10.7 million in the same period of 2016. The 2017 inventory adjustment resulted from a comprehensive review of our portfolio and inventory during the year ended December 31, 2017. The 2017 inventory adjustment primarily related to legacy plastics printers, refurbished and used metals printers and parts that have shown little to no use over extended periods. The majority of this adjustment relates to the products category. Gross profit for materials decreased primarily due to the addition of Vertex’s conventional dental materials, which are lower gross profit margin than 3D printing materials. Gross profit margin for services decreased due to lower gross profit margins in printer services as we invested in addressing legacy issues and building out our service model, which offset the benefit of higher demand for healthcare services. On demand manufacturing services gross profit margin remained flat at 43.1% for the year ended December 31, 2017, compared to 43.0% for the year ended December 31, 2016.

Operating expenses

2018 compared to 2017

The following table sets forth the components of operating expenses for the years ended December 31, 2018 and 2017.

Table 7

	Year Ended December 31					
	2018		2017		Change	
(Dollars in thousands)	Amount	% Revenue	Amount	% Revenue	$	%
Selling, general and administrative expenses	$272,287	39.6 %	$264,185	40.9 %	$8,102	3.1%

Research and development expenses	95,298	13.9	%	94,627	14.6	%	671	0.7%
Total operating expenses	$367,585	53.5	%	$358,812	55.5	%	$8,773	2.4%

Selling, general and administrative expenses increased due to additional employee related costs, in particular to support selling & marketing activities incurred in connection with the launch of new products during 2018, continued investment in IT infrastructure, and higher legal expenses; partially offset by a reduction in outside services costs.

Research and development expenses remained relatively flat as our increased investment in our workforce was offset by a reduction in outside services costs and a reduced materials spend related to products which have been brought to market during 2018.

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2017 compared to 2016

The following table sets forth the components of operating expenses for the years ended December 31, 2017 and 2016.

Table 8

	Year Ended December 31,							
	2017			2016			Change	
(Dollars in thousands)	Amount	% Revenue		Amount	% Revenue		$	%
Selling, general and administrative expenses	$264,185	40.9	%	$259,776	41.0	%	$4,409	1.7%
Research and development expenses	94,627	14.6	%	88,395	14.0	%	6,232	7.1%
Total operating expenses	$358,812	55.5	%	$348,171	55.0	%	$10,641	3.1%

Selling, general and administrative expenses increased primarily due to our investments in go-to-market and IT infrastructure and additional talent and resources, as well as repairs and maintenance costs, offset by lower stock compensation expense due to the impact of adopting a new accounting standard which resulted in a change in our policy for accounting for award forfeitures.

Research and development expenses increased due to focused innovation to drive customers' shift to 3D production, including investment in plastics, in particular our Figure 4 platform, metals, materials and software as well as the addition of talent and resources. Research and development for 2016 included $4.6 million of expense related to charges and write-offs in connection with our updated strategy and project reprioritization.

Income (loss) from operations

The following table sets forth income (loss) from operations by geographic region for the years ended December 31, 2018, 2017 and 2016.

Table 9

	Year Ended December 31,		
(Dollars in thousands)	2018	2017	2016
Income (loss) from operations			
Americas	$(69,081)	$(79,429)	$(64,377)
EMEA	5,283	7,483	6,016
Asia Pacific	20,607	17,973	19,941
Total	$(43,191)	$(53,973)	$(38,420)

See "Gross profit and gross profit margins" and "Operating expenses" above.

Interest and other expenses, net

The following table sets forth the components of interest and other expenses, net, for the years ended December 31, 2018, 2017 and 2016.

Table 10

	Year Ended December 31,		
(Dollars in thousands)	2018	2017	2016
Interest and other expense, net:			
Foreign exchange (gain) loss	$(3,011)	$908	$(94)
Interest expense, net	399	135	475
Other expense, net	2,649	2,505	1,011
Interest and other expense, net	$37	$3,548	$1,392

The decrease for the year ended December 31, 2018, as compared to the year ended December 31, 2017, is primarily due to the favorable impact of foreign currency.

The increase for the year ended December 31, 2017, as compared to the year ended December 31, 2016, is attributable to impairment charges related to certain cost method investments and an unfavorable impact of foreign currency.

See Note 2 to the Consolidated Financial Statements.

Benefit and provision for income taxes

We recorded a $2.0 million and $7.8 million provision for income taxes for the years ended December 31, 2018 and 2017, respectively. In 2016, we recorded a benefit for income taxes of $0.5 million.

In 2018, our provision reflected $5.9 million in U.S. tax benefit and $7.9 million in foreign jurisdictions tax expense. In 2017, our provision reflected $1.8 million in U.S. tax expense and $6.0 million in foreign jurisdictions tax expense. In 2016, the benefit primarily reflected a $3.3 million U.S. tax benefit and $2.8 million of tax expense in foreign jurisdictions.

During 2018 and 2017, we concluded that it is more likely than not that our deferred tax assets will not be realized in certain jurisdictions, including the U.S. and certain foreign jurisdictions; therefore, we have a valuation allowance recorded against our deferred tax assets on our consolidated balance sheets totaling $95.4 million and $80.8 million as of December 31, 2018 and 2017, respectively.

For further discussion, see Notes 2 and 20 to the Consolidated Financial Statements.

Net loss attributable to 3D Systems

2018 compared to 2017

The following table sets forth the primary components of net loss attributable to 3D Systems for the years ended December 31, 2018 and 2017.

Table 11

	Year Ended December 31,		
(Dollars in thousands)	2018	2017	Change
Operating loss	$(43,191)	$(53,973)	$10,782
Less:			
Interest and other expense, net	37	3,548	3,511
Provision (benefit) for income taxes	2,035	7,802	5,767
Net loss attributable to noncontrolling interests	242	868	626
Net loss attributable to 3D Systems	$(45,505)	$(66,191)	$20,686
Weighted average shares, basic and diluted	112,327	111,554	
Loss per share, basic and diluted	$(0.41)	$(0.59)	

The decrease for the year ended December 31, 2018 as compared to the year ended December 31, 2017 is primarily due to a decrease in loss from operations and interest and other expense. See “Gross profit and gross profit margins” and “Operating expenses” above.

2017 compared to 2016

The following table sets forth the primary components of net loss attributable to 3D Systems for the years ended December 31, 2017 and 2016.

Table 12

	Year Ended December 31,		
(Dollars in thousands)	2017	2016	Change
Operating loss	$(53,973)	$(38,420)	$(15,553)
Less:			
Interest and other expense, net	3,548	1,392	2,156
Provision (benefit) for income taxes	7,802	(547)	8,349
Net loss attributable to noncontrolling interests	868	(846)	1,714
Net loss attributable to 3D Systems	$(66,191)	$(38,419)	$(27,772)
Weighted average shares, basic and diluted	111,554	111,189	
Loss per share, basic and diluted	$(0.59)	$(0.35)	

The increase for the year ended December 31, 2017 as compared to the year ended December 31, 2016, is primarily due to a decrease in gross profit, an increase in selling, general and administrative expenses due to investment in go to market and IT infrastructure, an increase in research and development expenses due to our continued investment in plastics, including our Figure 4 platform, metals, materials and software, and the effect of income taxes; which combined to offset the increase in revenue. See “Comparison of revenue by geographic region,” “Gross profit and gross profit margins,” and “Operating expenses” above.

Liquidity and Capital Resources

Table 13

	For the Year Ended December 31,		Change	
(Dollars in thousands)	2018	2017	$	%
Cash and cash equivalents	$109,998	$136,344	$(26,346)	(19.3)%
Accounts receivable, net	126,618	129,879	(3,261)	(2.5)%
Inventories	133,161	103,903	29,258	28.2 %
	369,777	370,126	(349)	
Less:				
Current portion of capitalized lease obligations	654	644	10	1.6 %
Accounts payable	66,722	55,607	11,115	20.0 %
Accrued and other liabilities	59,265	65,899	(6,634)	(10.1)%
	126,641	122,150	4,491	
Operating working capital	$243,136	$247,976	$(4,840)	(2.0)%

We assess our liquidity in terms of our ability to generate cash to fund our operating, investing and financing activities. In doing so, we review and analyze our current cash on hand, the number of days our sales are outstanding, inventory turns, capital expenditure commitments and accounts payable turns. Our cash requirements primarily consist of funding of working capital and funding of capital expenditures.

Cash flow from operations, cash and cash equivalents, and other sources of liquidity such as bank credit facilities and issuing equity or debt securities, are expected to be available and sufficient to meet foreseeable cash requirements. During the fourth quarter of 2018, we drew $25 million on our revolving credit line to support working capital and general corporate purposes.

Cash held outside the U.S. at December 31, 2018 was $73.3 million, or 66.7% of total cash and equivalents, compared to $88.9 million, or 65.2% of total cash and equivalents at December 31, 2017. Cash held outside the U.S. is used in our foreign operations for working capital purposes and is considered to be permanently invested. Cash equivalents are comprised of funds held in money market instruments and are reported at their current carrying value, which approximates fair value due to the short term nature of these instruments. We strive to minimize our credit risk by investing primarily in investment grade, liquid instruments and limit exposure to any one issuer depending upon credit quality. See “Cash flow”, “Credit facilities” and “Capitalized lease obligations” below.

We acquired one business, Vertex, in 2017 for consideration of approximately $37.6 million, net of cash assumed, related to expanding our healthcare solutions portfolio, particularly within the dental vertical. Consideration consisted of approximately $34.3 in cash, net of cash assumed, and approximately $3.2 million in shares of the Company’s common stock.

Days sales outstanding was 69 days at December 31, 2018 compared to 73 days at December 31, 2017, while accounts receivable more than 90 days past due decreased to 8.9% of gross receivables at December 31, 2018, from 9.1% at December 31, 2017. We review specific receivables periodically to determine the appropriate reserve for accounts receivable.

The majority of our inventory consists of finished goods, including products, materials and service parts. Inventory also consists of raw materials for certain printers and service products.

The changes that make up the other components of working capital not discussed above resulted from the ordinary course of business. Differences between the amounts of working capital item changes in the cash flow statement and the balance sheet changes for the corresponding items are primarily the result of foreign currency translation adjustments.

Cash Flow

The following tables set forth components of cash flow for the years ended December 31, 2018, 2017 and 2016.

Table 14

(Dollars in thousands)	Year Ended December 31, 2018	2017	2016
Net cash provided by operating activities	$4,796	$26,127	$57,483
Net cash used in investing activities	(41,827)	(70,659)	(21,882)
Net cash provided by (used in) financing activities	14,264	(9,188)	(3,926)
Effect of exchange rate changes on cash and cash equivalents	(3,145)	5,303	(2,369)
Net (decrease) increase in cash and cash equivalents	$(25,912)	$(48,417)	$29,306

Cash flow from operations

Table 15

(Dollars in thousands)	Year Ended December 31, 2018	2017	2016
Net loss	$(45,263)	$(65,323)	$(39,265)
Non-cash charges	89,378	100,095	107,952
Changes in working capital and all other operating assets	(39,319)	(8,645)	(11,204)
Net cash provided by operating activities	$4,796	$26,127	$57,483

Cash provided by operating activities for 2018, 2017 and 2016 was $4.8 million, $26.1 million and $57.5 million, respectively. Excluding non-cash charges, net income provided cash of $44.1 million in 2018, $34.8 million in 2017 and $68.7 million in 2016. Non-cash charges generally consist of depreciation, amortization, stock-based compensation and inventory adjustments.

Working capital requirements used cash of $39.3 million in 2018, $8.6 million in 2017 and $11.2 million in 2016. Spend on inventory was the primary driver of the working capital outflows in all years and it was partially offset by other working capital items.

Cash flow from investing activities

Table 16

(Dollars in thousands)	Year Ended December 31, 2018	2017	2016
Cash paid for acquisitions, net of cash assumed	$—	$(34,291)	$—
Purchases of property and equipment	(40,694)	(30,881)	(16,567)
Additions to license and patent costs	(970)	(1,159)	(1,132)
Purchase of noncontrolling interest	—	(2,250)	(3,533)
Proceeds from disposition of property and equipment	333	273	350
Other investing activities	(496)	(2,351)	(1,000)
Net cash used in investing activities	$(41,827)	$(70,659)	$(21,882)

Cash used by investing activities was $41.8 million in 2018, $70.7 million in 2017 and $21.9 million in 2016. The primary outflows of cash were acquisitions and capital expenditures.

Growth in capital expenditures is driven by our continued investment in our facilities for new product development efforts, including our Customer Innovation Centers, on demand facilities and IT infrastructure.

Acquisitions

As noted above, we acquired Vertex in 2017.

We made no acquisitions during the years ended December 31, 2018 and 2016.

Cash flow from financing activities

Table 17

(Dollars in thousands)	Year Ended December 31, 2018	2017	2016
Proceeds from borrowings	$25,000	$—	$—
Payments related to net-share settlement of stock-based compensation	(7,367)	(5,545)	(2,871)
Payments on earnout consideration	(2,675)	(3,206)	—
Repayment of capital lease obligations	(694)	(437)	(1,055)
Net cash provided by (used in) financing activities	$14,264	$(9,188)	$(3,926)

Cash provided by (used in) financing activities was $14.3 million in 2018, $(9.2) million in 2017 and $(3.9) million in 2016. The primary source of cash was a $25.0 million draw on our revolving credit line in the fourth quarter of 2018, offset by outflows of cash related to the settlement of stock-based compensation and payments on earnout provisions during the years ended 2018 and 2017. The primary outflows of cash in 2016 relate to the settlement of stock-based compensation and repayment of capital lease obligations.

Off-Balance Sheet Arrangements

We have no off-balance sheet arrangements and do not utilize any “structured debt,” “special purpose,” or similar unconsolidated entities for liquidity or financing purposes.

Contractual Obligations and Commercial Commitments

The table below summarizes our contractual obligations as of December 31, 2018.

Table 18

(Dollars in thousands)	Years Ending December 31, 2019	2020-2021	2022-2023	Later Years	Total
Capitalized lease obligations	$1,099	$ 1,747	$ 1,504	$5,990	$10,340
Debt obligations	25,000	—	—	—	25,000
Non-cancelable operating leases [(a)]	15,123				