HARVARD BIOSCIENCE INC
Form 10-K
March 16, 2018

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

Annual report pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934
For the fiscal year ended December 31, 2017

or

Transition report pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934
For the transition period from to

Commission File Number 001-33957

HARVARD BIOSCIENCE, INC.

(Exact Name of Registrant as Specified in Its Charter)

Delaware	**04-3306140**
(State or other jurisdiction of Incorporation or organization)	(I.R.S. Employer Identification No.)

84 October Hill Road, Holliston, Massachusetts 01746

(Address of Principal Executive Offices, including zip code)

(508) 893-8999

(Registrant's telephone number, including area code)

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

Title of each class	**Name of each exchange on which registered**
Common Stock, $0.01 par value	**The NASDAQ Global Market**

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

None

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

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

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

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). YES NO

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

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of “large accelerated filer,” “accelerated filer” and “smaller reporting company” in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer		Accelerated filer
Non-accelerated filer	(Do not check if a smaller reporting company)	Smaller reporting company
		Emerging growth company

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

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

The aggregate market value of 28,652,635 shares of voting common equity held by non-affiliates of the registrant as of June 30, 2017 was approximately $73,064,219 based on the closing sales price of the registrant’s common stock, par value $0.01 per share on that date. Shares of the registrant’s common stock held by each officer and director and each person known to the registrant to own 10% or more of the outstanding voting power of the registrant have been excluded in that such persons may be deemed affiliates. This determination of affiliate status is not a determination for other purposes. The registrant has no shares of non-voting common stock authorized or outstanding.

At March 9, 2018, there were 35,594,802 shares of the registrant’s common stock issued and outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Company’s definitive Proxy Statement in connection with the 2018 Annual Meeting of Stockholders (the “Proxy Statement”), to be filed within 120 days after the end of the Registrant’s fiscal year, are incorporated by reference into Part III of this Form 10-K. Except with respect to information specifically incorporated by reference in this Form 10-K, the Proxy Statement is not deemed to be filed as part hereof.

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This Annual Report on Form 10-K contains statements that are not statements of historical fact and are forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934 (Exchange Act), each as amended. The forward-looking statements are principally, but not exclusively, contained in "Item 1: Business" and "Item 7: Management's Discussion and Analysis of Financial Condition and Results of Operations." These statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. Forward-looking statements include, but are not limited to, statements about management's confidence or expectations, our business strategy, our ability to raise capital or borrow funds to consummate acquisitions and the availability of attractive acquisition candidates, our expectations regarding future costs of product revenues, our anticipated compliance with the covenants contained in our credit facility, the adequacy of our financial resources and our plans, objectives, expectations and intentions that are not historical facts. In some cases, you can identify forward-looking statements by terms such as "may," "will," "should," "could," "would," "seek," "expects," "plans," "aim," "anticipates," "believes," "estimates," "projects," "predicts," "intends," "think," "strategy," "potential," "objectives," "optimistic," "new," "goal" and similar expressions intended to identify forward-looking statements. These statements reflect our current views with respect to future events and are based on assumptions and subject to risks and uncertainties. Given these uncertainties, you should not place undue reliance on these forward-looking statements. We discuss many of these risks in detail under the heading "Item 1A. Risk Factors" beginning on page 9 of this Annual Report on Form 10-K. You should carefully review all of these factors, as well as other risks described in our public filings, and you should be aware that there may be other factors, including factors of which we are not currently aware, that could cause these differences. Also, these forward-looking statements represent our estimates and assumptions only as of the date of this report. We may not update these forward-looking statements, even though our situation may change in the future, unless we have obligations under the federal securities laws to update and disclose material developments related to previously disclosed information. Harvard Bioscience, Inc. is referred to herein as "we," "our," "us," and "the Company."

PART I

Item 1. *Business.*

Overview

Harvard Bioscience, Inc., a Delaware corporation, is a global developer, manufacturer and marketer of a broad range of scientific instruments and systems used to advance life science for basic research, drug discovery, clinical and environmental testing. Our products are sold to thousands of researchers in over 100 countries through our global sales organization, websites, catalogs, and through distributors including Thermo Fisher Scientific Inc., VWR and other specialized distributors. We have sales and manufacturing operations in the United States, the United Kingdom, Germany, Sweden, Spain, France, Canada, and China.

Our History

Our business began in 1901 under the name Harvard Apparatus. It was founded by Dr. William T. Porter, a Professor of Physiology at Harvard Medical School and a pioneer of physiology education. We have grown over the years with the development and evolution of modern life science research and education. Our early inventions included ventilators based on Dr. Porter's design, the mechanical syringe pump for drug infusion in the 1950s, and the microprocessor controlled syringe pump in the 1980s.

In March of 1996, a group of investors acquired a majority of the then existing business of our predecessor, Harvard Apparatus, Inc. Following this acquisition, our focus was redirected to acquiring complimentary companies with innovative technologies while continuing to grow the existing business through internal product development. Since 1996, we have completed more than 26 business or product line acquisitions related to our continuing operations. We have also developed many new product lines including: new generation Harvard Apparatus syringe pumps, PHD Ultra series of syringe pumps, advanced Inspira ventilators, GeneQuant DNA/RNA/protein calculators, UVM plate readers, BTX Gemini X2 multi-waveform electroporation system, BioDrop micro-volume spectrophotometer and cuvette, OxyletPro metabolic monitoring system, Multi-Channel Systems' automated four channel PatchServer, DP-304A amplifiers, Allegro Peristaltic pump systems, Centrifan small-volume evaporators and advanced VentElite ventilators.

Led by President and CEO Jeffrey A. Duchemin, we have conducted a multi-year restructuring program to reduce costs, align global functions, consolidate facilities to optimize our global footprint, divest non-core businesses and to reinvest in key areas such as sales and common IT systems. As part of these efforts, we divested our AHN Biotechnologie GmbH subsidiary (AHN) in the fourth quarter of 2016 and, during the first quarter of 2018, we sold substantially all the assets of our wholly-owned subsidiary, Denville Scientific, Inc. (Denville).

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We are also pursuing a strategy to grow the business through strategic, accretive acquisitions, including four acquisitions since the fourth quarter of 2014.

Most recently, in January 2018, we acquired Data Sciences International, Inc. (DSI) for approximately $70.0 million. DSI, a St. Paul, Minnesota-based life science research company, is a recognized leader in physiologic monitoring focused on delivering preclinical products, systems, services and solutions to its customers. Its customers include pharmaceutical and biotechnology companies, as well as contract research organizations, academic labs and government researchers. This acquisition diversifies our customer base into the biopharmaceutical and contract research organization markets and offers revenue and cost synergies.

Our Strategy

Our vision is to be a world leading life science company that excels in meeting the needs of our customers by providing a wide breath of innovative products and solutions, while providing exemplary customer service. Our business strategy is to grow our top-line and bottom-line, and build shareholder value through a commitment to:

- commercial excellence;
- new product development;
- strategic acquisitions; and
- operational efficiencies.

Our Products

As of December 31, 2017, our broad core product range was organized into three commercial product families: Physiology, Cell, Molecular Instruments (PCMI), Electrophysiology (Ephys), and Laboratory Products and Supplies (LPS). As of December 31, 2017, we primarily sold our products under brand names, including Harvard Apparatus, Denville Scientific, KD Scientific, Hoefer, Biochrom, BTX, Warner Instruments, MCS, HEKA, Hugo Sachs Elektronik, Panlab, Coulbourn Instruments, TBSI, and CMA Microdialysis. Following the sale of Denville and the acquisition of DSI in 2018, our core broad product ranges will be organized into three commercial product families, consisting of PCMI, Ephys, and Data Sciences.

Our products consist of instruments, consumables, and systems that are made up of several individual products. Sales prices of these products are mostly priced in the range of $5,000 to $15,000, but range from under $100 to over $100,000. We manufacture our products at our locations in the United States, Germany, Sweden and Spain.

In addition to our proprietary manufactured products, we sell many products that are made by other manufacturers. These distributed products accounted for approximately 36% of our revenues for the year ended December 31, 2017. Distributed products enable us to provide our customers with a single source for their research needs, and consist of a large variety of devices, instruments and consumable items used in experiments involving fluid handling, molecular and cell biology, tissue, organ and animal research. Many of our proprietary manufactured products are leaders in their fields; however, researchers often need complementary products in order to conduct particular experiments. Following is a description of each product family.

Physiology, Cell and Molecular Instruments Product Family

Our PCMI product family includes our traditional syringe pump and peristaltic pump product lines, as well as a broad range of instruments and accessories for tissue, organ and animal based lab research, including surgical products, infusion systems, microdialysis instruments, behavior research systems, and isolated organ and tissue bath systems. Our product offerings are marketed through our Harvard Apparatus, CMA Microdialysis, Panlab, Coulbourn, Hugo Sachs brands and entities. We sell these products through our global sales force, technical service team and our global distribution channel.

The PCMI product family also includes spectrophotometers, microplate readers, amino acid analyzers, gel electrophoresis equipment, and electroporation instruments. We market them under the names Biochrom, Libra, WPA, BioDrop, Hoefer, Scie-plas, and BTX. We sell them primarily through our distribution arrangements with various distributors.

Our PCMI product family made up approximately 56% of our global revenues for the year ended December 31, 2017.

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Electrophysiology Family

The Electrophysiology product family includes the brands Multi-Channel Systems, HEKA, TBSI and Warner Instruments.

Multi-Channel Systems focuses on the development and manufacture of precision scientific measuring instrumentation and equipment in the field of electrophysiology including:

- Data acquisition systems, for use with custom amplifier configurations.
- Complete in vivo-systems, the solution for in vivo recordings with microelectrode arrays.
- Complete in vitro-systems for extracellular recordings from microelectrode arrays in vitro.

HEKA also develops, designs and manufactures precision electrophysiology equipment specializing in Patch Clamp Amplifiers and both manual and automated Patch Clamp Systems along with the associated software. The brand also specializes in instrumentation and equipment for Electrochemistry.

Warner Instruments manufactures specialized tools for Electrophysiology and Cell Biology research including cell chambers, perfusion controllers, temperature controllers, microincubation systems and bio-sensing systems.

TBSI designs and develops in vivo neural interface systems research to aid neuroscience research, especially in the fields of electrophysiology, psychology, neurology and pharmacology. This includes both wireless and tethered systems for both stimulation and recording.

Our Electrophysiology product family made up approximately 20% of our global revenues for the year ended December 31, 2017.

Laboratory Products and Supplies Family

The LPS family consisted of the Denville Scientific brands.

Denville sold laboratory products such as syringe pipettes and tips, reagents, gloves, and other equipment. As discussed above, during the first quarter of 2018, we sold substantially all the assets of Denville, and we shortly thereafter acquired Data Sciences International. As such during 2018, the Laboratory Products and Supplies Family was replaced with the Data Sciences product family.

Our LPS family made up approximately 24% of our global revenues for the year ended December 31, 2017.

Our Customers

Our end-user customers are primarily research scientists at universities, hospitals, government laboratories, including the United States National Institute of Health (NIH), and pharmaceutical and biotechnology companies. We also have global and regional distribution partners, and original equipment manufacturer (OEM) customers who incorporate our products into their products under their brands. Our academic customers, which account for approximately 70% of our revenues historically, include major colleges and universities such as Baylor College of Medicine, Cambridge University, Harvard University, Johns Hopkins University, Massachusetts Institute of Technology, University of California system, University of Texas - MD Anderson Center and Yale University. Our pharmaceutical and biotechnology customers have included pharmaceutical companies and research laboratories such as Amgen, Inc., AstraZeneca plc, Genentech, Inc. and Johnson & Johnson. We have tens of thousands of customers worldwide and no customer accounted for more than 10% of our revenues in 2017.

With the sale of Denville and the acquisition of DSI, both in January 2018, the percentage of our revenues that is derived from academic customers will decline from approximately 70% to closer to 60% on a pro forma basis.

Sales and Marketing

We conduct direct sales in the United States, the United Kingdom, Germany, France, Spain, Sweden, Canada and China. We sell primarily through distributors in other countries. For the year ended December 31, 2017, revenues from direct sales to end-users represented approximately 65% of our revenues; and revenues from sales of our products through distributors represented approximately 35% of our revenues.

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Direct Sales

We have a global sales organization managing both direct sales and distributors. Our websites and catalogs serve as the primary sales tool for our Harvard Apparatus, Denville and other product lines, which includes both proprietary manufactured products and complementary products from various suppliers. Our reputation as a leading producer of many of our manufactured products creates traffic to our websites, enables cross-selling and facilitates the introduction of new products.

Distributors

We engage distributors for the sales of our own branded and private label products in certain areas of the world and for certain product lines.

Research and Development

Our principal research and development mission is to develop products that address growth opportunities within the life science research process, as well as to maintain and optimize our existing product portfolios. We maintain development staff in many of our manufacturing facilities to design and develop new products and to re-engineer existing products to bring them to the next generation. Our research and development expenses were approximately $5.6 million, $5.4 million and $6.4 million for the years ended December 31, 2017, 2016 and 2015, respectively. From time to time, we receive grants from governmental entities in relation to research projects. Such grants received are accounted for as a reduction in research and development expenses over the period of the project. We anticipate that we will continue to make investments in research and development activities as we deem appropriate. We plan to continue to pursue a balanced development portfolio strategy of originating new products from internal research and acquiring products through business and technology acquisitions.

Manufacturing

We manufacture and test the majority of our products in our principal manufacturing facilities located in the United States, Sweden, Spain and Germany. We have considerable manufacturing flexibility at our various facilities, and each facility can manufacture multiple products at the same time. We maintain in-house manufacturing expertise, technologies and resources. We seek to maintain multiple suppliers for key components that are not manufactured in-house, and while some of our products are dependent on sole-source suppliers, we do not believe our dependence upon these suppliers creates any significant risks.

Our manufacturing operations primarily involve assembly and testing activities along with some machine based processes.

Manufacturing Activity	Manufacturing Facility
syringe pumps, ventilators, cell injectors, molecular sample preparation products, electroporation products, electrophysiology products, spectrophotometers, amino acid analysis systems, low-volume, high-throughput liquid dispensers, plate readers, behavioral research products, and microdialysis products	Holliston, Massachusetts
electrophysiology products	Hamden, Connecticut
electrophysiology products	Reutlingen, Germany
electrophysiology products	Lambrecht, Germany
complete organ testing systems	March-Hugstetten, Germany
electrophoresis products	Richmond, California
behavioral research products	Barcelona, Spain
behavioral research products	Durham, North Carolina
microdialysis products	Kista, Sweden

Not included in the table above are the physiological monitoring products and systems that DSI manufactures at its leased facility in New Brighton, Minnesota.

Going forward we will continue to evaluate our manufacturing facilities and operations to further our goal of having an optimal manufacturing footprint.

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Competition

The markets into which we sell some of our products are highly competitive, and we expect the intensity of competition to continue or increase. We compete with many companies engaged in developing and selling tools for life science research. Many of our competitors have greater financial, operational, sales and marketing resources, and more experience in research and development and commercialization than we have. Moreover, our competitors may have greater name recognition than we do, and many offer discounts as a competitive tactic. These competitors and other companies may have developed or could in the future develop new technologies that compete with our products, which could render our products obsolete. We cannot assure you that we will be able to make the enhancements to our technologies necessary to compete successfully with newly emerging technologies. We believe that we offer one of the broadest selections of products to organizations engaged in life science research. We have numerous competitors on a product line basis. We believe that we compete favorably with our competitors on the basis of product performance, including quality, reliability and speed, technical support, price and delivery time.

We compete with several companies that provide instruments for life science research including, Lonza Group Ltd., Becton Dickinson, Eppendorf AG, Razel Scientific Instruments, Inc., Ugo Basile, Danaher Corporation, Bio-Rad Laboratories, Inc., PerkinElmer, Inc. and Thermo Fisher Scientific, Inc.

We cannot forecast if or when these or other companies may develop competitive products. We expect that other products will compete with our products and potential products based on efficacy, safety, cost and intellectual property positions. While we believe that these will be the primary competitive factors, other factors include, in certain instances, availability of supply, manufacturing, marketing and sales expertise and capability.

Seasonality

Sales and earnings in our third quarter are usually flat or down from the second quarter primarily because there are a large number of holidays and vacations during such quarter, especially in Europe. Additionally, academic institutions in the northern hemisphere typically take a hiatus during the summer months. Our fourth quarter revenues and earnings are often the highest in any fiscal year compared to the other three quarters, primarily because many of our customers tend to spend budgeted money before their own fiscal year ends.

Intellectual Property

To establish and protect our proprietary technologies and products, we rely on a combination of patent, copyright, trademark and trade-secret laws, as well as confidentiality provisions in our contracts. Patents or patent applications cover certain of our new technologies. Most of our more mature product lines are protected by trade names and trade secrets only.

We have implemented a patent strategy designed to provide us with freedom to operate and facilitate commercialization of our current and future products. Our success depends, to a significant degree, upon our ability to develop proprietary products and technologies. We intend to continue to file patent applications as we develop new products and technologies.

Patents provide some degree of protection for our intellectual property. However, the assertion of patent protection involves complex legal and factual determinations and is therefore uncertain. The scope of any of our issued patents may not be sufficiently broad to offer meaningful protection. In addition, our issued patents or patents licensed to us may be successfully challenged, invalidated, circumvented or unenforceable so that our patent rights would not create an effective competitive barrier. Moreover, the laws of some foreign countries may protect our proprietary rights to a greater or lesser extent than the laws of the United States. In addition, the laws governing patentability and the scope of patent coverage continue to evolve, particularly in areas of interest to us. As a result, there can be no assurance that patents will be issued from any of our patent applications or from applications licensed to us. As a result of these factors, our intellectual property positions bear some degree of uncertainty.

We also rely in part on trade-secret protection of our intellectual property. We attempt to protect our trade secrets by entering into confidentiality agreements with third parties, employees and consultants. Our employees and consultants also sign agreements requiring that they assign to us their interests in patents and copyrights arising from their work for us. Although many of our United States employees have signed agreements not to compete unfairly with us during their employment and after termination of their employment, through the misuse of confidential information, soliciting employees, soliciting customers and the like, the enforceability of these provisions varies from jurisdiction to jurisdiction and, in some circumstances, they may not be enforceable. In addition, it is possible that these agreements may be breached or invalidated and if so, there may not be an adequate corrective remedy available. Despite the measures we have taken to protect our intellectual property, we cannot assure you that third parties will not independently discover or invent competing technologies, or reverse engineer our trade secrets or other technologies. Therefore, the measures we are taking to protect our proprietary rights may not be adequate.

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We do not believe that our products infringe on the intellectual property rights of any third party. We cannot assure you, however, that third parties will not claim such infringement by us or our licensors with respect to current or future products. We expect that product developers in our market will increasingly be subject to such claims as the number of products and competitors in our market segment grows and the product functionality in different market segments overlaps. In addition, patents on production and business methods are becoming more common and we expect that more patents will be issued in our technical field. Any such claims, with or without merit, could be time-consuming, result in costly litigation and diversion of management's attention and resources, cause product shipment delays or require us to enter into royalty or licensing agreements. Moreover, such royalty or licensing agreements, if required, may not be on terms advantageous to us, or acceptable at all, which could seriously harm our business or financial condition.

"Harvard" is a registered trademark of Harvard University. The marks "Harvard Apparatus" and "Harvard Bioscience" are being used pursuant to a license agreement entered into in December 2002 between us and Harvard University.

Government Regulation

We are not subject to direct governmental regulation other than the laws and regulations generally applicable to businesses in the domestic and foreign jurisdictions in which we operate. In particular, our current products are not subject to pre-market approval by the United States Food and Drug Administration (FDA) for use on human clinical patients. In addition, we believe we are currently in compliance with all relevant environmental laws.

Employees

As of December 31, 2017, we employed 434 employees, of which 413 are full-time and 21 are part-time. As of December 31, 2016, we employed 435 employees, of which 411 were full-time and 24 were part-time.

Geographical residence information for these employees is summarized in the table below:

	As of December 31, 2017
United States	245
Germany	93
United Kingdom	46

Spain	27
Canada	7
Sweden	6
China	8
France	2
Total	434

Included in the table above are 55 Denville employees. All Denville employees were U.S. based as of December 31, 2017. Not included in the table above are employees of DSI and its subsidiaries, which had approximately 180 employees at the end of 2017.

Geographic Area

Financial information regarding geographic areas in which we operate is provided in Note 21 of the “Notes to Consolidated Financial Statements,” which are included elsewhere in this Annual Report.

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Executive Officers of the Registrant

The following table shows information about our executive officers as of December 31, 2017.

Name	Age	Position
Jeffrey Duchemin	52	Chief Executive Officer, President and Director
Robert Gagnon	43	Chief Financial Officer
Yong Sun	54	Vice President, Commercial Operations

Jeffrey A. Duchemin was appointed Chief Executive Officer on August 26, 2013. He assumed the additional roles of President on November 1, 2013 and Director on October 29, 2013. Prior to joining Harvard Bioscience, Mr. Duchemin spent 16 years with Becton Dickinson (BD) in progressive sales, marketing and executive leadership positions across BD's three business segments; BD Medical Systems, BD Diagnostic Systems, and BD Biosciences. In October 2012, BD Biosciences Discovery Labware was acquired by Corning Life Sciences. Mr. Duchemin was a Global Business Director for Corning Life Sciences until his departure to Harvard Bioscience. Mr. Duchemin is a transformational leader with demonstrated business results. The depth of his experience spans across a broad range of life science research and medical device products resulting in growth on a global basis. Mr. Duchemin earned an M.B.A. from Southern New Hampshire University and a B.S. in accounting from the University of Massachusetts Dartmouth.

Robert E. Gagnon was appointed Chief Financial Officer on November 1, 2013. Prior to joining the company he was recently Executive Vice President, Chief Financial Officer and Treasurer at Clean Harbors, Inc. (NYSE:CLH), a leading provider of environmental, energy and industrial services throughout North America. Prior to this, he served in progressive executive positions at Biogen Idec, Inc., a Fortune 500 company developing treatments in the areas of immunology and neurology. Earlier, he worked in a variety of senior positions at Deloitte & Touche, LLP, and PricewaterhouseCoopers, LLP. Mr. Gagnon holds an M.B.A. from the MIT Sloan School of Management and a B.A. in accounting from Bentley College.

Yong Sun assumed the role of Vice President, Commercial Operations on October 28, 2015. Previously Mr. Sun held the position of Vice President, Strategic Marketing and Business Development and Vice President, R&D since October 28, 2013 and March 10, 2014, respectively. Prior to joining Harvard Bioscience, he served as Vice President of Global Marketing and Americas Sales at Beaver-Visitec International, a company combining former ophthalmic business units from BD and Medtronic; in this role he led global marketing to develop and implement strategic marketing plans in target surgical markets. Prior to this, he served in progressive positions at BD, including Director of Global Marketing & United States Sales. Earlier, he served as Marketing Manager, Global Life Sciences Market & Greater China Region at Eli Lilly & Company's eLilly Unit (now InnoCentive, Inc.). Mr. Sun, holds an M.B.A. from the MIT Sloan School of Management, a M.S. in environmental science & engineering from Northeastern University and a B.S. in biochemistry from Peking University.

Available Information and Website

Our website address is www.harvardbioscience.com. Our Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and exhibits and amendments to those reports filed or furnished with the Securities and Exchange Commission pursuant to Section 13(a) of the Exchange Act are available for review on our website and the Securities and Exchange Commission's website at www.sec.gov. Any such materials that we file with, or furnish to, the SEC in the future will be available on our website as soon as reasonably practicable after they are electronically filed with, or furnished to, the SEC. The information on our website is not incorporated by reference into this Annual Report on Form 10-K.

Item 1A. *Risk Factors.*

The following factors should be reviewed carefully, in conjunction with the other information contained in this Annual Report on Form 10-K. As previously discussed, our actual results could differ materially from our forward-looking statements. Our business faces a variety of risks. These risks include those described below and may include additional risks and uncertainties not presently known to us or that we currently deem immaterial. If any of the events or circumstances described in the following risk factors occur, our business operations, performance and financial condition could be adversely affected and the trading price of our common stock could decline.

Reductions in customers' research budgets or government funding may adversely affect our business.

Many of our customers representing a significant portion of our revenues are universities, government research laboratories, private foundations and other institutions who are dependent for their funding upon grants from U.S. government agencies, such as the United States National Institutes of Health (NIH), and similar agencies in other countries. Research and development spending of our customers can fluctuate based on spending priorities and general economic conditions. The level of government funding of research and development is unpredictable. There have been instances where NIH grants have been frozen or otherwise unavailable for extended periods or directed for certain products. Any reduction or delay in governmental spending could cause our customers to delay or forego purchases of our products. If government funding necessary to purchase our products were to decrease, our business and results of operations could be materially adversely affected. Spending by some of these customers fluctuates based on budget allocations and the timely passage of the annual federal budget. An impasse in federal government budget decisions could lead to substantial delays or reductions in federal spending.

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With respect to acquisitions we have completed or may seek to consummate in the future, we have and will incur a variety of costs, and may never realize the anticipated benefits of the acquisitions due in part to difficulties integrating the businesses, operations and product lines.

Our business strategy includes the acquisition of businesses, technologies, services or products that we believe are a strategic fit with our business. Most recently, in January 2018, we completed the acquisition of all the outstanding stock of Data Sciences International, Inc., (DSI) a privately held physiologic monitoring business with headquarters in St. Paul, Minnesota. With respect to these recent acquisitions or if we undertake any future acquisition, the process of integrating the acquired business, technology, service or product may result in unforeseen operating difficulties and expenditures and may absorb significant management attention that would otherwise be available for ongoing development of our business. Moreover, we may fail to realize the anticipated benefits of any acquisition as rapidly as expected or at all. Such transactions are inherently risky, and any such recent or future acquisitions could reduce stockholders' ownership, cause us to incur debt, expose us to future liabilities and result in amortization expenses related to intangible assets with definite lives, which may adversely impact our ability to undertake future acquisitions on substantially similar terms. We may also incur significant expenditures in anticipation of an acquisition that is never realized.

Our ability to achieve the benefits of acquisitions depends in part on the integration and leveraging of technology, operations, sales and marketing channels and personnel. The integration process is a complex, time-consuming and expensive process and may disrupt our business if not completed in a timely and efficient manner. We may have difficulty successfully integrating acquired businesses, and their domestic and foreign operations or product lines, and as a result, we may not realize any of the anticipated benefits of the acquisitions we make. We cannot assure that our growth rate will equal the growth rates that have been experienced by us and these and other acquired companies, respectively, operating as separate companies in the past.

We have substantial debt and other financial obligations and we may incur even more debt. Any failure to meet our debt and other financial obligations could harm our business, financial condition and results of operations.

We have substantial debt and other financial obligations and significant unused borrowing capacity. On January 31, 2018, we entered into a Financing Agreement with Cerberus Business Finance, LLC, as agent and lender (the Credit Agreement). As of March 16, 2018, we had borrowings of $67.0 million under the Credit Agreement. The Credit Agreement includes financial covenants relating to leverage and fixed charges, as well as other customary affirmative and negative covenants, including limitations on our ability to incur additional indebtedness and requires lender approval for acquisitions funded with cash, promissory notes and/or other consideration in excess of $1.0 million and for acquisitions in excess of $0.5 million. If we are not in compliance with certain of these covenants, in addition to other actions the creditor may require, the amounts outstanding under the Credit Agreement may become immediately due and payable. This immediate payment may negatively impact our financial condition. In addition, any failure to make scheduled payments of interest and principal on our outstanding indebtedness would likely harm our ability to incur additional indebtedness on acceptable terms. Our cash flow and capital resources may be insufficient to pay interest and principal on our debt in the future. If that should occur, our capital raising or debt restructuring measures

may be unsuccessful or inadequate to meet our scheduled debt service obligations, which could cause us to default on our obligations and further impair our liquidity.

The obligations under the Credit Agreement and related guarantees are secured on a first-priority basis (subject to certain liens permitted under the Credit Agreement) by a lien on substantially all the tangible and intangible assets of our company and the subsidiary guarantors, including all of the capital stock held by such obligors, subject to a 65% limitation on pledges of capital stock of foreign subsidiaries and certain other exceptions. Our Credit Agreement and related obligations:

- Require us to dedicate significant cash flow to the payment of principal and interest on our debt, which reduces the funds we have available for other purposes;
- May limit our flexibility in planning for or reacting to changes in our business and market conditions or funding our strategic growth plan;
- Impose on us additional financial and operational restrictions;
- Expose us to interest rate risk since a portion of our debt obligations is at variable rates (which is mitigated to a certain extent, by interest rate hedging transactions we entered into in connection with our Credit Agreement); and
- Restrict our ability to fund certain acquisitions.

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In addition, investors may be apprehensive about investing in companies such as ours that carry a substantial amount of leverage on their balance sheets, and this apprehension may adversely affect the price of our common stock.

Further, based upon our actual performance levels, our covenants relating to leverage and fixed charges could limit our ability to incur additional debt, which could hinder our ability to execute our current business strategy.

Our ability to make scheduled payments on our debt and other financial obligations and comply with financial covenants depends on our financial and operating performance. Our financial and operating performance will continue to be subject to prevailing economic conditions and to financial, business and other factors, some of which are beyond our control. Failure within any applicable grace or cure periods to may such payments, comply with the financial covenants, or any other non-financial or restrictive covenant, would create a default under our Credit Agreement. The maturity date with respect to the loans under the Credit Agreement is currently January 31, 2023. Our cash flow and existing capital resources may be insufficient to repay our debt at maturity, in which such case prior thereto we would have to extend such maturity date, or otherwise repay, refinance and or restructure the obligations under the Credit Agreement, including with proceeds from the sale of assets, and additional equity or debt capital. If we are unsuccessful in obtaining such extension, or entering into such repayment, refinance or restructure prior to maturity, or any other default existed under the Credit Agreement, our lenders could accelerate the indebtedness under the Credit Agreement, foreclose against their collateral or seek other remedies, which would jeopardize our ability to continue our current operations.

A portion of our revenues are derived from customers from the pharmaceutical and biotechnology industries and are subject to risks faced by those industries. Such risks may adversely affect our financial results.

We derive a significant portion of our revenues from pharmaceutical and biotechnology companies. We expect that pharmaceutical and biotechnology companies will continue to be a significant source of our revenues for the foreseeable future, including in our PCMI, Ephys and Data Sciences commercial product families. As a result, we are subject to risks and uncertainties that affect the pharmaceutical and biotechnology industries, such as government regulation, ongoing consolidation, uncertainty of technological change, and reductions and delays in research and development expenditures by companies in these industries.

In particular, the biotechnology industry is largely dependent on raising capital to fund its operations. If biotechnology companies that are our customers are unable to obtain the financing necessary to purchase our products, our business and results of operations could be adversely affected. In addition, we are dependent, both directly and indirectly, upon general health care spending patterns, particularly in the research and development budgets of the pharmaceutical and biotechnology industries, as well as upon the financial condition and purchasing patterns of various governments and government agencies. As it relates to both the biotechnology and pharmaceutical industries, many companies have significant patents that have expired or are about to expire, which could result in reduced revenues for those companies. If pharmaceutical or biotechnology companies that are our customers suffer reduced revenues as a result

of these patent expirations, they may be unable to purchase our products, and our business and results of operations could be adversely affected.

Customer, vendor and employee uncertainty about the effects of any of our acquisitions could harm us.

The customers of any company we acquire, including DSI and others in the future, may, in response to the consummation of the acquisition, delay or defer purchasing decisions. Any delay or deferral in purchasing decisions by customers could adversely affect our business. Similarly, employees of acquired companies may experience uncertainty about their future role until or after we execute our post-acquisition strategies. This may adversely affect our ability to attract and retain key management, sales, marketing and technical personnel following an acquisition.

Our business is subject to economic, political and other risks associated with international revenues and operations.

We manufacture and sell our products worldwide and as a result, our business is subject to risks associated with doing business internationally. A substantial amount of our revenues are derived from international operations, and we anticipate that a significant portion of our sales will continue to come from outside the United States in the future. We anticipate that revenues from international operations will likely continue to increase as a result of our efforts to expand our business in markets abroad. In addition, a number of our manufacturing facilities and suppliers are located outside the United States. Our foreign operations subject us to certain risks, including: effects of fluctuations in foreign currency exchange rates (discussed below); the impact of local economic conditions; local product preferences and seasonality (discussed below) and product requirements; local difficulty to effectively establish and expand our business and operations in international markets; disruptions of capital and trading markets; restrictions and potentially negative tax implications of transfer of capital across borders; differing labor regulations; other factors beyond our control, including potential political instability, terrorism, acts of war, natural disasters and diseases; unexpected changes and increased enforcement of regulatory requirements and various state, federal and international, intellectual property, environmental, antitrust, anti-corruption, fraud and abuse (including anti-kickback and false claims laws) and employment laws; and interruption to transportation flows for delivery of parts to us and finished goods to our customers.

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Specifically with respect to the expansion of our business into China, our financial performance may be subject to the following risks, among others affecting companies that operate in China: the impact of declining economic growth in China; regulation of foreign investment and business activities by the Chinese government, including recent scrutiny of foreign companies, may limit our ability to expand our business in China; uncertainties with respect to the legal system in China may limit the legal protections available to us in China; government restrictions on the remittance of currency out of China and the ability of any subsidiary we may establish in China to pay dividends and make other distributions to us; and potential unfavorable tax consequences as a result of our operations in China.

Newly enacted U.S. government tax reform could have a negative impact on the results of future operations.

On December 22, 2017, the President of the United States signed into law H.R. 1, originally known as the “Tax Cuts and Jobs Act”, hereafter referred to as “the Tax Act”, to be effective as of January 1, 2018. The Company is in the process of determining the impact to the financial statements of all aspects of the Tax Act and will reflect the impact of such reform in the financial statements during the period in which such amounts can be reasonably estimated. The Tax Act contained certain substantial changes to the Internal Revenue Code, some of which could have an adverse effect on our business. The Tax Act significantly revises the U.S. corporate income tax by, among other things, lowering corporate income tax rates, implementing a modified territorial tax system and imposing a repatriation tax on undistributed foreign earnings of foreign subsidiaries. Given the complexity of the Tax Act, anticipated guidance from the Internal Revenue Service about implementing the Tax Act, and the potential for additional guidance from the Securities and Exchange Commission or the Financial Accounting Standards Board related to the Tax Act, the intended and unintended consequences of the Tax Act on our business and on holders of our common shares is uncertain and could be adverse, which could result in further impact to our results of operations, financial condition and cash flow.

Foreign currency exchange rate fluctuations may have a negative impact on our reported earnings.

We are also subject to the risks of fluctuating foreign currency exchange rates, which could have an adverse effect on the sales price of our products in foreign markets, as well as the costs and expenses of our foreign subsidiaries. A substantial amount of our revenues are derived from international operations, and we anticipate that a significant portion of revenues will continue to come from outside the United States in the future. As a result, currency fluctuations among the United States dollar, British pound, euro and the other currencies in which we do business have caused and will continue to cause foreign currency translation and transaction gains and losses. We have not used forward exchange contracts to hedge our foreign currency exposures. We attempt to manage foreign currency risk through the matching of assets and liabilities. In the future, we may undertake to manage foreign currency risk through hedging methods, including foreign currency contracts. We recognize foreign currency gains or losses arising from our operations in the period incurred. We cannot guarantee that we will be successful in managing foreign currency risk or in predicting the effects of exchange rate fluctuations upon our future operating results because of the number of currencies involved, the variability of currency exposure and the potential volatility of currency exchange rates. We cannot predict with any certainty changes in foreign currency exchange rates or the degree to which we can address these risks.

Economic conditions and regulatory changes caused by the United Kingdom's likely exit from the European Union could adversely affect our business.

In June 2016, the United Kingdom (the U.K.) held a referendum in which voters approved an exit from the European Union (E.U.), commonly referred to as Brexit. On March 29, 2017, the U.K. formally notified the E.U. of its intention to withdraw pursuant to the Treaty on European Union. The withdrawal of the U.K. from the E.U. will take effect either when agreed upon or, in the absence of such an agreement, two years after the U.K. provided its notice of withdrawal. It appears likely that this withdrawal will involve a process of lengthy negotiations between the U.K. and the E.U. member states to determine the terms of the withdrawal as well as the U.K.'s relationship with the E.U. going forward. The announcement of Brexit has resulted in significant volatility in global stock market and currency exchange rate fluctuations that resulted in strengthening of the U.S. dollar relative to other foreign currencies in which we conduct business. The announcement of Brexit and the likely withdrawal of the U.K. from the E.U. may also create global economic uncertainty, including an uncertain funding environment for U.K. customers receiving funding from the E.U, which may cause our customers to closely monitor their costs and reduce their spending budgets. The effects of Brexit will depend on any agreements the U.K. makes to retain access to E.U. markets either during a transitional period or more permanently. Since a significant proportion of the regulatory framework in the U.K. is derived from E.U. directives and regulations, the referendum could materially change the regulatory regime applicable to the approval of any product candidates in the U.K. In addition, since the EMA is located in the U.K., the implications for the regulatory review process in the E.U. has not been clarified and could result in relocation of the EMA or a disruption in the EMA review process.

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Further, Brexit could adversely affect European and worldwide economic or market conditions and could contribute to instability in global financial markets. Brexit is likely to lead to legal uncertainty and potentially divergent national laws and regulations as the U.K. determines which E.U. laws to replace or replicate. This could adversely affect our business, financial condition, operating results and cash flows.

Domestic and global economic conditions could adversely affect our operations.

We are subject to the risks arising from adverse changes in domestic and global economic conditions. If global economic and market conditions, or economic conditions in the United States, deteriorate, we may experience an adverse effect on our business, operating results and financial condition. Concerns about credit markets, consumer confidence, economic conditions, government spending to sponsor life science research, volatile corporate profits and reduced capital spending could negatively impact demand for our products. If economic growth in the United States and other countries slows or deteriorates, customers may delay or forego purchases of our products. Unstable economic, political and social conditions make it difficult for our customers, our suppliers and us to accurately forecast and plan future business activities. If such conditions exist, our business, financial condition and results of operations could suffer. We cannot project the extent of the impact of the economic environment on our industry or us.

Changes in governmental regulations may reduce demand for our products, adversely impact our revenues, or increase our expenses.

We compete in many markets in which we and our customers must comply with federal, state, local and international regulations. We develop, configure and market our products to meet customer needs created by those regulations. These requirements include, among other things, regulations regarding manufacturing practices, product labeling, and advertising and post marketing reporting. We must incur expense and spend time and effort to ensure compliance with these complex regulations. Possible regulatory actions for non-compliance could include warning letters, fines, damages, injunctions, civil penalties, recalls, seizures of our products, and criminal prosecution. These actions could result in, among other things, substantial modifications to our business practices and operations; refunds, recalls, or seizures of our products; a total or partial shutdown of production in one or more of our facilities while we or our suppliers remedy the alleged violation; and withdrawals or suspensions of current products from the market. Any of these events could disrupt our business and have a material adverse effect on our revenues, profitability and financial condition.

We continue to expand our business into foreign countries and international markets. If our products are not accepted in these new markets our financial performance may suffer.

We continue to aggressively expand our sales and marketing efforts in foreign countries and international markets. The cost and diversion of resources to these efforts may not result in an increase in revenues in our business. Expansion of our business into new markets may be more costly and require the devotion of more of our management's time than we anticipate, which may hurt our business performance in other markets. Our operating results may suffer to the extent that our efforts to expand our product sales in these new markets are delayed or prove to be unsuccessful.

The life sciences industry is very competitive.

We expect to encounter increased competition from both established and development-stage companies that continually enter the market. These include companies developing and marketing life science instruments, systems and lab consumables, health care companies that manufacture laboratory-based tests and analyzers, diagnostic and pharmaceutical companies, analytical instrument companies, and companies developing life science or drug discovery technologies. Currently, our principal competition comes from established companies that provide products that perform many of the same functions for which we market our products. Many of our competitors have substantially greater financial, operational, marketing and technical resources than we do. Moreover, these competitors may offer broader product lines and tactical discounts, and may have greater name recognition. In addition, we may face competition from new entrants into the field. We may not have the financial resources, technical expertise or marketing, distribution or support capabilities to compete successfully in the future. In addition, we face changing customer preferences and requirements, including increased customer demand for more environmentally-friendly products.

The life sciences industry is also subject to rapid technological change and discovery. The development of new or improved products, processes or technologies by other companies may render our products or proposed products obsolete or less competitive. In some instances, our competitors may develop or market products that are more effective or commercially attractive than our current or future products. To meet the evolving needs of customers, we must continually enhance our current and planned products and develop and introduce new products. However, we may experience difficulties that may delay or prevent the successful development, introduction and marketing of new products or product enhancements. In addition, our product lines are based on complex technologies that are subject to change as new technologies are developed and introduced in the marketplace. We may have difficulty in keeping abreast of the changes affecting each of the different markets we serve or intend to serve. Our failure to develop and introduce products in a timely manner in response to changing technology, market demands or the requirements of our customers could cause our product sales to decline, and we could experience significant losses.

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We offer and plan to offer a broad range of products and have incurred and expect to continue to incur substantial expenses for development of new products and enhanced versions of our existing products. The speed of technological change in our market may prevent us from being able to successfully market some or all of our products for the length of time required to recover development costs. Failure to recover the development costs of one or more products or product lines could decrease our profitability or cause us to experience significant losses.

Ethical concerns surrounding the use of our products and misunderstanding of the nature of our business could adversely affect our ability to develop and sell our existing products and new products.

Some of our products may be used in areas of research usage involving animal research and other techniques presently being explored in the life science industry. These techniques have drawn negative attention in the public forum. Government authorities may regulate or prohibit any of these activities. Additionally, the public may disfavor or reject these activities.

If we are not able to manage our growth, our operating profits may be adversely impacted.

Our success will depend on the expansion of our operations through both organic growth and acquisitions. Effective growth management will place increased demands on our management team, operational and financial resources and expertise. To manage growth, we must expand our facilities, optimize our operational, financial and management systems, and hire and train additional qualified personnel. Failure to manage this growth effectively could impair our ability to generate revenues or could cause our expenses to increase more rapidly than revenues, resulting in operating losses or reduced profitability.

Failure or inadequacy of our information technology infrastructure or software could adversely affect our day-to-day operations and decision-making processes and have an adverse effect on our performance.

We depend on accurate and timely information and numerical data from key software applications to aid our day-to-day business, financial reporting and decision-making and, in many cases, proprietary and custom-designed software is necessary to operate our business. We are upgrading our disaster recovery procedures for our critical systems. However, any disruption caused by the failure of these systems, the underlying equipment, or communication networks could delay or otherwise adversely impact our day-to-day business and decision making, could make it impossible for us to operate critical equipment, and could have an adverse effect on our performance, if our disaster recovery plans do not mitigate the disruption. Disruptions could be caused by a variety of factors, such as catastrophic events or weather, power outages, or cyber-attacks on our systems by outside parties.

An information security incident, including a cybersecurity breach, could have a negative impact to our business or reputation

To meet business objectives, we rely on both internal information technology (IT) systems and networks, and those of third parties and their vendors, to process and store sensitive data, including confidential research, business plans, financial information, intellectual property, and personal data that may be subject to legal protection. The extensive information security and cybersecurity threats, which affect companies globally, pose a risk to the security and availability of these IT systems and networks, and the confidentiality, integrity, and availability of our sensitive data. We continually assess these threats and make investments to increase internal protection, detection, and response capabilities, as well as ensure our third party providers have required capabilities and controls, to address this risk. To date, we have not experienced any material impact to the business or operations resulting from information or cybersecurity attacks; however, because of the frequently changing attack techniques, along with the increased volume and sophistication of the attacks, there is the potential for us to be adversely impacted. This impact could result in reputational, competitive, operational or other business harm as well as financial costs and regulatory action.

We may experience difficulties fully implementing our enterprise resource planning systems.

We have been engaged in a project to upgrade and harmonize our enterprise resource planning (ERP) systems. Our ERP systems are critical to our ability to accurately maintain books and records, record transactions, provide important information to our management and prepare our financial statements. The implementation of the new ERP systems has required, and will continue to require, the investment of significant financial and human resources. In addition, we may not be able to successfully complete the full implementation of the ERP systems without experiencing difficulties. Any disruptions, delays or deficiencies in the design and implementation of the new ERP systems could adversely affect our ability to process orders, ship products, provide services and customer support, send invoices and track payments, fulfill contractual obligations or otherwise operate our business.

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We may incur additional restructuring costs or not realize the expected benefits of our initiatives to reduce operating expenses to date and in the future.

We may not be able to implement all of the actions that we intend to take in the restructuring of our operations and we may not be able to fully realize the expected benefits from such realignment and restructuring plans or other similar restructurings in the future. In addition, we may incur additional restructuring costs in implementing such realignment and restructuring plans or other similar future plans in excess of our expectations. The implementation of our restructuring efforts, including the reduction of our workforce, may not improve our operational and cost structure or result in greater efficiency of our organization; and we may not be able to support sustainable revenue growth and profitability following such restructurings.

Attractive acquisition opportunities may not be available to us in the future.

We will consider the acquisition of other businesses. However, we may not have the opportunity to make suitable acquisitions on favorable terms in the future, which could negatively impact the growth of our business. In order to pursue such opportunities, we may require significant additional financing, which may not be available to us on favorable terms, if at all. We expect that our competitors, many of which have significantly greater resources than we do, will compete with us to acquire businesses. This competition could increase prices for acquisitions that we would likely pursue.

We may be the subject of lawsuits from counterparties to acquisitions and divestitures, including an acquiring company or its stockholders, an acquired company's previous stockholders, a divested company's stockholders or our current stockholders.

We may be the subject of lawsuits from either an acquiring company or its stockholders, an acquired company's previous stockholders, a divested company's stockholders or our current stockholders. Such lawsuits could result from the actions of the acquisition or divestiture target prior to the date of the acquisition or divestiture, from the acquisition or divestiture transaction itself or from actions after the acquisition or divestiture. Defending potential lawsuits could cost us significant expense and detract management's attention from the operation of the business. Additionally, these lawsuits could result in the cancellation of or the inability to renew certain insurance coverage that would be necessary to protect our assets.

Failure to raise additional capital or generate the significant capital necessary to implement our acquisition strategy, expand our operations and invest in new products could reduce our ability to compete and result in less revenues.

We anticipate that our financial resources, which include available cash, cash generated from operations, and debt and equity capacity, will be sufficient to finance operations and capital expenditures for at least the next twelve months. However, this expectation is premised on the current operating plan, which may change as a result of many factors, including market acceptance of new products and future opportunities with collaborators. Consequently, we may need additional funding sooner than anticipated. In addition, our Credit Agreement is not sufficient to fund our acquisition strategy. In such case, our inability to raise sufficient capital on favorable terms and in a timely manner (if at all) could seriously harm our business, product development, and acquisition efforts. In addition, our Credit Agreement contains limitations on our ability to incur additional indebtedness and requires lender approval for acquisitions funded with cash, promissory notes and/or other consideration in excess of $1.0 million and for acquisitions in excess of $0.5 million. If future financing is not available or is not available on acceptable terms, we may have to alter our operations or change our business strategy. We cannot assure you that the capital required to fund operations or our acquisition strategy will be available in the future.

If we raise additional funds through the sale of equity or convertible debt or equity-linked securities, existing percentages of ownership in our common stock will be reduced and these transactions may dilute the value of our outstanding common stock.

We may raise additional funds through the sale of equity or convertible debt or equity-linked securities to repay our existing indebtedness, implement our acquisition strategy, expand our operations and/or invest in new products. If we so raise additional funds through such sales, existing percentages of ownership in our common stock will be reduced and these transactions may dilute the value of our outstanding common stock. We may issue securities that have rights, preferences and privileges senior to our common stock. If we raise additional funds through collaborations or licensing arrangements, we may relinquish rights to certain of our technologies or products, or grant licenses to third parties on terms that are unfavorable.

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Our stock price has fluctuated in the past and could experience substantial declines in the future.

The market price of our common stock has experienced significant fluctuations and may become volatile and could decline in the future, perhaps substantially, in response to various factors including, but not limited to:

- Significant sales of our common stock, whether by us or our shareholders;
- volatility of the financial markets;
- uncertainty regarding the prospects of the domestic and foreign economies;
- technological innovations by competitors or in competing technologies;
- revenues and operating results fluctuating or failing to meet the expectations of management, securities analysts, or investors in any quarter;
- comments of securities analysts and mistakes by or misinterpretation of comments from analysts, downward revisions in securities analysts' estimates or management guidance;
- investment banks and securities analysts becoming subject to lawsuits that may adversely affect the perception of the market;
- conditions or trends in the biotechnology and pharmaceutical industries;
- announcements of significant acquisitions or financings or strategic partnerships;
- failure to realize the anticipated benefits of the DSI acquisition;
- non-compliance with the internal control standards pursuant to the Sarbanes-Oxley Act of 2002; and
- a decrease in the demand for our common stock.

In addition, public stock markets have experienced extreme price and trading volatility. The stock market and the NASDAQ Global Market in general, and the biotechnology industry and small cap markets in particular, have experienced significant price and volume fluctuations that at times may have been unrelated or disproportionate to the operating performance of those companies. These broad market and industry factors may further harm the market price of our common stock, regardless of our operating performance. In the past, securities class action litigation has often been instituted following periods of volatility in the market price of a company's securities. A securities class action suit against us could result in substantial costs, potential liabilities and the diversion of management's attention and resources.

As a result of our spin-off of Harvard Apparatus Regenerative Technology, Inc., now known as Biostage, together with certain related transactions, third parties may seek to hold us responsible for Biostage's liabilities, including liabilities that Biostage has assumed from us.

Third parties may seek to hold us responsible for Biostage's liabilities, including any of the liabilities that Biostage agreed to retain or assume in connection with the separation of the Biostage business from our businesses, and related spin-off distribution. On April 14, 2017, anticipated representatives for the estate of an individual plaintiff filed a wrongful death complaint with the Suffolk Superior Court, in the County of Suffolk, Massachusetts, against us and other defendants, including Biostage, as well as another third party. The complaint seeks payment for an unspecified amount of damages and alleges that the plaintiff sustained terminal injuries allegedly caused by products, including synthetic trachea scaffolds and bioreactors, provided by certain of the named defendants and utilized in connection with surgeries performed by third parties in 2012 and 2013. The litigation is at an early stage and we continue to vigorously defend this case through our liability insurance carrier from whom we have requested defense and indemnification of any losses incurred in connection with this lawsuit. Any such product liability insurance coverage may not be sufficient to satisfy all liabilities resulting from this claim. If claims against us substantially exceed our coverage, then our business could be adversely impacted. While we believe that such claim is without merit, we are unable to predict the ultimate outcome of such litigation. Pursuant to our agreements with Biostage, Biostage has agreed to indemnify us for claims and losses relating to certain liabilities that it has assumed from us, including liabilities in connection with the sale of Biostage's products, intellectually property infringement and other liabilities related to the operation of Biostage's business. However, if those liabilities are significant and we are ultimately held liable for them, we cannot assure you that Biostage will have the ability to satisfy its obligations to us, in particular due to Biostage having limited revenues, products in early stage development and a need for additional funds in the future. If Biostage is unable to satisfy its obligations under its indemnity to us, we may have to satisfy these obligations, which could have an adverse impact on our financial condition, results of operations or cash flows.

If our goodwill or intangible assets become impaired, we may be required to record a significant charge to earnings.

Under accounting principles generally accepted in the United States, we review our goodwill and intangible assets for impairment when events or changes in circumstances indicate the carrying value may not be recoverable. Goodwill is also required to be tested for impairment at least annually. Factors that may be considered a change in circumstances indicating that the carrying value of our goodwill or other intangible assets may not be recoverable include a decline in our stock price and market capitalization, future cash flows, and slower growth rates in our industry. We may be required to record a significant charge to earnings in our financial statements during the period in which any impairment of our goodwill or other intangible assets is determined, which could adversely impact our results of operations.

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Accounting for goodwill, other intangible assets and long-lived assets may have an adverse effect on us.

We assess the recoverability of identifiable intangibles with finite lives and other long-lived assets, such as property, plant and equipment, for impairment whenever events or changes in circumstances indicate that the carrying value may not be recoverable in accordance with the provisions of Financial Accounting Standards Board (FASB) Accounting Standards Codification (ASC) 360, "Property, Plant and Equipment". In accordance with FASB ASC 350, "Intangibles-Goodwill and Other", goodwill and intangible assets with indefinite lives from acquisitions are evaluated annually, or more frequently, if events or circumstances indicate there may be an impairment, to determine whether any portion of the remaining balance of goodwill and indefinite lived intangibles may not be recoverable. If it is determined in the future that a portion of our goodwill and other intangible assets is impaired, we will be required to write off that portion of the asset according to the methods defined by FASB ASC 360 and FASB ASC 350, which could have an adverse effect on net income for the period in which the write-off occurs. At December 31, 2017, we had goodwill and intangible assets of $57.2 million, or 52%, of our total assets and we concluded that none of our goodwill or other intangible assets was impaired.

If our accounting estimates are not correct, our financial results could be adversely affected.

Management judgment and estimates are required in the application of our Critical Accounting Policies. We discuss these estimates in the subsection entitled critical accounting policies beginning on page 34 in Item 7, Management's Discussion and Analysis of Financial Condition and Results of Operations in this Annual Report. If our estimates are incorrect, our future financial operating results and financial condition could be adversely affected.

If we fail to retain key personnel and hire, train and retain qualified employees, we may not be able to compete effectively, which could result in reduced revenue or increased costs.

Our success is highly dependent on the continued services of key management, technical and scientific personnel. Our management and other employees may voluntarily terminate their employment at any time upon short notice. The loss of the services of any member of the senior management team, including the Chief Executive Officer, Jeffrey A. Duchemin; the Chief Financial Officer, Robert E. Gagnon; the Vice President, Commercial Operations, Yong Sun; or any of the managerial, technical or scientific staff may significantly delay or prevent the achievement of product development, our growth strategies and other business objectives. Our future success will also depend on our ability to identify, recruit and retain additional qualified scientific, technical and managerial personnel. We operate in several geographic locations where labor markets are particularly competitive, including the Boston, Massachusetts metropolitan area, England, and Germany where demand for personnel with these skills is extremely high and is likely to remain high. As a result, competition for qualified personnel is intense, particularly in the areas of general management, finance, information technology, engineering and science, and the process of hiring suitably qualified personnel is often lengthy and expensive, and may become more expensive in the future. If we are unable to hire and retain a sufficient number of qualified employees, our ability to conduct and expand our business could be seriously

reduced.

If we are unable to effectively protect our intellectual property, third parties may use our technology, which would impair our ability to compete in our markets.

Our continued success will depend in significant part on our ability to obtain and maintain meaningful patent protection for certain of our products throughout the world. Patent law relating to the scope of claims in the technology fields in which we operate is still evolving. The degree of future protection for our proprietary rights is uncertain. We also own numerous United States registered trademarks and trade names and have applications for the registration of trademarks and trade names pending. We rely on patents to protect a significant part of our intellectual property and to enhance our competitive position. However, our presently pending or future patent applications may not be accepted and patents might not be issued, and any patent previously issued to us may be challenged, invalidated, held unenforceable or circumvented. Furthermore, the claims in patents which have been issued or which may be issued to us in the future may not be sufficiently broad to prevent third parties from producing competing products similar to our products. In addition, the laws of various foreign countries in which we compete may not protect our intellectual property to the same extent, as do the laws of the United States. If we fail to obtain adequate patent protection for our proprietary technology, our ability to be commercially competitive could be materially impaired.

In addition to patent protection, we also rely on protection of trade secrets, know-how and confidential and proprietary information. To maintain the confidentiality of trade-secrets and proprietary information, we generally seek to enter into confidentiality agreements with our employees, consultants and strategic partners upon the commencement of a relationship. However, we may not be able to obtain these agreements in all circumstances in part due to local regulations. In the event of unauthorized use or disclosure of this information, these agreements, even if obtained, may not provide meaningful protection for our trade-secrets or other confidential information. In addition, adequate remedies may not exist in the event of unauthorized use or disclosure of this information. The loss or exposure of our trade secrets and other proprietary information would impair our competitive advantages and could have an adverse effect on our operating results, financial condition and future growth prospects.

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The manufacture, sale and use of products and services may expose us to product liability claims for which we could have substantial liability.

We face an inherent business risk of exposure to product liability claims if our products, services or product candidates, including without limitation, any of our life science research tools are alleged or found to have caused injury, damage or loss. We may in the future be unable to obtain insurance with adequate levels of coverage for potential liability on acceptable terms or claims of this nature may be excluded from coverage under the terms of any insurance policy that we can obtain. If we are unable to obtain such insurance or the amounts of any claims successfully brought against us substantially exceed our coverage, then our business could be adversely impacted.

We may be involved in lawsuits to protect or enforce our patents that would be expensive and time-consuming.

In order to protect or enforce our patent rights, we may initiate patent litigation against third parties. We may also become subject to interference proceedings conducted in the patent and trademark offices of various countries to determine the priority of inventions. Several of our products are based on patents that are closely surrounded by patents held by competitors or potential competitors. As a result, we believe there is a greater likelihood of a patent dispute than would be expected if our patents were not closely surrounded by other patents. The defense and prosecution, if necessary, of intellectual property suits, interference proceedings and related legal and administrative proceedings would be costly and divert our technical and management personnel from their normal responsibilities. We may not prevail in any of these suits should they occur. An adverse determination of any litigation or defense proceedings could put our patents at risk of being invalidated or interpreted narrowly and could put our patent applications at risk of being rejected and no patents being issued.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. For example, during the course of this kind of litigation, there could be public announcements of the results of hearings, motions or other interim proceedings or developments in the litigation. Securities analysts or investors may perceive these announcements to be negative, which could cause the market price of our stock to decline.

Our success will depend partly on our ability to operate without infringing on or misappropriating the intellectual property rights of others.

We may be sued for infringing on the intellectual property rights of others, including the patent rights, trademarks and trade names of third parties. Intellectual property litigation is costly and the outcome is uncertain. If we do not prevail in any intellectual property litigation, in addition to any damages we might have to pay, we could be required to stop

the infringing activity, or obtain a license to or design around the intellectual property in question. If we are unable to obtain a required license on acceptable terms, or are unable to design around any third party patent, we may be unable to sell some of our products and services, which could result in reduced revenue.

Rising commodity and precious metals costs could adversely impact our profitability.

Raw material commodities such as resins, and precious metal commodities such as platinum are subject to wide price variations. Increases in the costs of these commodities and the costs of energy, transportation and other necessary services may adversely affect our profit margins if we are unable to pass along any higher costs in the form of price increases or otherwise achieve cost efficiencies such as in manufacturing and distribution.

Regulations related to conflict minerals may force us to incur additional expenses and otherwise adversely impact our business.

The SEC has promulgated final rules mandated by the Dodd-Frank Act regarding disclosure of the use of tin, tantalum, tungsten and gold, known as conflict minerals, in products manufactured by public companies. These new rules require ongoing due diligence to determine whether such minerals originated from the Democratic Republic of Congo (the DRC) or an adjoining country and whether such minerals helped finance the armed conflict in the DRC. Reporting obligations for the rule began on May 31, 2014 and are required annually thereafter. There will be costs associated with complying with these disclosure requirements, including costs to determine the origin of conflict minerals in our products. The implementation of these rules and their effect on customer, supplier and/or consumer behavior could adversely affect the sourcing, supply and pricing of materials used in our products. As a result, we may also incur costs with respect to potential changes to products, processes or sources of supply. We may face disqualification as a supplier for customers and reputational challenges if the due diligence procedures we implement do not enable us to verify the origins for all conflict minerals used in our products, including that such minerals did not originate from any of the covered conflict countries. Accordingly, the implementation of these rules could have an adverse effect on our business, results of operations and/or financial condition.

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Provisions of Delaware law, of our charter and bylaws may make a takeover more difficult, which could cause our stock price to decline.

Provisions in our certificate of incorporation and bylaws and in the Delaware corporate law may make it difficult and expensive for a third party to pursue a tender offer, change in control or takeover attempt, which is opposed by management and the board of directors. Public stockholders who might desire to participate in such a transaction may not have an opportunity to do so. We have a staggered board of directors that makes it difficult for stockholders to change the composition of the board of directors in any one year. These anti-takeover provisions could substantially impede the ability of public stockholders to change our management and board of directors. Such provisions may also limit the price that investors might be willing to pay for shares of our common stock in the future.

An active trading market for our common stock may not be sustained.

Although our common stock is quoted on the NASDAQ Global Market, an active trading market for the shares may not be sustained. This could negatively affect the price for our common stock, including investors' ability to buy or sell our common stock and the listing thereof.

Your percentage ownership will be diluted in the future because of equity award issuances.

Your percentage ownership will be diluted in the future because of equity awards that we expect will be granted to our directors, officers and employees, as well as shares of common stock, or securities convertible into common stock, we issue in connection with future capital raising or strategic transactions. Our Third Amended and Restated 2000 Stock Option and Incentive Plan provides for the grant of equity-based awards, including restricted stock, restricted stock units, stock options, stock appreciation rights and other equity-based awards to our directors, officers and other employees, advisors and consultants. The issuance of any shares of our stock would dilute the proportionate ownership and voting power of existing security holders.

Any issuance of preferred stock in the future may dilute the rights of our common stockholders.

Our board of directors has the authority to issue up to 5,000,000 shares of preferred stock and to determine the price, privileges and other terms of these shares. The board of directors may exercise this authority without any further approval of stockholders. The rights of the holders of common stock may be adversely affected by the rights of future holders of preferred stock.

Cash dividends will not likely be paid on our common stock.

Currently, we intend to retain all of our earnings to finance the expansion and development of our business and do not anticipate paying any cash dividends to holders of our common stock in the near future. As a result, capital appreciation, if any, of our common stock will be a stockholder's sole source of gain for the near future.

Changes in the European regulatory environment regarding privacy and data protection regulations could have a material adverse impact on our results of operations.

The E.U. has recently adopted a comprehensive overhaul of its data protection regime in the form of the General Data Protection Regulation (GDPR), which comes into effect in May 2018. GDPR extends the scope of the existing E.U. data protection law to foreign companies processing personal data of E.U. residents. The regulation imposes a strict data protection compliance regime with severe penalties of 4% of worldwide turnover or €20 million, whichever is greater, and includes new rights such as the right of erasure of personal data. Although the GDPR will apply across the E.U., as has been the case under the current data protection regime, E.U. Member States have some national derogations and local data protection authorities (DPAs) will still have the ability to interpret the GDPR, which has the potential to create inconsistencies on a country-by-country basis. Implementation of, and compliance with the GDPR could increase our cost of doing business and/or force us to change our business practices in a manner adverse to our business. In addition, violations of the GDPR may result in significant fines, penalties and damage to our brand and business which could, individually or in the aggregate, materially harm our business and reputation.

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Item 1B. ***Unresolved Staff Comments.***

None.

Item 2. ***Properties.***

Our principal facilities incorporate manufacturing, research and development, sales and marketing, and administration functions. Our facilities consist of:

- a leased 83,123 square foot facility in Holliston, Massachusetts, which includes our corporate headquarters,
- a leased 29,020 square foot facility in Richmond, California,
- a leased 22,449 square foot facility in Reutlingen, Germany,
- a leased 20,853 square foot facility in Barcelona, Spain,
- a leased 12,031 square foot facility in March-Hugstetten, Germany,

Excluded from the listing of facilities above, is the 115,667 square foot facility leased by DSI in New Brighton, Minnesota, and the 36,144 square foot facility in Charlotte, North Carolina that was leased by Denville.

We also lease additional facilities in Cambourne, England, Lambrecht, Germany, Hamden Connecticut, Durham, North Carolina and Kista, Sweden, Shanghai, China, Les Ulis, France, St. Augustin, Germany, Lunenburg, Canada and Montreal, Canada.

We believe our current facilities are adequate for our needs for the foreseeable future.

Item 3. ***Legal Proceedings.***

On April 14, 2017, anticipated representatives for the estate of an individual plaintiff filed a wrongful death complaint with the Suffolk Superior Court, in the County of Suffolk, Massachusetts, against the Company and other defendants,

including Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.), our former subsidiary that was spun off in 2013, as well as another third party. The complaint seeks payment for an unspecified amount of damages and alleges that the plaintiff sustained terminal injuries allegedly caused by products, including synthetic trachea scaffolds and bioreactors, provided by certain of the named defendants and utilized in connection with surgeries performed by third parties in 2012 and 2013. The litigation is at an early stage and the Company intends to vigorously defend this case and has contacted its liability insurance carrier to request defense and indemnification of any losses incurred in connection with this lawsuit. While we believe that such claim is without merit, we are unable to predict the ultimate outcome of such litigation.

Item 4. Mine Safety Disclosures

Not Applicable.

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PART II

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

Price Range of Common Stock

Our common stock has been quoted on the NASDAQ Global Market since our initial public offering on December 7, 2000, and currently trades under the symbol "HBIO." The following table sets forth the range of the high and low sales prices per share of our common stock as reported on the NASDAQ Global Market for the quarterly periods indicated.

Fiscal Year Ended December 31, 2017	High	Low
First Quarter	$3.25	$2.55
Second Quarter	$2.75	$2.30
Third Quarter	$3.75	$2.35
Fourth Quarter	$3.80	$3.08

Fiscal Year Ended December 31, 2016	High	Low
First Quarter	$3.25	$2.48
Second Quarter	$3.83	$2.72
Third Quarter	$3.19	$2.53
Fourth Quarter	$3.05	$2.30

On March 9, 2018, the closing sale price of our common stock on the NASDAQ Global Market was $4.60 per share. There were 116 holders of record of our common stock as of March 9, 2018. We believe that the number of beneficial owners of our common stock at that date was substantially greater.

Dividend Policy

We have never declared or paid cash dividends on our common stock in the past and do not intend to pay cash dividends on our common stock in the foreseeable future. Any future determination to pay cash dividends will be at the discretion of our Board of Directors and will depend on our financial condition, results of operations, capital requirements and other factors our Board of Directors deems relevant.

Stockholder Return Performance Graph

This performance graph shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended (the Exchange Act), or incorporated by reference into any filing of Harvard Bioscience under the Securities Act of 1933, as amended, or the Exchange Act, except as shall be expressly set forth by specific reference in such filing.

The following graph provides a comparison of the cumulative total stockholder return on the Company's common stock from December 31, 2012 to December 31, 2017 with the cumulative return of the Russell 2000 Index and the Nasdaq Biotechnology Index over the same period. The five-year cumulative return assumes an initial investment of $100 in the Company's common stock and in each index on December 31, 2012. The total return for the Company's common stock and the indices used assumes the reinvestment of all dividends. The table below reflects the stock prices as adjusted for the spin-off of HART which was effected on November 1, 2013, for all periods presented.

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	12/12	12/13	12/14	12/15	12/16	12/17
Harvard Bioscience, Inc.	100.00	141.63	170.86	104.56	91.91	99.44
Russell 2000	100.00	138.82	145.62	139.19	168.85	193.58
NASDAQ Biotechnology	100.00	174.05	230.33	244.29	194.95	228.29

The stock price performance included in this graph is not necessarily indicative of future stock price performance.

Item 6. Selected Financial Data

The financial data presented below have been derived from our audited consolidated financial statements. The selected historical financial data presented below should be read in conjunction with “Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations” and “Item 8. Financial Statements and Supplementary Data.” and with our previously filed Annual Reports on Form 10-K. The selected data in this section is not intended to replace the consolidated financial statements. The information presented below is not necessarily indicative of the results of our future operations.

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	For The Year Ended December 31,				
	2017	2016	2015	2014	2013
	(in thousands, except per share data)				
Statement of Operations Data:					
Revenues	$101,882	$104,521	$108,664	$108,663	$105,171
Cost of revenues	54,285	56,106	59,941	59,319	57,475
Gross profit	47,597	48,415	48,723	49,344	47,696
Operating expenses	47,698	51,412	50,436	42,726	46,159
Operating (loss) income	(101)	(2,997)	(1,713)	6,618	1,537
Other expense, net	(1,987)	(81)	(1,895)	(2,201)	(1,102)
(Loss) income from continuing operations before income taxes (1)	(2,088)	(3,078)	(3,608)	4,417	435
Income tax expense (benefit) (2)	(1,223)	1,229	15,431	2,062	(288)
(Loss) income from continuing operations	(865)	(4,307)	(19,039)	2,355	723
Discontinued operations (3):					
Loss from discontinued operations, net of tax	-	-	-	-	(2,553)
Net (loss) income	$(865)	$(4,307)	$(19,039)	$2,355	$(1,830)
(Loss) earnings per share:					
Basic (loss) earnings per common share from continuing operations	$(0.02)	$(0.13)	$(0.57)	$0.07	$0.02
Discontinued operations	-	-	-	-	(0.08)
Basic (loss) earnings per common share	$(0.02)	$(0.13)	$(0.57)	$0.07	$(0.06)
Diluted (loss) earnings per common share from continuing operations	$(0.02)	$(0.13)	$(0.57)	$0.07	$0.02
Discontinued operations	-	-	-	-	(0.08)
Diluted (loss) earnings per common share	$(0.02)	$(0.13)	$(0.57)	$0.07	$(0.06)
Weighted average common shares:					
Basic	34,753	34,212	33,593	32,171	30,384
Diluted	34,753	34,212	33,593	33,237	31,914

	As of December 31,				
	2017	2016	2015	2014	2013
	(in thousands)				
Balance Sheet Data:					
Cash and cash equivalents	$5,733	$5,596	$6,744	$14,134	$25,771
Working capital	33,494	30,871	31,226	38,964	44,665
Total assets	109,354	107,765	120,050	135,916	135,460
Long-term debt, net of current portion	8,983	11,374	16,369	16,450	19,750
Stockholders' equity	80,900	72,196	77,598	95,468	94,485

(1) Included in the net operating loss for the year ended December 31, 2016 was $1.7 million of forensic investigation costs from the first half, a $0.7 million AHN impairment charge from the third quarter, and a $1.2 million loss on sale of AHN from the fourth quarter. The total impact of these three charges, on a pre-tax basis, was $3.6 million for the year ended December 31, 2016.

(2) Income tax expense for the year ended December 31, 2015 is primarily the result of the recognition of a valuation allowance on U.S. deferred tax assets.

(3) On September 30, 2008, we completed the sale of assets of our Union Biometrica Division including its German subsidiary, Union Biometrica GmbH, representing at that time the remaining portion of our Capital Equipment Business Segment, to UBIO Acquisition Company. The purchase price paid by UBIO Acquisition Company included an earn-out based on the revenue generated by the acquired business over a five-year post-transaction period. Discontinued operations include a gain on disposal related to the earn-out, net of tax, of $0.3 million in 2013.

On November 1, 2013, the spin-off of our RMD business from our Company was completed. Through the spin-off date the historical operations of RMD were reported as continuing operations in our consolidated statements of operations. Following the spin-off, and reported herein, the historical operations of RMD were restated and presented as discontinued operations in our consolidated statements of operations presented. Discontinued operations include the results of the RMD business except for certain corporate overhead costs and other allocations, which remain in continuing operations. The costs incurred to separate and spin-off the RMD business remain in continuing operations and have been classified and reported as transaction costs, within operating expenses, on our consolidated statements of operations. Discontinued operations include losses from operations of the RMD business, net of tax, for 2013 of $2.8 million.

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

Forward-Looking Statements

The following section of this Annual Report on Form 10-K entitled "Management's Discussion and Analysis of Financial Condition and Results of Operations" contains statements that are not statements of historical fact and are forward-looking statements within the meaning of federal securities laws. These statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. These statements reflect our current views with respect to future events and are based on assumptions and subject to risks and uncertainties. Factors that may cause our actual results to differ materially from those in the forward-looking statements include those factors described in "Item 1A. Risk Factors" beginning on page 9 of this Annual Report on Form 10-K. You should carefully review all of these factors, as well as the comprehensive discussion of forward-looking statements on page 1 of this Annual Report on Form 10-K.

Overview

Harvard Bioscience, Inc., a Delaware corporation, is a global developer, manufacturer and marketer of a broad range of scientific instruments, systems and lab consumables used to advance life science for basic research, drug discovery, clinical and environmental testing. Our products are sold to thousands of researchers in over 100 countries through our global sales organization, websites, catalogs, and through distributors including Thermo Fisher Scientific Inc., VWR and other specialized distributors. We have sales and manufacturing operations in the United States, the United Kingdom, Germany, Sweden, Spain, France, Canada, and China.

Led by President and CEO Jeffrey A. Duchemin, we have conducted a multi-year restructuring program to reduce costs, align global functions, consolidate facilities to optimize our global footprint, divest non-core businesses and to reinvest in key areas such as sales and common IT systems. As part of these efforts, we divested our AHN Biotechnologie GmbH subsidiary (AHN) in the fourth quarter of 2016 and, during the first quarter of 2018, we sold substantially all the assets of our wholly-owned subsidiary, Denville Scientific, Inc. (Denville).

We are also pursuing a strategy to grow the business through strategic, accretive acquisitions, including four acquisitions since the fourth quarter of 2014.

Most recently, in January 2018, we acquired Data Sciences International, Inc. (DSI) for approximately $70.0 million. DSI, a St. Paul, Minnesota-based life science research company, is a recognized leader in physiologic monitoring

focused on delivering preclinical products, systems, services and solutions to its customers. Its customers include pharmaceutical and biotechnology companies, as well as contract research organizations, academic labs and government researchers. This acquisition diversifies our customer base into the biopharmaceutical and contract research organization markets and offers revenue and cost synergies.

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Our Strategy

Our vision is to be a world leading life science company that excels in meeting the needs of our customers by providing a wide breath of innovative products and solutions, while providing exemplary customer service. Our business strategy is to grow our top-line and bottom-line, and build shareholder value through a commitment to:

- commercial excellence;
- new product development;
- strategic acquisitions; and
- operational efficiencies.

In the table below, we provide an overview of selected operating metrics.

	2017	% of Revenues		2016	% of Revenues		2015	% of Revenues	
	(dollars in thousands)								
Revenues	$101,882			$104,521			$108,664		
Cost of revenues	54,285	53.3	%	56,106	53.7	%	59,941	55.2	%
Sales and marketing expenses	21,036	20.6	%	20,486	19.6	%	20,577	18.9	%
General and administrative expenses	18,575	18.2	%	20,950	20.0	%	19,832	18.3	%
Research and development expenses	5,645	5.5	%	5,392	5.2	%	6,420	5.9	%
Restructuring (credits) charges	-	0.0	%	(4)	0.0	%	788	0.7	%
Amortization of intangible assets	2,442	2.4	%	2,722	2.6	%	2,819	2.6	%
Impairment charges	-	0.0	%	676	0.6	%	-	0.0	%
Loss on sale of AHN	-	0.0	%	1,190	1.1	%	-	0.0	%

Components of Operating Income

Revenues. We generate revenues by selling apparatus, instruments, devices and consumables through our distributors, direct sales force, websites and catalogs. Our websites and catalogs serve as the primary sales tools for

our various product lines. These product lines include both proprietary manufactured products and complementary products from various suppliers. Our reputation as a leading producer in many of our manufactured products creates traffic to our website, enables cross-selling and facilitates the introduction of new products. We have field sales teams in the U.S., Canada, the United Kingdom, Germany, France, Spain and China. In those regions where we do not have a direct sales team, we use distributors. Revenues from direct sales to end users represented approximately 65%, 64% and 63% of our revenues for the years ended December 31, 2017, 2016 and 2015, respectively.

Our products consist of instruments, consumables, and systems that are made up of several individual products. Sales prices of these products are mostly priced in the range of $5,000 to $15,000, but range from under $100 to over $100,000. They are mainly scientific instruments like spectrophotometers and plate readers that analyze light to detect and quantify a wide range of molecular and cellular processes, or apparatus like gel electrophoresis units. We also use distributors for both our catalog products and our higher priced products, for sales in locations where we do not have subsidiaries or where we have existing distributors in place from acquired businesses. For the years ended December 31, 2017, 2016 and 2015, approximately 35%, 36% and 37% of our revenues, respectively, were derived from sales to distributors.

For the years ended December 31, 2017, 2016 and 2015, approximately 62% of our revenues, for all periods, were derived from products we manufacture, approximately 14%, 14% and 13%, respectively, were derived from complementary products we distribute in order to provide the researcher with a single source for all equipment needed to conduct a particular experiment. Approximately 24%, 24% and 25% of our revenues, respectively, for the years ended December 31, 2017, 2016, 2015 were derived from distributed products sold under our brand names.

For the years ended December 31, 2017, 2016 and 2015, approximately 35%, 38% and 40% of our revenues, respectively, were derived from sales made by our non-United States operations. The decrease in international revenues was primarily due to the impact of the loss of revenue following the AHN disposition, the effects of currency fluctuation, and the impact of softness in the European funding environment.

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Changes in the relative proportion of our revenue sources between catalog or website sales, direct sales and distribution sales are primarily the result of a different sales proportion of acquired companies and changes in geographic mix.

Cost of revenues. Cost of revenues includes material, labor and manufacturing overhead costs, obsolescence charges, packaging costs, warranty costs, shipping costs and royalties. Our cost of revenues may vary over time based on the mix of products sold. We sell products that we manufacture and products that we purchase from third parties. The products that we purchase from third parties typically have a higher cost of revenues as a percent of revenues because the profit is effectively shared with the original manufacturer. We anticipate that our manufactured products will continue to have a lower cost of revenues as a percentage of revenues as compared with the cost of non-manufactured products for the foreseeable future. Additionally, our cost of revenues as a percent of revenues will vary based on mix of direct to end user sales and distributor sales, mix by product line and mix by geography.

Sales and marketing expenses. Sales and marketing expense consists primarily of salaries and related expenses for personnel in sales, marketing and customer support functions. We also incur costs for travel, trade shows, demonstration equipment, public relations and marketing materials, consisting primarily of the printing and distribution of our catalogs, supplements and the maintenance of our websites. We may from time to time expand our marketing efforts by employing additional technical marketing specialists in an effort to increase sales of selected categories of products. We may also from time to time expand our direct sales organizations in an effort to concentrate on key accounts or promote certain product lines.

General and administrative expenses. General and administrative expense consists primarily of salaries and other related costs for personnel in executive, finance, accounting, information technology and human resource functions. Other costs include professional fees for legal and accounting services, facility costs, investor relations, insurance and provision for doubtful accounts.

Research and development expenses. Research and development expense consists primarily of salaries and related expenses for personnel and spending to develop and enhance our products. Other research and development expense includes fees for consultants and outside service providers, and material costs for prototype and test units. We expense research and development costs as incurred. From time to time, we receive grants from governmental entities in relation to research projects. Such grants received are accounted for as a reduction in research and development expense over the period of the project. We believe that investment in product development is a competitive necessity and plan to continue to make these investments in order to realize the potential of new technologies that we develop, license or acquire for existing markets.

Restructuring charges. Restructuring charges consist of severance, other personnel-related charges and exit costs related to plans to create organizational efficiencies and reduce operating expenses.

Amortization of intangibles. Amortization of intangibles expense consists of the expensing of the costs of the finite lived intangible assets over the useful life of the assets.

Stock-based compensation expenses. Stock-based compensation expense for the years ended December 31, 2017, 2016 and 2015 was $3.5 million, $3.5 million and $2.8 million, respectively. The stock-based compensation expense related to stock options, restricted stock units, restricted stock units with a market condition and the employee stock purchase plan and was recorded as a component of cost of revenues, sales and marketing expenses, general and administrative expenses, research and development expenses and discontinued operations.

Currently, we intend to retain all of our earnings to pay down debt, finance the expansion and development of our business and do not anticipate paying any cash dividends to holders of our common stock in the near future. As a result, capital appreciation, if any, of our common stock will be a stockholder’s sole source of gain for the near future.

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Selected Results of Operations

Year Ended December 31, 2017 compared to Year Ended December 31, 2016

Revenues

Revenues decreased 2.6%, or $2.6 million, to $101.9 million for the year ended December 31, 2017, compared to revenues of $104.5 million for the year ended December 31, 2016.

The loss in revenues from the October 2016 AHN disposition negatively impacted 2017 revenues by approximately $2.1 million, while the impact of currency translation negatively impacted 2017 revenues by approximately $0.3 million. Excluding the impact of the AHN disposition and currency translation, organic revenues declined approximately $0.3 million, or 0.2%.

Reconciliation of Changes In Revenues Compared to the Same Period of the Prior Year

	For the Year Ended December 31, 2017	
Organic and AHN change	-2.3	%
Foreign exchange effect	-0.3	%
Total revenue change	-2.6	%

Each reporting period, we face currency exposure that arises from translating the results of our worldwide operations to the United States dollar at exchange rates that fluctuate from the beginning of such period. We evaluate our results of operations on both a reported and a foreign currency-neutral basis, which excludes the impact of fluctuations in foreign currency exchange rates. We believe that disclosing this non-GAAP financial information provides investors with an enhanced understanding of the underlying operations of the business. This non-GAAP financial information is used by our management to internally evaluate our operating results. The non-GAAP financial information provided in the table above should be considered in addition to, not as a substitute for, the financial information provided and presented in accordance with accounting principles generally accepted in the United States, or GAAP and may be different than other companies' non-GAAP financial information.

Cost of revenues

Cost of revenues were $54.3 million for the year ended December 31, 2017, a decrease of $1.8 million, or 3.2%, compared with $56.1 million for the year ended December 31, 2016. The decrease in cost of revenues was primarily due to the decrease in sales, including the effect of cost of revenues from the sale of AHN of approximately $1.6 million. Gross profit margin as a percentage of revenues increased slightly to 46.7% for the year ended December 31, 2017 compared with 46.3% for 2016.

Sales and marketing expenses

Sales and marketing expenses increased $0.5 million, or 2.7%, to $21.0 million for the year ended December 31, 2017 compared with $20.5 million for the year ended December 31, 2016. This increase was due to increases in employee costs and stock compensation offset by decreases in consulting and purchased services as well as the impact of the sale of AHN.

General and administrative expenses

General and administrative expenses were $18.6 million for the year ended December 31, 2017, a decrease of $2.4 million, or 11.3%, compared with $21.0 million for the year ended December 31, 2016. The decrease was primarily due to a decrease in audit costs, consulting and purchased services costs, as well as the impact of the sale of AHN.

Research and development expenses

Research and development expenses were $5.6 million for the year ended December 31, 2017, an increase of $0.2 million, or 4.7%, compared with $5.4 million for the year ended December 31, 2016. The increase was primarily due to an increase in employee, consulting and other purchased services due to investments in product development and compliance efforts.

Amortization of intangible assets

Amortization of intangible asset expenses was $2.4 million for the year ended December 31, 2017 compared with $2.7 million for the year ended December 31, 2016. The decrease in amortization expense was due to some long-lived intangibles having become fully amortized in 2016, as well as the impact of the disposal of AHN.

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Impairment charges

During the third quarter of 2016, we initiated plans to sell the operations of AHN. As a result of initiating the plan to sell the operations of AHN, we evaluated the long-lived assets for impairment, pursuant to ASC 360-10. Based on the resulting impairment analysis, we recognized an impairment charge of $0.7 million for the year ended December 31, 2016.

Loss on sale of AHN

The loss on sale of AHN was $1.2 million for the year ended December 31, 2016. During the fourth quarter of 2016, we concluded the sale of AHN. Upon the closing of the transaction, we recorded a loss on sale of $1.2 million for the year ended December 31, 2016.

Other expense, net

Other expense, net, was $2.0 million and $0.1 million for the years ended December 31, 2017 and 2016, respectively. Included in other expense, net for the year ended December 31, 2017 was $0.7 million of interest expense and $0.7 million of transaction related costs, including due diligence and deal investigative activities. For the year ended December 31, 2016, other expense, net included $0.6 million of interest expense. The increase in other expense, net was primarily due to the increase in transaction related costs and currency exchange rate fluctuations. Currency exchange rate fluctuations included as a component of net loss resulted in approximately $0.5 million in currency losses during the year ended December 31, 2017, compared to $0.7 million in currency gains during the year ended December 31, 2016.

Income taxes

Income tax was a benefit of approximately $1.2 million and an expense of $1.2 million for the years ended December 31, 2017 and 2016, respectively. The decrease in income tax expense year over year was primarily attributable to a reduction in the valuation allowance recorded against US net deferred tax assets in 2017, partially offset by tax expense associated with the remeasurement of net federal deferred tax assets. These events result directly from recent U.S. tax reform legislation which is discussed below.

On December 22, 2017, tax reform legislation known as the Tax Cuts and Jobs Act (the Tax Act) was signed into law. The Tax Act makes broad and complex changes to the U.S. Internal Revenue Code, including the reduction of the corporate income tax rate from 35% to 21% and the implementation of a modified territorial tax system; the latter includes a one-time transition tax on previously unremitted earnings of foreign subsidiaries. The Company has recorded provisional estimates related to repatriation tax impact and changes in the revaluation of net deferred tax assets in the consolidated financial statements. Other provisions of the Tax Act will not impact the Company until the tax year ended December 31, 2018.

Year Ended December 31, 2016 compared to Year Ended December 31, 2015

Revenues

Revenues decreased 3.8%, or $4.2 million, to $104.5 million for the year ended December 31, 2016, compared to revenues of $108.7 million for the year ended December 31, 2015.

Excluding the effects of currency translation, primarily from the weakening of the British Pound against the U.S. dollar, our revenues decreased 1.8% or $2.0 million, from the previous year. The remainder of the decline in revenues was primarily the result of softness in the European funding environment and slower than expected NIH budget funding, as well as less revenues from AHN in 2016 compared to 2015, following its sale in October 2016, due to two fewer months of revenue which amounted to approximately $0.5 million.

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Reconciliation of Changes In Revenues Compared to the Same Period of the Prior Year

	For the Year Ended December 31, 2016	
Organic and AHN change	-1.8	%
Foreign exchange effect	-2.0	%
Total revenue change	-3.8	%

Each reporting period, we face currency exposure that arises from translating the results of our worldwide operations to the United States dollar at exchange rates that fluctuate from the beginning of such period. We evaluate our results of operations on both a reported and a foreign currency-neutral basis, which excludes the impact of fluctuations in foreign currency exchange rates. We believe that disclosing this non-GAAP financial information provides investors with an enhanced understanding of the underlying operations of the business. This non-GAAP financial information approximates information used by our management to internally evaluate our operating results. The non-GAAP financial information provided in the table above should be considered in addition to, not as a substitute for, the financial information provided and presented in accordance with accounting principles generally accepted in the United States, or GAAP.

Cost of revenues

Cost of revenues were $56.1 million for the year ended December 31, 2016, a decrease of $3.8 million, or 6.4%, compared with $59.9 million for the year ended December 31, 2015. Gross profit margin as a percentage of revenues increased to 46.3% for the year ended December 31, 2016 compared with 44.8% for 2015. The increase in gross profit margin was due primarily due to the savings associated with the relocation and consolidation of certain facilities in 2015.

Sales and marketing expenses

Sales and marketing expenses decreased $0.1 million, or 0.4%, to $20.5 million for the year ended December 31, 2016 compared with $20.6 million for the year ended December 31, 2015. The decrease was primarily due to favorable currency translation and the impact of our restructuring activities.

General and administrative expenses

General and administrative expenses were $21.0 million for the year ended December 31, 2016, an increase of $1.2 million, or 5.6%, compared with $19.8 million for the year ended December 31, 2015. The increase was primarily due to audit and forensic investigation costs, higher stock compensation expense, partially offset by favorable currency translation, and the impact of our restructuring activities.

Research and development expenses

Research and development expenses were $5.4 million for the year ended December 31, 2016, a decrease of $1.0 million, or 16.0%, compared with $6.4 million for the year ended December 31, 2015. The decrease was primarily due to the impact of our restructuring activities, favorable currency translation, and an increase in the amount of research grants earned. Research grants earned are accounted for as a reduction in research and development expense.

Restructuring

Restructuring charges were immaterial for the year ended December 31, 2016 compared with $0.8 million for the year ended December 31, 2015. There were no restructuring activities during the year ended December 31, 2016.

Restructuring charges recorded during the year ended December 31, 2015 included additional charges related to the restructuring plan we implemented during the year ended December 31, 2014, as well as charges related to restructuring plans commenced during the year ended December 31, 2015. The 2015 restructuring plans included actions to move the Coulbourn Instruments' operations to Holliston, MA and the HEKA Canada operations to HEKA Germany, as well as eliminating certain positions made redundant as a result of our site consolidations and a realignment of our commercial sales team.

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Amortization of intangible assets

Amortization of intangible asset expenses was $2.7 million for the year ended December 31, 2016 compared with $2.8 million for the year ended December 31, 2015.

Impairment charges

During the third quarter of 2016, we initiated plans to sell the operations of AHN. As a result of initiating the plan to sell the operations of AHN, we evaluated the long-lived assets for impairment, pursuant to ASC 360-10. Based on the resulting impairment analysis, we recognized an impairment charge of $0.7 million for the year ended December 31, 2016.

Loss on sale of AHN

The loss on sale of AHN was $1.2 million for the year ended December 31, 2016. During the fourth quarter of 2016, we concluded the sale of AHN. Upon the closing of the transaction, we recorded a loss on sale of $1.2 million for the year ended December 31, 2016.

Other expense, net

Other expense, net, was $0.1 million and $1.9 million for the years ended December 31, 2016 and 2015, respectively. Included in other expense, net for the year ended December 31, 2016 was interest expense of $0.6 million. For the year ended December 31, 2015 other expense, net included $0.9 million of interest expense and $1.2 million of acquisition related costs, including due diligence and deal investigative activities. The decrease in other expense, net was primarily due to the decrease in acquisition related costs and currency exchange rate fluctuations. Currency exchange rate fluctuations included as a component of net (loss) income resulted in approximately $0.7 million in currency gains during the year ended December 31, 2016, compared to $0.2 million in currency gains during the year ended December 31, 2015.

Income taxes

Income tax expense was approximately $1.2 million and $15.4 million for the years ended December 31, 2016 and 2015, respectively. The decrease in income tax expense year over year was primarily attributable to the recognition of a valuation allowance on U.S. deferred tax assets in 2015. During the year ended December 31, 2015, we determined that it was more likely than not that our U.S. deferred tax assets would not be realized and therefore recorded a net increase to the valuation allowance of $16.4 million to offset U.S. deferred tax assets net of deferred tax liabilities except for certain indefinite-lived intangible assets. This decision was based on all available evidence.

Liquidity and Capital Resources

Historically, we have financed our business through cash provided by operating activities, the issuance of common stock, and bank borrowings. Our liquidity requirements arise primarily from investing activities, including funding of acquisitions, and other capital expenditures. On October 26, 2016, we sold the operations of AHN and received approximately $1.4 million, net of cash on hand. Subsequent to December 31, 2017, we sold the operations of Denville Scientific, Inc. and received approximately $17.0 million. Simultaneously, we retired our existing debt balances of approximately $11.9 million. On January 31, 2018, we entered into a financing agreement which comprised of a $64.0 million term loan and up to a $25.0 million line of credit. Finally, on January 31, 2018, we acquired Data Sciences International, Inc. for $70.0 million.

As of December 31, 2017, we held cash and cash equivalents of $5.7 million, compared with $5.6 million at December 31, 2016. As of December 31, 2017 and December 31, 2016, we had $11.7 million and $13.7 million, respectively, of borrowings outstanding under our credit facility. Total debt, net of cash and cash equivalents was $6.0 million at December 31, 2017, compared to $8.1 million at December 31, 2016. In addition, we had an underfunded United Kingdom pension liability of approximately $1.2 million and $3.0 million at December 31, 2017 and December 31, 2016, respectively.

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As of December 31, 2017 and December 31, 2016, cash and cash equivalents held by our foreign subsidiaries was $4.8 million and $4.5 million, respectively. Funds held by our foreign subsidiaries are not available for domestic operations unless the funds are repatriated. At December 31, 2017, we changed our indefinite reinvestment assertion to provide that all foreign earnings above the level required for local operating expenses would be repatriated to the U.S. in tax years after 2017. At December 31, 2017, as we were considering a potential U.S. acquisition, we changed our assertion and it was anticipated that U.S. needs would require repatriation of all foreign subsidiaries' earnings rather than just France and Canada. As a result of the Tax Act, all prior unremitted earnings are deemed paid and included in the current provision under the one-time repatriation tax calculation. Prior to 2017, this modified assertion only applied to our subsidiaries in France and Canada. Therefore, no tax liability other than withholding tax has been accrued at December 31, 2017 for these anticipated repatriations.

Condensed Cash Flow Statements

(unaudited)

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Cash flows from operations:			
Net loss	$(865)	$(4,307)	$(19,039)
Changes in assets and liabilities	(3,811)	(41)	(2,719)
Other adjustments to operating cash flows	5,733	9,731	22,463
Net cash provided by operating activities	1,057	5,383	705
Investing activities:			
Additions to property, plant and equipment	(890)	(1,445)	(2,960)
Acquisitions, net of cash acquired	-	-	(4,545)
Dispositions, net of cash on hand	-	1,417	-
Other investing activities	(27)	(34)	(12)
Net cash used by investing activities	(917)	(62)	(7,517)
Financing activities:			
Net repayments of debt	(1,952)	(5,050)	(2,550)
Other financing activities	160	182	2,010
Net cash used by financing activities	(1,792)	(4,868)	(540)
Effect of exchange rate changes on cash	1,789	(1,601)	(38)
Increase (decrease) in cash and cash equivalents	$137	$(1,148)	$(7,390)

Our operating activities provided cash of $1.1 million, $5.4 million and $0.7 million for the years ended December 31, 2017, 2016 and 2015, respectively. The decrease in cash flows from operations in 2017 compared to 2016 was

primarily due to larger outflows due to working capital changes in 2017 as well as larger noncash charges in 2016. The increase in cash flows from operations in 2016 compared to 2015 was primarily due to a lower net loss with higher noncash charges in 2016, and a decrease in inventory and receivables as compared to 2015.

Our investing activities used cash of $0.9 million during the year ended December 31, 2017, $0.1 million for the year ended December 31, 2016, and $7.5 million for the year ended December 31, 2015. Investing activities during 2017, 2016 and 2015 included purchases of property, plant and equipment, proceeds from the sale of property, plant and equipment and expenditures for our catalogs. In addition, investing activities in 2016 included proceeds from the disposition of AHN, net of cash on hand, of $1.4 million. In January 2015, we acquired HEKA for approximately $4.5 million, net of cash acquired. During 2017, 2016 and 2015, capital expenditures were $0.9 million, $1.4 million and $3.0 million, respectively. The increases in capital expenditures in 2016 over 2015 was due to the investment in implementing a new Enterprise Resource Planning (ERP) platform. Capital expenditure decreased in 2017, as a significant amount of the upfront ERP costs had already been incurred.

Our financing activities have historically consisted of borrowings and repayments under our revolving credit facility and term loans, payments of debt issuance costs, and the issuance of common stock. During the years ended December 31, 2017, 2016 and 2015, financing activities used cash of $1.8 million, $4.9 million and $0.5 million , respectively. During the year ended December 31, 2017, we borrowed $2.8 million under our credit facility, repaid $4.7 million of debt under our credit facility and term loans and ended the year with $11.7 million of borrowings. Net proceeds from the issuance of common stock for the year ended December 31, 2017 were $0.2 million, which related to the exercise of stock options and the employee stock purchase plan. During the year ended December 31, 2016, we borrowed $4.0 million under our credit facility, repaid $9.0 million of debt under our credit facility and term loans and ended the year with $13.7 million of borrowings. Net proceeds from the issuance of common stock for 2016 were $0.2 million, which related to the exercise of stock options and the employee stock purchase plan. During the year ended December 31, 2015, we borrowed $5.8 million under our credit facility, repaid $8.4 million of debt under our credit facility and term loans and ended the year with $18.9 million of borrowings. Net proceeds from the issuance of common stock for 2015 were $2.0 million, which related to the exercise of stock options and the employee stock purchase plan.

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Borrowing Arrangements

On August 7, 2009, we entered into an Amended and Restated Revolving Credit Loan Agreement related to a $20.0 million revolving credit facility with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co as lenders (as amended, the 2009 Credit Agreement). On March 29, 2013, we entered into a Second Amended and Restated Revolving Credit Agreement (as amended, the 2013 Credit Agreement) with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co, as lenders that amended and restated the 2009 Credit Agreement. Between September 2011 and May 2017, we entered into a series of amendments that among other things did the following:

- on September 30, 2011, reduced interest rates to the London Interbank Offered Rate plus 3.0%;
- on March 29, 2013, converted existing loan advances into a term loan in the principal amount of $15.0 million (the 2013 Term Loan), provided a revolving credit facility in the maximum principal amount of $25.0 million (the 2013 Revolving Line) and a delayed draw term loan (the 2013 DDTL) of up to $15.0 million;
- on October 31, 2013, reduced the 2013 DDTL from up to $15.0 million to up to $10.0 million;
- on April 24, 2015, extended the maturity date of the 2013 Revolving Line to March 29, 2018 and reduced the interest rates on the 2013 Revolving Line, 2013 Term Loan and 2013 DDTL;
- on June 30, 2015, amended its quarterly minimum fixed charge coverage financial covenant;
- on March 9, 2016, amended the principal payment amortization of the 2013 Term Loan and 2013 DDTL to five years, as well as amended its quarterly minimum fixed charge coverage financial covenant; and
- on May 2, 2017, entered into a Third Amended and Restated Revolving Credit Agreement (as amended, the Credit Agreement) with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co, as lenders that amended and restated the 2013 Credit Agreement.

The Credit Agreement was entered into to, among other things, consolidate, combine and restate the outstanding indebtedness, on the date of the Credit Agreement, into a term loan (the Term Loan) in the principal amount of $14.0 million, and also provide for a $25.0 million revolving line of credit (the Revolving Line). The Term Loan and the Revolving Line each have a maturity date of May 1, 2022. Borrowings under the Term Loan accrue interest at a rate based on either the effective LIBOR for certain interest periods selected by us, or a daily floating rate based on the BBA LIBOR as published by Reuters (or other commercially available source providing quotations of BBA LIBOR), plus in either case, a margin of 2.75%. Additionally, the Revolving Line accrues interest at a rate based on either the

effective LIBOR for certain interest periods selected by us, or a daily floating rate based on the BBA LIBOR, plus in either case, a margin of 2.25%.

The Term Loan and loans under the Revolving Line evidenced by the Credit Agreement, or the Loans, are guaranteed by all of our direct and indirect domestic subsidiaries, and secured by substantially all of the assets of the Company and the guarantors. The Loans are subject to restrictive covenants under the Credit Agreement, and financial covenants that require us and our subsidiaries to maintain certain financial ratios on a consolidated basis, including a maximum leverage, minimum fixed charge coverage and minimum working capital. Prepayment of the Loans is allowed by the Credit Agreement at any time during the terms of the Loans. The Loans also contain limitations on our ability to incur additional indebtedness and requires lender approval for acquisitions funded with cash, promissory notes and/or other consideration in excess of $6.0 million and for acquisitions funded solely with equity in excess of $10.0 million.

As of December 31, 2017 and December 31, 2016, we had borrowings of $11.7 million and $13.7 million, net of deferred financing costs, respectively, outstanding under our Credit Agreement. The carrying value of the debt approximates fair value because the interest rate under the obligation approximates market rates of interest available to us for similar instruments.

As of December 31, 2017, the weighted effective interest rates, net of the impact of our interest rate swaps, on our Term Loan, was 4.61%.

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On January 22, 2018, in connection with the sale of Denville, we terminated the Credit Agreement. All outstanding amounts under the agreement were repaid in full using a portion of the proceeds of the Denville sale. At the time of repayment, there was approximately $11.9 million outstanding.

On January 31, 2018, we acquired all of the issued and outstanding shares of Data Sciences International, Inc. (DSI), a Delaware corporation for approximately $70.0 million. We funded the acquisition from our existing cash balances, the proceeds of the Denville transaction and the proceeds of the Financing Agreement discussed below.

Additionally, on January 31, 2018, we entered into a financing agreement by and among us and certain of our subsidiaries, as borrowers (collectively, the Borrower), certain of our subsidiaries, as guarantors, various lenders from time to time party thereto (the Lenders), and Cerberus Business Finance, LLC, as collateral agent and administrative agent for the Lenders (the Financing Agreement).

The Financing Agreement provides for senior secured credit facilities (the Senior Secured Credit Facilities) comprised of a $64.0 million term loan and up to a $25.0 million revolving line of credit. The proceeds of the term loan and $4.8 million of advances under the revolving line of credit were used to fund a portion of the DSI acquisition, and to pay fees and expenses related thereto and the closing of the Senior Secured Credit Facilities. In addition, the revolving facility is available for use by us and our subsidiaries for general corporate and working capital needs, and other purposes to the extent permitted by the Financing Agreement. The Senior Secured Credit Facilities have a maturity of five years. At the closing date of the Financing Agreement, we had approximately $14.5 million of available borrowing capacity under the revolving line of credit.

Commencing on March 31, 2018, the outstanding term loans will amortize in equal quarterly installments equal to $0.4 million per quarter on such date and during each of the next three quarters thereafter, $0.6 million per quarter during the next four quarters thereafter and $0.8 million per quarter thereafter, with a balloon payment at maturity.

The obligations of the Borrower under the Senior Secured Credit Facilities are unconditionally guaranteed by us and certain of our existing and subsequently acquired or organized subsidiaries. The Senior Secured Credit Facilities and related guarantees are secured on a first-priority basis (subject to certain liens permitted under the Financing Agreement) by a lien on substantially all the tangible and intangible assets of the Borrower and the subsidiary guarantors, including all of the capital stock held by such obligors (subject to a 65% limitation on pledges of capital stock of foreign subsidiaries), subject to certain exceptions.

Interest on all loans under the Senior Secured Credit Facilities is paid monthly. Borrowings under the Financing Agreement accrue interest at a per annum rate equal to, at our option, a base rate plus 4.75% or a LIBOR rate plus 6.25%. The loans are also subject to a 1.25% interest rate floor for LIBOR loans and a 4.25% interest rate floor for

base rate loans.

As a result of terminating the Credit Agreement, we unwound our previously existing swap agreement and received an immaterial amount of proceeds. On February 16, 2018, we entered into a new interest rate swap contract with PNC bank with a notional amount of $36.0 million and a termination date of January 31, 2023 in order to hedge the risk of changes in the effective benchmark interest rate (LIBOR) associated with the Financing Agreement. The swap contract converted specific variable-rate debt into fixed-rate debt and fixed the LIBOR rate associated with a portion of the term loan under the Financing Agreement at 2.72%.

The Financing Agreement contains customary representations and warranties and affirmative covenants applicable us and our subsidiaries and also contains certain restrictive covenants, including, among others, limitations on the incurrence of additional debt, liens on property, acquisitions and investments, loans and guarantees, mergers, consolidations, liquidations and dissolutions, asset sales, dividends and other payments in respect of the Company’s capital stock, prepayments of certain debt, transactions with affiliates and modifications of organizational documents, material contracts, affiliated practice agreements and certain debt agreements. The Financing Agreement also contains customary events of default.

Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement that involves risks and uncertainties, and actual results could vary as a result of a number of factors. Based on our current operations and current operating plans, we expect that our available cash, cash generated from current operations and debt capacity will be sufficient to finance current operations, any potential future acquisitions and capital expenditures for the next 12 months and beyond. This may involve incurring additional debt or raising equity capital for our business. Additional capital raising activities will dilute the ownership interests of existing stockholders to the extent we raise capital by issuing equity securities and we cannot guarantee that we will be successful in raising additional capital on favorable terms or at all.

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Contractual Obligations

The following schedule represents our contractual obligations for our continuing operations, excluding interest, as of December 31, 2017.

	Total	2018	2019	2020	2021	2022	2023 and Beyond
	(in thousands)						
Bank credit facility and notes payable	$11,899	$11,899	$-	$-	$-	$-	$ -
Operating leases	8,974	1,744	1,657	1,501	1,110	1,089	1,873
Total	$20,873	$13,643	$1,657	$1,501	$1,110	$1,089	$ 1,873

As previously noted, we sold Denville in January 2018, and accordingly the table above excludes its future payments under operating leases. Additionally, we acquired DSI in January 2018, and as such the table above, which is as of December 31, 2017, excludes its future operating payments under its operating lease.

We have a liability at December 31, 2017 and 2016 of $0.3 million and $0.4 million, respectively for uncertain tax positions taken in an income tax return. We do not know the ultimate resolution of these uncertain tax positions and as such, do not know the ultimate timing of payments, if any, related to this liability. Accordingly, this amount is not included in the above table.

We have an underfunded United Kingdom pension liability of $1.2 million and $3.0 million as of December 31, 2017 and 2016, respectively, which is recognized as part of the "Other long term liabilities" line item in our consolidated balance sheets. Since we do not know the ultimate timing of payments related to this liability, this amount has not been included in the above table.

Critical Accounting Policies

We believe that our critical accounting policies are as follows:

- revenue recognition;
- accounting for income taxes;

- inventory;

- valuation of identifiable intangible assets in business combinations;

- valuation of long-lived and intangible assets and goodwill; and

- stock-based compensation.

Revenue recognition. We follow the provisions of FASB ASC 605, "Revenue Recognition". We recognize revenue of products when persuasive evidence of a sales arrangement exists, the price to the buyer is fixed or determinable, delivery has occurred, and collectability of the sales price is reasonably assured. Sales of some of our products include provisions to provide additional services such as installation and training. Revenues on these products are recognized when the additional services have been performed. Service agreements on our equipment are typically sold separately from the sale of the equipment. Revenues on these service agreements are recognized ratably over the life of the agreement, typically one year, in accordance with the provisions of FASB ASC 605-20, "Revenue Recognition—Services".

We account for shipping and handling fees and costs in accordance with the provisions of FASB ASC 605-45-45, "Revenue Recognition—Principal Agent Considerations", which requires all amounts charged to customers for shipping and handling to be classified as revenues. Our costs incurred related to shipping and handling are classified as cost of product revenues. Warranties and product returns are estimated and accrued for at the time sales are recorded. We have no obligations to customers after the date products are shipped or installed, if applicable, other than pursuant to warranty obligations and service or maintenance contracts. We provide for the estimated amount of future returns upon shipment of products or installation, if applicable, based on historical experience. Historically, product returns and warranty costs have not been significant, and they have been within our expectations and the provisions established, however, there is no assurance that we will continue to experience the same return rates and warranty repair costs that we have in the past. Any significant increase in product return rates or a significant increase in the cost to repair our products could have a material adverse impact on our operating results for the period or periods in which such returns or increased costs materialize.

We make estimates evaluating our allowance for doubtful accounts. On an ongoing basis, we monitor collections and payments from our customers and maintain a provision for estimated credit losses based upon our historical experience and any specific customer collection issues that we have identified. Historically, such credit losses have not been significant, and they have been within our expectations and the provisions established, however, there is no assurance that we will continue to experience the same credit loss rates that we have in the past. A significant change in the liquidity or financial position of our customers could have a material adverse impact on the collectability of our accounts receivable and our future operating results.

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Accounting for income taxes. We determine our annual income tax provision in each of the jurisdictions in which we operate. This involves determining our current and deferred income tax expense that reflects accounting for differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases. The future tax consequences attributable to these differences result in deferred tax assets and liabilities, which are included in our consolidated balance sheets. We assess the recoverability of the deferred tax assets by considering whether it is more likely than not that some portion or all of the deferred tax assets will not be realized. To the extent we believe that recovery does not meet this "more likely than not" standard as required in FASB ASC 740, "Income Taxes", we must establish a valuation allowance. If a valuation allowance is established, increased or decreased in a period, we allocate the related income tax expense or benefit to income from continuing operations in the consolidated statement of operations.

Management's judgment and estimates are required in determining our income tax provision, deferred tax assets and liabilities and any valuation allowance recorded against deferred tax assets. We review the recoverability of deferred tax assets during each reporting period by reviewing estimates of future taxable income, future reversals of existing taxable temporary differences, and tax planning strategies that would, if necessary, be implemented to realize the benefit of a deferred tax asset before expiration. Due to our three year cumulative loss position, we concluded that a full valuation allowance was required to offset most U.S. deferred tax assets, net of deferred tax liabilities except deferred tax liabilities related to indefinite lived intangible assets. At December 31, 2017, we have a valuation allowance of $11.4 million, of which $10.6 million relates to our U.S. deferred tax assets. The remainder relates to deferred tax assets in certain foreign jurisdictions.

We assess tax positions taken on tax returns, including recognition of potential interest and penalties, in accordance with the recognition thresholds and measurement attributes outlined in FASB ASC 740. Interest and penalties recognized, if any, would be classified as a component of income tax expense.

Inventory. We value our inventory at the lower of the actual cost to purchase (first-in, first-out method) and/or manufacture the inventory or the current estimated market value of the inventory. We regularly review inventory quantities on hand and record a provision to write down excess and obsolete inventory to its estimated net realizable value if less than cost, based primarily on historical inventory usage and estimated forecast of product demand. Since forecasted product demand quite often is a function of previous and current demand, a significant decrease in demand could result in an increase in the charges for excess inventory quantities on hand. In addition, our industry is subject to technological change and new product development, and technological advances could result in an increase in the amount of obsolete inventory quantities on hand. Therefore, any significant unanticipated changes in demand or technological developments could have a significant adverse impact on the value of our inventory and our reported operating results.

Valuation of identifiable intangible assets acquired in business combinations. The determination of the fair value of intangible assets, which represents a significant portion of the purchase price in our acquisitions, requires the use of significant judgment with regard to (i) the fair value; and (ii) whether such intangibles are amortizable or not amortizable and, if the former, the period and the method by which the intangibles asset will be amortized. We

estimate the fair value of acquisition-related intangible assets principally based on projections of cash flows that will arise from identifiable assets of acquired businesses. The projected cash flows are discounted to determine the present value of the assets at the dates of acquisitions. At December 31, 2017, amortizable intangible assets include existing technology, trade names, distribution agreements, customer relationships and patents. These amortizable intangible assets are amortized on a straight-line basis over 7 to 15 years, 10 to 15 years, 4 to 5 years, 5 to 15 years and 5 to 15 years, respectively.

Valuation of long-lived and intangible assets. In accordance with the provisions of FASB ASC 360, *"Property, Plant and Equipment"*, we assess the value of identifiable intangibles with finite lives and long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying value may not be recoverable. Factors we consider important which could trigger an impairment review include the following: significant underperformance relative to expected historical or projected future operating results; significant changes in the manner of our use of the acquired assets or the strategy for our overall business; significant negative industry or economic trends; significant changes in who our competitors are and what they do; significant changes in our relationship with our distributors; significant decline in our stock price for a sustained period; and our market capitalization relative to net book value.

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If we were to determine that the value of long-lived assets and identifiable intangible assets with finite lives was not recoverable based on the existence of one or more of the aforementioned factors, then the recoverability of those assets to be held and used would be measured by a comparison of the carrying amount of those assets to undiscounted future net cash flows before tax effects expected to be generated by those assets. If such assets are considered to be impaired, the impairment to be recognized would be measured by the amount by which the carrying value of the assets exceeds the fair value of the assets.

As a result of our initiation of plans to sell the operations of AHN during the third quarter of 2016, we conducted an evaluation of AHN's assets for impairment. Based on this evaluation, we recognized an impairment charge of $0.7 million on its long-lived assets.

Goodwill and Other Intangible Assets. FASB ASC 350, *"Intangibles-Goodwill and Others"* addresses financial accounting and reporting for acquired goodwill and other intangible assets. Among other things, FASB ASC 350 requires that goodwill and intangible assets with indefinite useful lives no longer be amortized, but rather tested annually for impairment or more frequently if events or circumstances indicate that there may be impairment. Goodwill is also subject to an annual impairment test, or more frequently, if indicators of potential impairment arise. ASU 2011-08 intends to simplify goodwill impairment testing by permitting an assessment of qualitative factors to determine when events and circumstances lead to the conclusion that it is necessary to perform the two-step goodwill impairment test required under ASC 350. The two-step goodwill impairment test consists of a comparison of the fair value of our reporting units with their carrying amount. If the carrying amount exceeds its fair value, we are required to perform the second step of the impairment test, as this is an indication that goodwill may be impaired. The impairment loss is measured by comparing the implied fair value of the reporting unit's goodwill with its carrying amount. If the carrying amount exceeds the implied fair value, an impairment loss shall be recognized in an amount equal to the excess. After an impairment loss is recognized, the adjusted carrying amount of the intangible asset shall be its new accounting basis. Subsequent reversal of a previously recognized impairment loss is prohibited. For unamortizable intangible assets, if the carrying amount were to exceed the fair value of the asset we would write down the unamortizable intangible asset to fair value.

For the purpose of our goodwill analysis, we have one reporting unit. We conducted our annual impairment analysis in the fourth quarter of fiscal year 2017. The determination of the fair value of the reporting unit requires us to make a significant estimate on control premiums appropriate of industries in which we compete. We compared our carrying value to our overall market capitalization.

The results of our test for goodwill impairment showed that the estimated fair value of our business substantially exceeded its carrying value. We concluded that none of our goodwill was impaired. We also concluded that the fair value of the unamortized intangible assets significantly exceeds the carrying amounts.

Stock-based compensation. We account for stock-based payment awards in accordance with the provisions of FASB ASC 718, *"Compensation—Stock Compensation"*, which requires us to recognize compensation expense for all stock-based payment awards made to employees and directors including stock options, restricted stock units, restricted stock units with a market condition and employee stock purchases related to our Employee Stock Purchase Plan (as amended, ESPP). We issue new shares upon stock option exercises, upon the vesting of restricted stock units and restricted stock units with a market condition, and under our ESPP.

FASB ASC 718 requires companies to estimate the fair value of stock-based payment awards on the date of grant using an option-pricing model. The value of the award that vests is recognized as expense over the requisite service periods in our consolidated statement of operations. We adopted ASU 2016-09 as of January 1, 2017. As a result of this adoption, we have elected as an accounting policy to account for forfeitures for service based awards as they occur, with no adjustment for estimated forfeitures.

We value stock-based payment awards, except restricted stock awards, at the grant date using the Black-Scholes option-pricing model. We value the restricted stock units with a market condition at the grant date using a Monte-Carlo valuation simulation. Our determination of fair value of stock-based payment awards on the date of grant using an option-pricing model or Monte-Carlo valuation simulation is affected by our stock price as well as assumptions regarding a number of highly complex and subjective variables. These variables include, but are not limited to our expected stock price volatility over the term of the awards and actual and projected stock option exercise behaviors.

The fair value of restricted stock units are based on the market price of our common stock on the date of grant and are recorded as compensation expense ratably over the applicable service period, which ranges from one to four years. Unvested restricted stock units are forfeited in the event of termination of employment or engagement with our Company.

We record stock compensation expense on a straight-line basis over the requisite service period for all awards granted.

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Impact of Foreign Currencies

Our international operations in some instances operate in a natural hedge as we sell our products in many countries and a substantial portion of our revenues, costs and expenses are denominated in foreign currencies, especially the British pound sterling, the Euro, the Canadian dollar and the Swedish krona.

For the year ended December 31, 2017, the U.S dollar's strengthening in relation to those currencies resulted in an unfavorable translation effect on our consolidated revenues and a neutral effect on our consolidated net loss. Changes in foreign currency exchange rates resulted in an unfavorable effect on revenues of approximately $0.3 million and a favorable effect on expenses of approximately $0.3 million. During 2016, the U.S dollar's strengthening in relation to those currencies resulted in an unfavorable translation effect on our consolidated revenues and our consolidated net loss. Changes in foreign currency exchange rates resulted in an unfavorable effect on revenues of approximately $2.1 million and a favorable effect on expenses of approximately $1.9 million. Similarly, during 2015, the U.S dollar's strengthening in relation to those currencies resulted in an unfavorable translation effect on our consolidated revenues and our net income. Changes in foreign currency exchange rates resulted in an unfavorable effect on revenues of $4.0 million and a favorable effect on expenses of $3.6 million.

The gain associated with the translation of foreign equity into U.S. dollars included as a component of comprehensive income (loss) for the year ended December 31, 2017, was approximately $4.4 million, compared to losses of $4.6 million and $4.9 million for the years ended December 31, 2016 and 2015, respectively.

In addition, currency exchange rate fluctuations included as a component of net loss resulted in currency losses of approximately $0.5 million during the year ended December 31, 2017, compared to currency gains of approximately $0.7 million and $0.2 million during the years ended December 31, 2016 and 2015, respectively.

Recently Issued Accounting Pronouncements

In February 2016, the FASB issued ASU 2016-02, *Leases*, which is intended to improve financial reporting about leasing transactions. The update requires a lessee to record on the balance sheet the assets and liabilities for the rights and obligations created by lease terms of more than 12 months. The update is effective for fiscal years beginning after December 15, 2018. We have commenced the process of evaluating the requirements of the standard as well as collecting information on all our leases. We have not yet concluded on the impact of the adoption on our consolidated financial position, results of operations and cash flows, however, assets and liabilities will increase upon adoption for right-of-use assets and lease liabilities. Our future commitments under lease obligations are summarized under the "Contractual Obligations" heading above.

In June 2016, the FASB issued ASU 2016-13, *Financial Instruments – Credit Losses (Topic 326), Measurement of credit losses on Financial Instruments.* The update amends the FASB's guidance on the impairment of financial instruments. The ASU adds to U.S. GAAP an impairment model (known as the current expected credit loss (CECL) model) that is based on expected losses rather than incurred losses. Under the new guidance, an entity recognizes as an allowance its estimate of expected credit losses, which the FASB believes will result in more timely recognition of such losses. The ASU is effective for fiscal years beginning after December 15, 2019, including interim periods within those fiscal years. We are evaluating the impact of ASU 2016-13 on our consolidated financial statements.

In August 2017, the FASB issued ASU 2017-12, *Derivatives and Hedging (Topic 815)* which amends the hedge accounting recognition and presentation requirements in ASC 815. The Board's objectives in issuing the ASU are to (1) improve the transparency and understandability of information conveyed to financial statement users about an entity's risk management activities by better aligning the entity's financial reporting for hedging relationships with those risk management activities and (2) reduce the complexity of and simplify the application of hedge accounting by preparers. The ASU is effective for annual reporting periods, including interim periods within those annual reporting periods, beginning after December 15, 2018. Early adoption is permitted, including adoption in any interim period. We are evaluating the requirements of this guidance and have not yet determined the impact of the adoption on our consolidated financial position, results of operations and cash flows.

Recently Adopted Accounting Pronouncements

Adopted in 2017

In March 2016, the FASB issued ASU 2016-09, Compensation – Stock Compensation (Topic 718): *Improvements to Employee Share-Based Payment Accounting*, which simplifies the accounting for share-based payment transactions, including the income tax consequences, classification of awards as either equity or liabilities and classification on the statement of cash flows.

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The standard requires an entity to recognize all excess tax benefits and tax deficiencies as income tax benefit or expense in the income statement as discrete items in the reporting period in which they occur, and such tax benefits and tax deficiencies are not included in the estimate of an entity's annual effective tax rate, applied on a prospective basis. Further, the standard eliminates the requirement to defer the recognition of excess tax benefits until the benefit is realized through a reduction to taxes payable. All excess tax benefits previously unrecognized, along with any valuation allowance, should be recognized on a modified retrospective basis as a cumulative adjustment to retained earnings as of the date of adoption. Under ASU 2016-09, an entity that applies the treasury stock method in calculating diluted earnings per share is required to exclude excess tax benefits and deficiencies from the calculation of assumed proceeds since such amounts are recognized in the income statement. Excess tax benefits should also be classified as operating activities in the same manner as other cash flows related to income taxes on the statement of cash flows, as such excess tax benefits no longer represent financing activities since they are recognized in the income statement, and should be applied prospectively or retrospectively to all periods presented.

We adopted ASU 2016-09 as of January 1, 2017. We recorded a cumulative increase in retained earnings of $0.5 million at the beginning of the first quarter of 2017 with a corresponding increase in deferred tax assets related to the prior years' unrecognized excess tax benefits. An equal amount of valuation allowance was also recorded against these deferred tax assets with a corresponding decrease to retained earnings resulting in no net impact to retained earnings and deferred tax assets. In addition, tax deficiencies related to vested restricted stock units and canceled stock options during the year ended December 31, 2017 have been recognized in the current period's income statement.

ASU 2016-09 also allows an entity to elect as an accounting policy either to continue to estimate the total number of awards for which the requisite service period will not be rendered or to account for forfeitures for service based awards as they occur. An entity that elects to account for forfeitures as they occur should apply the accounting change on a modified retrospective basis as a cumulative effect adjustment to retained earnings as of the date of adoption. We elected as an accounting policy to account for forfeitures for service based awards as they occur, and as a result, we recorded a cumulative effect adjustment of $0.1 million to reduce retained earnings with a corresponding increase in additional paid in capital related to the prior years' stock-based compensation expense as required under the modified retrospective approach. The tax effect of this adjustment, which included the impact of a valuation allowance was immaterial.

Adopted in 2018

In May 2014, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (ASU) 2014-09, *Revenue from Contracts with Customers,* a new accounting standard that provides for a comprehensive model to use in the accounting for revenue arising from contracts with customers that will replace most existing revenue recognition guidance within generally accepted accounting principles in the United States. Under this standard, revenue will be recognized to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which we expect to be entitled in exchange for those goods or services.

We have completed the process of evaluating the impact of the new standard on its consolidated financial position, results of operations and cash flows. We adopted this standard as of January 1, 2018 using the modified retrospective approach. As part of the implementation of the standard, we identified our significant revenue streams, which currently consist primarily of product revenue transactions, and to a lesser extent, extended warranty transactions on certain product sales, and revenues from government contracts. The timing of recognizing revenues for these revenue streams is not expected to materially change. Additionally, no material changes to business processes, systems and controls are expected. We are drafting enhanced revenue disclosures which will be presented prospectively starting in the first quarter of 2018.

In May 2017, the FASB issued ASU 2017-09, Stock compensation (Topic 718): Scope of modification accounting which amends the scope of modification accounting for share-based payment arrangements. The ASU provides guidance on the types of changes to the terms or conditions of share-based payment awards to which an entity would be required to apply modification accounting under ASC 718. Specifically, an entity would not apply modification accounting if the fair value, vesting conditions, and classification of the awards are the same immediately before and after the modification. The ASU is effective for annual reporting periods, including interim periods within those annual reporting periods, beginning after December 15, 2017. We adopted this guidance on January 1, 2018, and the new standard did not have a material impact on our consolidated financial position, results of operations and cash flows.

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Item 7A. ***Quantitative and Qualitative Disclosures about Market Risk.***

The majority of our manufacturing and testing of products occurs in our facilities in the United States, Germany, Sweden and Spain. We sell our products globally through our distributors, direct sales force, websites and catalogs. As a result, our financial results are affected by factors such as changes in foreign currency exchange rates and weak economic conditions in foreign markets.

We collect amounts representing a substantial portion of our revenues and pay amounts representing a substantial portion of our operating expenses in foreign currencies. As a result, changes in currency exchange rates from time to time may affect our operating results.

We are exposed to market risk from changes in interest rates primarily through our financing activities. As of December 31, 2017, we had $11.7 million outstanding under our Credit Agreement.

As noted above under the heading “Borrowing Arrangements”, on May 2, 2017, we entered into the Credit Agreement to amend our credit facility with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co. as lenders. Immediately after entering into this Credit Agreement, we entered into a new interest rate swap contract with Bank of America with a notional amount of $14.0 million and a termination date of March 30, 2022 in order to hedge the risk of changes in the effective benchmark interest rate (LIBOR) associated with our Term Loan. The swap contract converted specific variable-rate debt into fixed-rate debt and fixed the LIBOR rate associated with the Term Loan at 1.86%. The interest rate swap was designated as a cash flow hedge instrument in accordance with ASC 815 “Derivatives and Hedging”. As a result of entering into the new interest rate swap contract, we unwound the previous interest rate swap contracts, and received an immaterial amount in proceeds.

As further noted under the “Borrowing Arrangements” heading, on January 22, 2018, we terminated the Credit Agreement, and on January 31, 2018, entered into the Financing Agreement. As a result of terminating the Credit Agreement, we unwound our previously existing swap agreement and received an immaterial amount of proceeds. On February 16, 2018, we entered into a new interest rate swap contract with PNC bank with a notional amount of $36.0 million and a termination date of January 31, 2023 in order to hedge the risk of changes in the effective benchmark interest rate (LIBOR) associated with the Financing Agreement. The swap contract converted specific variable-rate debt into fixed-rate debt and fixed the LIBOR rate associated with a portion of the term loan under the Financing Agreement at 2.72%.

As of December 31, 2017, the weighted effective interest rate, net of the impact of our interest rate swap, on our Term Loan was 4.61%. Following our entering into the Financing Agreement, our weighted effective interest rate on outstanding borrowings was approximately 8.42%.

Assuming no other changes which would affect the margin of the interest rate, the estimated effect of interest rate fluctuations on outstanding borrowings under our Financing Agreement over the next twelve months from January 31, 2018 is quantified and summarized as follows:

	Interest expense increase (in thousands)
Interest rates increase by 1%	$ 328
Interest rates increase by 2%	$ 656

Item 8. ***Financial Statements and Supplementary Data.***

The information required by this item is contained in the consolidated financial statements filed as part of this Annual Report on Form 10-K are listed under Item 15 of Part IV below.

Item 9. ***Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.***

None.

Item 9A. ***Controls and Procedures.***

This Report includes the certifications of our Chief Executive Officer and Chief Financial Officer required by Rule 13a-14 of the Securities Exchange Act of 1934, as amended (the “Exchange Act”). See Exhibits 31.1 and 31.2. This Item 9A includes information concerning the controls and control evaluations referred to in those certifications.

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(a) Evaluation of Disclosure Controls and Procedures

Disclosure controls and procedures refer to controls and other procedures designed to ensure that information required to be disclosed in the reports we file or submit under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the rules and forms of the U.S. Securities and Exchange Commission. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by us in our reports that we file or submit under the Exchange Act is accumulated and communicated to our management, including our Chief Executive Officer and Chief Financial Officer, as appropriate to allow timely decisions regarding our required disclosure. In designing and evaluating our disclosure controls and procedures, our management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives, and management was required to apply its judgment in evaluating and implementing possible controls and procedures.

We carried out an evaluation, under the supervision and with the participation our Chief Executive Officer and Chief Financial Officer, of the effectiveness of the design and operation of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act) as of the end of the period covered in this Report. Based upon the evaluation described above, our Chief Executive Officer and Chief Financial Officer have concluded that they believe that our disclosure controls and procedures were effective, as of December 31, 2017, in providing reasonable assurance that information required to be disclosed by us in the reports that we file or submit under the Exchange Act is accumulated and communicated to our management, including our Chief Executive Officer and Chief Financial Officer, to allow timely decisions regarding required disclosures, and is recorded, processed, summarized and reported within the time periods specified in the Securities and Exchange Commission’s rules and forms.

(b) Management’s Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act). Our internal control over financial reporting is a process designed by and under the supervision of our Chief Executive Officer and Chief Financial Officer and effected by our management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of consolidated financial statements for external purposes in accordance with generally accepted accounting principles. Our internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect transactions and dispositions of assets, (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of consolidated financial statements for external purposes in accordance with generally accepted accounting principles, (3) provide reasonable assurance that receipts and expenditures are being made only in accordance with authorizations of management and directors, and (4) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of assets that could have a material effect on the consolidated financial statements.

Because of inherent limitations, internal control over financial reporting may not prevent or detect misstatements. It is a process that involves human diligence and compliance and is therefore subject to human error and misjudgment. In general, evaluations of effectiveness for future periods are subject to risk as controls may become inadequate due to changes in conditions or the degree of compliance with key processes or procedures could deteriorate.

Our management evaluated the effectiveness of our internal control over financial reporting as of December 31, 2017 using the criteria set forth in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). As a result of that evaluation, management has concluded that our internal control over financial reporting was effective as of December 31, 2017.

The effectiveness of our internal control over financial reporting as of December 31, 2017 has also been audited by Grant Thornton LLP, our independent registered public accounting firm, as stated in their report, which is included below in Item 9A(e).

(c) Changes in Internal Controls Over Financial Reporting

The Company identified control deficiencies related to current and deferred income taxes and inventory costing and reserves for the year-ended December 31, 2016, which were assessed as material weaknesses. We developed a remediation plan at the time, and designed and implemented certain new internal controls in an effort to remediate the material weaknesses. During the fourth quarter of fiscal 2017, we successfully completed the testing necessary to conclude that the material weaknesses had been remediated.

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Except as noted above, there has been no change in the Company's internal control over financial reporting as of December 31, 2017, that has materially affected, or is reasonably likely to materially affect, the Company's internal control over financial reporting.

(d) Inherent Limitations on Effectiveness of Controls

The design of any system of control is based upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated objectives under all future events, no matter how remote, that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may not deteriorate. Because of their inherent limitations, systems of control may not prevent or detect all misstatements. Accordingly, even effective systems of control can provide only reasonable assurance of achieving their control objectives.

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(e) Report of Independent Registered Public Accounting Firm

Report of Independent Registered Public Accounting Firm

The Board of Directors and Shareholders

Harvard Bioscience, Inc.:

Opinion on internal control over financial reporting

We have audited the internal control over financial reporting of Harvard Bioscience, Inc. (a Delaware corporation) and subsidiaries (the "Company") as of December 31, 2017, based on criteria established in the 2013 *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2017, based on criteria established in the 2013 *Internal Control—Integrated Framework* issued by COSO.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) ("PCAOB"), the consolidated financial statements of the Company as of and for the year ended December 31, 2017, and our report dated March 16, 2018 expressed an unqualified opinion on those financial statements.

Basis for opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control Over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and limitations of internal control over financial reporting

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

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

/s/ GRANT THORNTON, LLP

Boston, Massachusetts

March 16, 2018

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Item 9B. Other Information.

None.

PART III

Item 10. ***Directors, Executive Officers and Corporate Governance.***

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act, in connection with our 2018 Annual Meeting of Stockholders. Information concerning executive officers of our Company is included in Part I of this Annual Report on Form 10-K as Item 1. Business- Executive Officers of the Registrant and incorporated herein by reference.

Item 11. ***Executive Compensation.***

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2018 Annual Meeting of Stockholders.

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

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2018 Annual Meeting of Stockholders.

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

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2018 Annual Meeting of Stockholders.

Item 14. ***Principal Accounting Fees and Services.***

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2018 Annual Meeting of Stockholders.

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Item 15.*Exhibits, Financial Statement Schedules.*

(a) Documents Filed. The following documents are filed as part of this Annual Report on Form 10-K or incorporated by reference as indicated:

1 Financial Statements. The consolidated financial statements of Harvard Bioscience, Inc. and its subsidiaries filed under this Item 15:

2 Exhibits and Exhibit Index. See the Exhibit Index included as the last part of this Annual Report on Form 10-K, which is incorporated herein by reference.

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INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

HARVARD BIOSCIENCE, INC.

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Report of Independent Registered Public Accounting Firm

The Board of Directors and Shareholders

Harvard Bioscience, Inc.:

Opinion on the financial statements

We have audited the accompanying consolidated balance sheet of Harvard Bioscience, Inc. (a Delaware corporation) and subsidiaries (the "Company") as of December 31, 2017, and the related consolidated statements of operations, comprehensive loss, stockholders' equity, and cash flows for the year ended December 31, 2017, and the related notes (collectively referred to as the "financial statements"). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2017, and the results of its operations and its cash flows for the year ended December 31, 2017, in conformity with accounting principles generally accepted in the United States of America.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) ("PCAOB"), the Company's internal control over financial reporting as of December 31, 2017, based on criteria established in the 2013 Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"), and our report dated March 16, 2018, expressed an unqualified opinion.

Basis for opinion

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

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audit included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. Our audit also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audit provides a reasonable basis for our opinion.

/s/ GRANT THORNTON LLP

We have served as the Company’s auditor since 2017.

Boston, Massachusetts

March 16, 2018

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Report of Independent Registered Public Accounting Firm

The Board of Directors and Stockholders

Harvard Bioscience, Inc.:

We have audited the accompanying consolidated balance sheet of Harvard Bioscience, Inc. and subsidiaries (the Company) as of December 31, 2016, and the related consolidated statements of operations, comprehensive (loss) income, stockholders' equity and cash flows for each of the years in the two-year period ended December 31, 2016. These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these consolidated financial statements based on our audits.

We conducted our audits in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of Harvard Bioscience, Inc. and subsidiaries as of December 31, 2016, and the results of their operations and their cash flows for each of the years in the two-year period ended December 31, 2016, in conformity with U.S. generally accepted accounting principles.

/s/ KPMG LLP

Cambridge, Massachusetts

March 16, 2017

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HARVARD BIOSCIENCE, INC.

CONSOLIDATED BALANCE SHEETS

(In thousands, except share and per share data)

	December 31, 2017	December 31, 2016
Assets		
Current assets:		
Cash and cash equivalents	$5,733	$5,596
Accounts receivable, net of allowance for doubtful accounts of $454 and $611, respectively	16,236	15,746
Inventories	21,353	19,955
Other receivables and other assets	4,213	4,175
Total current assets	47,535	45,472
Property, plant and equipment, net	4,140	4,296
Deferred income tax assets	182	1,157
Amortizable intangible assets, net	15,960	17,471
Goodwill	39,969	38,032
Indefinite lived intangible assets	1,244	1,209
Other assets	324	128
Total assets	$109,354	$107,765
Liabilities and Stockholders' Equity		
Current liabilities:		
Current portion, long-term debt	$2,765	$2,372
Accounts payable	5,404	6,196
Deferred revenue	633	500
Accrued income taxes	387	223
Accrued expenses	4,551	4,550
Other liabilities - current	301	760
Total current liabilities	14,041	14,601
Long-term debt, less current installments	8,983	11,374
Deferred income tax liabilities	3,964	6,417
Other long term liabilities	1,466	3,177
Total liabilities	28,454	35,569
Commitments and contingencies		
Stockholders' equity:		
Preferred stock, par value $0.01 per share, 5,000,000 shares authorized	-	-
	419	418

Common stock, par value $0.01 per share, 80,000,000 shares authorized; 42,763,985 and 42,186,827 shares issued and 35,018,478 and 34,441,320 shares outstanding, respectively		
Additional paid-in-capital	218,792	215,134
Accumulated deficit	(116,967)	(116,030)
Accumulated other comprehensive loss	(10,676)	(16,658)
Treasury stock at cost, 7,745,507 common shares	(10,668)	(10,668)
Total stockholders' equity	80,900	72,196
Total liabilities and stockholders' equity	$109,354	$107,765

See accompanying notes to consolidated financial statements.

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HARVARD BIOSCIENCE, INC.

CONSOLIDATED STATEMENTS OF OPERATIONS

(In thousands, except per share data)

	Year Ended December 31,		
	2017	2016	2015
Revenues	$101,882	$104,521	$108,664
Cost of revenues (exclusive of items shown separately below)	54,285	56,106	59,941
Gross profit	47,597	48,415	48,723
Sales and marketing expenses	21,036	20,486	20,577
General and administrative expenses	18,575	20,950	19,832
Research and development expenses	5,645	5,392	6,420
Restructuring (credits) charges	-	(4)	788
Amortization of intangible assets	2,442	2,722	2,819
Impairment charges	-	676	-
Loss on sale of AHN	-	1,190	-
Total operating expenses, net	47,698	51,412	50,436
Operating loss	(101)	(2,997)	(1,713)
Other income (expense):			
Foreign exchange	(534)	737	210
Interest expense, net	(713)	(639)	(846)
Other expense, net	(740)	(179)	(1,259)
Other expense, net	(1,987)	(81)	(1,895)
Loss before income taxes	(2,088)	(3,078)	(3,608)
Income tax (benefit) expense	(1,223)	1,229	15,431
Net loss	(865)	(4,307)	(19,039)
Loss per share:			
Basic loss per common share	$(0.02)	$(0.13)	$(0.57)
Diluted loss per common share	$(0.02)	$(0.13)	$(0.57)
Weighted average common shares:			
Basic	34,753	34,212	33,593
Diluted	34,753	34,212	33,593

See accompanying notes to consolidated financial statements.

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HARVARD BIOSCIENCE, INC.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME (LOSS)

(In thousands)

	Year Ended December 31,		
	2017	2016	2015
Net loss	$(865)	$(4,307)	$(19,039)
Other comprehensive income (loss):			
Foreign currency translation adjustments	4,445	(4,606)	(4,936)
Derivatives qualifying as hedges, net of tax:			
Loss on derivative instruments designated and qualifying as cash flow hedges	(24)	(29)	(85)
Amounts reclassified from accumulated other comprehensive income (loss) to net loss	61	39	93
Derivatives qualifying as hedges, net of tax	37	10	8
Defined benefit pension plans, net of tax:			
Amortization of net losses included in net periodic pension costs, net of tax expense of $62, $52 and $58 in 2017, 2016 and 2015, respectively	300	252	248
Net gain (loss), net of tax (benefit) expense of ($246), $88 and $241 in 2017, 2016 and 2015, respectively	1,200	(430)	1,029
Defined benefit pension plans, net of tax	1,500	(178)	1,277
Other comprehensive income (loss)	5,982	(4,774)	(3,651)
Comprehensive income (loss)	$5,117	$(9,081)	$(22,690)

See accompanying notes to consolidated financial statements.

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HARVARD BIOSCIENCE, INC.

CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY

(In thousands)

	Number of Shares Issued	Common Stock	Additional Paid-in Capital	Accumulated Deficit	Accumulated Other Comprehensive Income (Loss)	Treasury Stock	Total Stockho Equity
Balance at December 31, 2014	40,309	$397	$206,656	$(92,684)	$(8,233)	$(10,668)	$95,468
Stock option exercises	1,772	25	2,605	-	-	-	2,630
Stock purchase plan	59	-	208	-	-	-	208
Vesting of restricted stock units	237	-	-	-	-	-	-
Shares withheld for taxes	(652)	(6)	(767)	-	-	-	(773
Stock compensation expense	-	-	2,755	-	-	-	2,755
Net income	-	-	-	(19,039)	-	-	(19,03
Other comprehensive loss	-	-	-	-	(3,651)	-	(3,651
Balance at December 31, 2015	41,725	416	211,457	(111,723)	(11,884)	(10,668)	77,598
Stock option exercises	375	4	167	-	-	-	171
Stock purchase plan	81	-	196	-	-	-	196
Vesting of restricted stock units	302	-	-	-	-	-	-
Shares withheld for taxes	(296)	(2)	(183)	-	-	-	(185
Stock compensation expense	-	-	3,497	-	-	-	3,497
Net loss	-	-	-	(4,307)	-	-	(4,307
Other comprehensive loss	-	-	-	-	(4,774)	-	(4,774
Balance at December 31, 2016	42,187	418	215,134	(116,030)	(16,658)	(10,668)	72,196
Share based payment change in accounting principle	-	-	72	(72)	-	-	-
Stock option exercises	143	2	188	-	-	-	190
Stock purchase plan, net	76	-	140	-	-	-	140
Vesting of restricted stock units	489	-	-	-	-	-	-
Shares withheld for taxes	(131)	(1)	(242)	-	-	-	(243
Stock compensation expense	-	-	3,500	-	-	-	3,500
Net loss	-	-	-	(865)	-	-	(865
Other comprehensive income	-	-	-	-	5,982	-	5,982
Balance at December 31, 2017	42,764	$419	$218,792	$(116,967)	$(10,676)	$(10,668)	$80,900

See accompanying notes to consolidated financial statements.

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HARVARD BIOSCIENCE, INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS

(In thousands)

	Year Ended December 31,		
	2017	2016	2015
Cash flows from operating activities:			
Net loss	$(865)	$(4,307)	$(19,039)
Adjustments to reconcile net loss to net cash provided by operating activities:			
Stock compensation expense	3,500	3,497	2,755
Depreciation	1,317	1,532	1,745
Impairment charges	-	676	-
Loss on sale of AHN	93	1,190	-
(Gain) loss on sale of assets, net	(12)	-	25
Non-cash restructuring (credit)	-	(27)	(85)
Amortization of catalog costs	42	20	9
(Recovery of) provision for allowance for doubtful accounts	(109)	309	(7)
Amortization of intangible assets	2,442	2,722	2,819
Amortization of deferred financing costs	44	91	86
Deferred income taxes	(1,584)	(279)	15,116
Changes in operating assets and liabilities:			
Decrease (increase) in accounts receivable	196	566	(1,340)
(Increase) decrease in inventories	(548)	1,248	(1,223)
(Increase) decrease in other receivables and other assets	(102)	(658)	755
(Decrease) increase in trade accounts payable	(918)	(2,413)	2,577
Decrease (increase) in accrued income taxes	212	(195)	(311)
(Decrease) increase in accrued expenses	(736)	871	(1,511)
Increase (decrease) in deferred revenue	95	(187)	120
(Decrease) increase in other liabilities	(2,010)	727	(1,786)
Net cash provided by operating activities	1,057	5,383	705
Cash flows (used in) provided by investing activities:			
Additions to property, plant and equipment	(890)	(1,445)	(2,960)
Additions to catalog costs	(39)	(34)	(18)
Proceeds from disposition	-	1,417	-
Proceeds from sales of property, plant and equipment	12	-	6
Acquisitions, net of cash acquired	-	-	(4,545)
Net cash used in investing activities	(917)	(62)	(7,517)
Cash flows provided by (used in) financing activities:			
Proceeds from issuance of debt	2,750	4,000	5,800
Repayments of debt	(4,702)	(9,050)	(8,350)
Payments of debt issuance costs	-	-	(32)
Net proceeds from issuance of common stock	160	182	2,042

Net cash used in financing activities	(1,792)	(4,868)	(540)
Effect of exchange rate changes on cash	1,789	(1,601)	(38)
Increase (decrease) in cash and cash equivalents	137	(1,148)	(7,390)
Cash and cash equivalents at the beginning of period	5,596	6,744	14,134
Cash and cash equivalents at the end of period	$5,733	$5,596	$6,744
Supplemental disclosures of cash flow information:			
Cash paid for interest	$686	$620	$854
Cash paid for income taxes, net of refunds	$(13)	$928	$963

See accompanying notes to consolidated financial statements.

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HARVARD BIOSCIENCE, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Organization

Harvard Bioscience, Inc. ("Harvard Bioscience" or "the Company") is a global developer, manufacturer and marketer of a broad range of scientific instruments and systems used to advance life science for basic research, drug discovery, clinical and environmental testing. The Company's products are sold to thousands of researchers in over 100 countries through its global sales organization, websites, catalogs, and through distributors including Thermo Fisher Scientific Inc., VWR and other specialized distributors. The Company has sales and manufacturing operations in the United States, the United Kingdom, Germany, Sweden, Spain, France, Canada and China.

2. Summary of Significant Accounting Policies

(a) Principles of Consolidation

The consolidated financial statements include the accounts of Harvard Bioscience, Inc. and its wholly-owned subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

(b) Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires the use of management estimates. Such estimates include the determination and establishment of certain accruals and provisions, including those for inventory excess and obsolescence, income tax and reserves for bad debts. In addition, certain estimates are required in order to determine the value of assets and liabilities associated with acquisitions, as well as the Company's defined benefit pension obligations. Estimates are also required to evaluate the value and recoverability of existing long-lived and intangible assets, including goodwill. On an ongoing basis, the Company reviews its estimates based upon currently available information. Actual results could differ materially from those estimates.

(c) Cash and Cash Equivalents

For purposes of the consolidated balance sheets and statements of cash flows, the Company considers all highly liquid instruments with original maturities of three months or less to be cash equivalents.

For the purposes of reporting consolidated cash flows, cash and cash equivalents include cash on hand and amounts due from banks. The Company maintains a portion of its cash in bank deposit accounts which, at times, may exceed federally insured limits. The Company has not experienced any losses in such accounts. The Company believes it is not exposed to any significant risk with respect to these accounts.

(d) Allowance for Doubtful Accounts

Allowance for doubtful accounts is based on the Company's assessment of collectability of customer accounts. The Company regularly reviews the allowance by considering factors such as historical experience, credit quality, age of the accounts receivable balances and other factors that may affect a customer's ability to pay.

(e) Inventories

The Company values its inventories at the lower of the actual cost to purchase (first-in, first-out method) and/or manufacture the inventories or the current estimated market value of the inventories. The Company regularly reviews inventory quantities on hand and records a provision to write down excess and obsolete inventories to its estimated net realizable value if less than cost, based primarily on historical inventory usage and estimated forecast of product demand.

(f) Property, Plant and Equipment

Property, plant and equipment are stated at cost and depreciated using the straight-line method over the estimated useful lives of the assets as follows:

Buildings	40	years
Machinery and equipment	3 - 10	years
Computer equipment and software	3 - 7	years
Furniture and fixtures	5 - 10	years
Automobiles	3 - 6	years

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Property and equipment held under capital leases and leasehold improvements are amortized using the straight line method over the shorter of the lease term or estimated useful life of the asset.

(g) Catalog Costs

Significant costs of product catalog design, development and production are capitalized and amortized over the expected useful life of the catalog (usually one to three years).

(h) Income Taxes

Income taxes are accounted for under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates expected to be applied to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date.

The Company recognizes the effect of income tax positions only if those positions are more likely than not of being sustained. Recognized income tax positions are measured at the largest amount that is more than 50% likely of being realized. Changes in recognition are reflected in the period in which the judgement occurs.

(i) Foreign Currency Translation

The functional currency of the Company’s foreign subsidiaries is generally their local currency. All assets and liabilities of its foreign subsidiaries are translated at exchange rates in effect at period-end. Income and expenses are translated at rates which approximate those in effect on the transaction dates. The resulting translation adjustment is recorded as a separate component of stockholders’ equity in accumulated other comprehensive (loss) income (AOCI) in the consolidated balance sheets. Gains and losses resulting from foreign currency transactions are included in net (loss) income.

(j) Earnings per Share

Basic earnings per share is computed by dividing net income by the weighted average number of shares of common stock outstanding during the periods presented. The computation of diluted earnings per share is similar to the

computation of basic earnings per share, except that the denominator is increased for the assumed exercise of dilutive options and other potentially dilutive securities using the treasury stock method unless the effect is antidilutive.

(k) Comprehensive Income (Loss)

The Company follows the provisions of Financial Accounting Standards Board (FASB) Accounting Standards Codification (ASC) 220, “Comprehensive Income”. FASB ASC 220 requires companies to report all changes in equity during a period, resulting from net (loss) income and transactions from non-owner sources, in a financial statement in the period in which they are recognized. The Company has chosen to disclose comprehensive income (loss), which encompasses net loss, foreign currency translation adjustments, gains and losses on derivatives, the underfunded status of its pension plans, and pension minimum additional liability adjustments, net of tax, in the consolidated statements of comprehensive income (loss).

(l) Revenue Recognition

The Company follows the provisions of FASB ASC 605, “Revenue Recognition”. The Company recognizes product revenues when persuasive evidence of a sales arrangement exists, the price to the buyer is fixed or determinable, delivery has occurred, and collectability of the sales price is reasonably assured. Sales of some of its products include provisions to provide additional services such as installation and training. Revenues on these products are recognized when the additional services have been performed. Service agreements on its equipment are typically sold separately from the sale of the equipment. Cash received prior to rendering of the service on these contracts is recorded as deferred revenue and the revenues are recognized ratably over the life of the agreement, typically one year, in accordance with the provisions of FASB ASC 605-20, “Revenue Recognition—Services”.

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The Company accounts for shipping and handling fees and costs in accordance with the provisions of FASB ASC 605-45-45, “Revenue Recognition—Principal Agent Considerations”, which requires all amounts charged to customers for shipping and handling to be classified as revenues. The costs incurred related to shipping and handling is classified as cost of product revenues. Warranties and product returns are estimated and accrued for at the time sales are recorded. The Company has no obligations to customers after the date products are shipped or installed, if applicable, other than pursuant to warranty obligations and service or maintenance contracts. The Company provides for the estimated amount of future returns upon shipment of products or installation, if applicable, based on historical experience.

Sales taxes, value added taxes, and certain excise taxes collected from customers and remitted to governmental authorities are accounted for on a net basis, and are therefore excluded from revenues.

(m) Valuation of Identifiable Intangible Assets Acquired in Business Combinations

The determination of the fair value of intangible assets, which represents a significant portion of the purchase price in the Company’s acquisitions, requires the use of significant judgment with regard to (i) the fair value; and (ii) whether such intangibles are amortizable or not amortizable and, if the former, the period and the method by which the intangibles asset will be amortized. The Company estimates the fair value of acquisition-related intangible assets principally based on projections of cash flows that will arise from identifiable assets of acquired businesses. The projected cash flows are discounted to determine the present value of the assets at the dates of acquisitions. At December 31, 2017, amortizable intangible assets include existing technology, trade names, distribution agreements, customer relationships and patents. These amortizable intangible assets are amortized on a straight-line basis over 7 to 15 years, 10 to 15 years, 4 to 5 years, 5 to 15 years and 5 to 15 years, respectively.

(n) Goodwill and Other Intangible Assets

Goodwill and unamortizable intangible assets acquired in a business combination and determined to have an indefinite useful life are not amortized, but instead are tested for impairment annually or more frequently if events or changes in circumstances indicate that the asset might be impaired, in accordance with the provisions of FASB ASC 350, “Intangibles—Goodwill and Other”.

For the purpose of its goodwill analysis, the Company has one reporting unit. The Company conducted its annual impairment analysis in the fourth quarter of fiscal year 2017. The goodwill impairment test is a two-step process. The first step of the impairment analysis compares the Company’s fair value to its carrying value to determine if there is any indication of impairment. Step two of the analysis compares the implied fair value of goodwill to its carrying amount in a manner similar to a purchase price allocation for business combination. If the carrying amount of goodwill exceeds its implied fair value, an impairment loss is recognized equal to that excess. For indefinite-lived intangible assets if the carrying amount exceeds the fair value of the asset, the Company would write down the indefinite-lived intangible asset to fair value.

At December 31, 2017, the fair value of the Company significantly exceeded the carrying value. The Company concluded that none of its goodwill was impaired.

The Company evaluates indefinite-lived intangible assets for impairment annually and when events occur or circumstances change that may reduce the fair value of the asset below its carrying amount. Events or circumstances that might require an interim evaluation include unexpected adverse business conditions, economic factors, unanticipated technological changes or competitive activities, loss of key personnel and acts by governments and courts. At December 31, 2017, the Company concluded that none of its indefinite-lived intangible assets were impaired.

(o) Impairment of Long-Lived Assets

The Company assesses recoverability of its long-lived assets that are held for use, such as property, plant and equipment and amortizable intangible assets in accordance with FASB ASC 360, “Property, Plant and Equipment” when events or changes in circumstances indicate that the carrying amount of an asset or asset group may not be recoverable. Recoverability of assets or an asset group to be held and used is measured by a comparison of the carrying amount of an asset or asset group to estimated undiscounted future cash flows expected to be generated by the asset or the asset group. Cash flow projections are based on trends of historical performance and management’s estimate of future performance. If the carrying amount of the asset or asset group exceeds the estimated future cash flows, an impairment charge is recognized by the amount by which the carrying amount of the asset or asset group exceeds its estimated fair value. At December 31, 2017, the Company concluded that none of its long-lived assets were impaired.

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(p) Derivatives

The Company uses interest-rate-related derivative instruments to manage its exposure related to changes in interest rates on its variable-rate debt instruments. The Company does not enter into derivative instruments for any purpose other than cash flow hedging. The Company does not speculate using derivative instruments. The Company recognizes all derivative instruments as either assets or liabilities in the balance sheet at their respective fair values. For derivatives designated in hedging relationships, changes in the fair value are either offset through earnings against the change in fair value of the hedged item attributable to the risk being hedged or recognized in AOCI, to the extent the derivative is effective at offsetting the changes in cash flows being hedged until the hedged item affects earnings.

The Company only enters into derivative contracts that it intends to designate as a hedge of a forecasted transaction or the variability of cash flows to be received or paid related to a recognized asset or liability (cash flow hedge). For all hedging relationships, the Company formally documents the hedging relationship and its risk-management objective and strategy for undertaking the hedge, the hedging instrument, the hedged transaction, the nature of the risk being hedged, how the hedging instrument's effectiveness in offsetting the hedged risk will be assessed prospectively and retrospectively, and a description of the method used to measure ineffectiveness. The Company also formally assesses, both at the inception of the hedging relationship and on an ongoing basis, whether the derivatives that are used in hedging relationships are highly effective in offsetting changes in cash flows of hedged transactions. For derivative instruments that are designated and qualify as part of a cash flow hedging relationship, the effective portion of the gain or loss on the derivative is reported as a component of other comprehensive income and reclassified into earnings in the same period or periods during which the hedged transaction affects earnings. Gains and losses on the derivative representing either hedge ineffectiveness or hedge components excluded from the assessment of effectiveness are recognized in current earnings.

The Company discontinues hedge accounting prospectively when it determines that the derivative is no longer effective in offsetting cash flows attributable to the hedged risk, the derivative expires or is sold, terminated, or exercised, the cash flow hedge is de-designated because a forecasted transaction is not probable of occurring, or management determines to remove the designation of the cash flow hedge.

In all situations in which hedge accounting is discontinued and the derivative remains outstanding, the Company continues to carry the derivative at its fair value on the balance sheet and recognizes any subsequent changes in its fair value in earnings. When it is probable that a forecasted transaction will not occur, the Company discontinues hedge accounting and recognizes immediately in earnings gains and losses that were accumulated in other comprehensive income related to the hedging relationship.

(q) Fair Value of Financial Instruments

The carrying values of the Company's cash and cash equivalents, trade accounts receivable and trade accounts payable and short-term debt approximate their fair values because of the short maturities of those instruments. The fair value of the Company's long-term debt approximates its carrying value and is based on the amount of future cash flows associated with the debt discounted using current borrowing rates for similar debt instruments of comparable maturity.

Financial reporting standards define a fair value hierarchy that consists of three levels:

- Level 1 includes instruments for which quoted prices in active markets for identical assets or liabilities accessible to the Company at the measurement date.

- Level 2 includes instruments for which the valuations are based on quoted prices for similar assets or liabilities, quoted prices in markets that are not active, or other inputs that are observable or can be corroborated by observable data for substantially the full term of the assets or liabilities.

- Level 3 includes valuations based on inputs that are unobservable and significant to the overall fair value measurement.

(r) Stock-based Compensation

The Company accounts for stock-based payment awards in accordance with the provisions of FASB ASC 718, "Compensation—Stock Compensation", which requires it to recognize compensation expense for all stock-based payment awards made to employees and directors including stock options, restricted stock units, restricted stock units with a market condition and employee stock purchases ("employee stock purchases") related to its Employee Stock Purchase Plan (as amended, the ESPP). The Company issues new shares upon stock option exercises, upon vesting of restricted stock units and restricted stock units with a market condition, and under the Company's ESPP.

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Stock-based compensation expense recognized is based on the value of the portion of stock-based payment awards that is ultimately expected to vest. The value of the award is recognized as expense as it vests over the requisite service periods in its consolidated statements of operations. The Company values stock-based payment awards, except restricted stock units at grant date using the Black-Scholes option-pricing model (Black-Scholes model). The Company values restricted stock units with a market condition using a Monte-Carlo valuation simulation. The determination of fair value of stock-based payment awards on the date of grant using an option-pricing model or Monte-Carlo valuation simulation is affected by its stock price as well as assumptions regarding certain variables. These variables include, but are not limited to its expected stock price volatility over the term of the awards and actual and projected stock option exercise behaviors.

The fair value of restricted stock units are based on the market price of the Company's stock on the date of grant and are recorded as compensation expense ratably over the applicable service period, which ranges from one to four years. Unvested restricted stock units are forfeited in the event of termination of employment with the Company.

Stock-based compensation expense recognized under FASB ASC 718 for the years ended December 31, 2017, 2016 and 2015 consisted of stock-based compensation expense related to stock options, the employee stock purchase plan, and the restricted stock units and was recorded as a component of cost of product revenues, sales and marketing expenses, general and administrative expenses, research and development expenses and discontinued operations. Refer to footnote 19 for further details.

(s) Recently Issued Accounting Pronouncements

In February 2016, the FASB issued ASU 2016-02, *Leases*, which is intended to improve financial reporting about leasing transactions. The update requires a lessee to record on the balance sheet the assets and liabilities for the rights and obligations created by lease terms of more than 12 months. The update is effective for fiscal years beginning after December 15, 2018. The Company has commenced the process of evaluating the requirements of the standard as well as collecting information on all its leases. The Company has not yet concluded on the impact of the adoption on its consolidated financial position, results of operations and cash flows, however, assets and liabilities will increase upon adoption for right-of-use assets and lease liabilities. The Company's future commitments under lease obligations are summarized in Note 14.

In June 2016, the FASB issued ASU 2016-13, *Financial Instruments – Credit Losses (Topic 326), Measurement of credit losses on Financial Instruments.* The update amends the FASB's guidance on the impairment of financial instruments. The ASU adds to U.S. GAAP an impairment model (known as the current expected credit loss (CECL) model) that is based on expected losses rather than incurred losses. Under the new guidance, an entity recognizes as an allowance its estimate of expected credit losses, which the FASB believes will result in more timely recognition of such losses. The ASU is effective for fiscal years beginning after December 15, 2019, including interim periods within those fiscal years. The Company is evaluating the impact of ASU 2016-13 on its consolidated financial statements.

In August 2017, the FASB issued ASU 2017-12, *Derivatives and Hedging (Topic 815)* which amends the hedge accounting recognition and presentation requirements in ASC 815. The Board's objectives in issuing the ASU are to (1) improve the transparency and understandability of information conveyed to financial statement users about an entity's risk management activities by better aligning the entity's financial reporting for hedging relationships with those risk management activities and (2) reduce the complexity of and simplify the application of hedge accounting by preparers. The ASU is effective for annual reporting periods, including interim periods within those annual reporting periods, beginning after December 15, 2018. Early adoption is permitted, including adoption in any interim period. The Company is evaluating the requirements of this guidance and has not yet determined the impact of the adoption on its consolidated financial position, results of operations and cash flows.

Recently Adopted Accounting Pronouncements

Adopted in 2017

In March 2016, the FASB issued ASU 2016-09, Compensation – Stock Compensation (Topic 718): *Improvements to Employee Share-Based Payment Accounting*, which simplifies the accounting for share-based payment transactions, including the income tax consequences, classification of awards as either equity or liabilities and classification on the statement of cash flows.

The standard requires an entity to recognize all excess tax benefits and tax deficiencies as income tax benefit or expense in the income statement as discrete items in the reporting period in which they occur, and such tax benefits and tax deficiencies are not included in the estimate of an entity's annual effective tax rate, applied on a prospective basis. Further, the standard eliminates the requirement to defer the recognition of excess tax benefits until the benefit is realized through a reduction to taxes payable. All excess tax benefits previously unrecognized, along with any valuation allowance, should be recognized on a modified retrospective basis as a cumulative adjustment to retained earnings as of the date of adoption. Under ASU 2016-09, an entity that applies the treasury stock method in calculating diluted earnings per share is required to exclude excess tax benefits and deficiencies from the calculation of assumed proceeds since such amounts are recognized in the income statement. Excess tax benefits should also be classified as operating activities in the same manner as other cash flows related to income taxes on the statement of cash flows, as such excess tax benefits no longer represent financing activities since they are recognized in the income statement, and should be applied prospectively or retrospectively to all periods presented.

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The Company adopted ASU 2016-09 as of January 1, 2017. The Company recorded a cumulative increase in retained earnings of $0.5 million at the beginning of the first quarter of 2017 with a corresponding increase in deferred tax assets related to the prior years' unrecognized excess tax benefits. An equal amount of valuation allowance was also recorded against these deferred tax assets with a corresponding decrease to retained earnings resulting in no net impact to retained earnings and deferred tax assets. In addition, tax deficiencies related to vested restricted stock units and canceled stock options during the year ended December 31, 2017 have been recognized in the current period's income statement.

ASU 2016-09 also allows an entity to elect as an accounting policy either to continue to estimate the total number of awards for which the requisite service period will not be rendered or to account for forfeitures for service based awards as they occur. An entity that elects to account for forfeitures as they occur should apply the accounting change on a modified retrospective basis as a cumulative effect adjustment to retained earnings as of the date of adoption. The Company elected as an accounting policy to account for forfeitures for service based awards as they occur, and as a result, the Company recorded a cumulative effect adjustment of $0.1 million to reduce retained earnings with a corresponding increase in additional paid in capital related to the prior years' stock-based compensation expense as required under the modified retrospective approach. The tax effect of this adjustment, which included the impact of a valuation allowance was immaterial.

Adopted in 2018

In May 2014, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (ASU) 2014-09, *Revenue from Contracts with Customers,* a new accounting standard that provides for a comprehensive model to use in the accounting for revenue arising from contracts with customers that will replace most existing revenue recognition guidance within generally accepted accounting principles in the United States. Under this standard, revenue will be recognized to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the Company expects to be entitled in exchange for those goods or services.

The Company has completed the process of evaluating the impact of the new standard on its consolidated financial position, results of operations and cash flows. The Company adopted this standard as of January 1, 2018 using the modified retrospective approach. As part of the implementation of the standard, the Company identified its significant revenue streams, which currently consist primarily of product revenue transactions, and to a lesser extent, extended warranty transactions on certain product sales, and revenues from government contracts. The timing of recognizing revenues for these revenue streams is not expected to materially change. Additionally, no material changes to business processes, systems and controls are expected. The Company is drafting enhanced revenue disclosures which will be presented prospectively starting in the first quarter of 2018.

In May 2017, the FASB issued ASU 2017-09, Stock compensation (Topic 718): Scope of modification accounting which amends the scope of modification accounting for share-based payment arrangements. The ASU

provides guidance on the types of changes to the terms or conditions of share-based payment awards to which an entity would be required to apply modification accounting under ASC 718. Specifically, an entity would not apply modification accounting if the fair value, vesting conditions, and classification of the awards are the same immediately before and after the modification. The ASU is effective for annual reporting periods, including interim periods within those annual reporting periods, beginning after December 15, 2017. The Company adopted this guidance on January 1, 2018, and the new standard did not have a material impact on its consolidated financial position, results of operations and cash flows..

3. Concentrations

No customer accounted for more than 10% of revenues for the years ended December 31, 2017, 2016 and 2015. At December 31, 2017 and 2016, no customer accounted for more than 10% of net accounts receivable.

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4. Accumulated Other Comprehensive Loss

Changes in each component of accumulated other comprehensive loss, net of tax are as follows:

(in thousands)	Foreign currency translation adjustments	Derivatives qualifying as hedges	Defined benefit pension plans	Total
Balance at December 31, 2015	$ (9,594)	$ (10)	$ (2,280)	$ (11,884)
Other comprehensive (loss) income before reclassifications	(4,606)	(29)	(430)	(5,065)
Amounts reclassified from AOCI	-	39	252	291
Net other comprehensive (loss) income	(4,606)	10	(178)	(4,774)
Balance at December 31, 2016	(14,200)	$ -	(2,458)	(16,658)
Other comprehensive (loss) income before reclassifications	4,445	(24)	1,200	5,621
Amounts reclassified from AOCI	-	61	300	361
Other comprehensive (loss) income	4,445	37	1,500	5,982
Balance at December 31, 2017	$ (9,755)	$ 37	$ (958)	$ (10,676)

The amounts reclassified out of accumulated other comprehensive (loss) income are as follows:

(in thousands)	Affected line item in the Statements of Operations	Year Ended December 31, 2017	2016	2015
Amounts Reclassified From AOCI				
Derivatives qualifying as hedges				
Realized loss on derivatives qualifying as hedges	Interest expense	$61	$39	$93
Income tax	Income tax (benefit) expense	-	-	-
		61	39	93
Defined benefit pension plans				
Amortization of net losses included in net periodic pension costs	General and administrative expenses	362	304	306

Income tax	Income tax (benefit) expense	(62)	(52)	(58)
		300	252	248
Total reclassifications		$361	$291	$341

5. Inventories

Inventories consist of the following:

	December 31, 2017	December 31, 2016
	(in thousands)	
Finished goods	$10,284	$9,340
Work in process	1,042	823
Raw materials	10,027	9,792
Total	$21,353	$19,955

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6. Property, Plant and Equipment

Property, plant and equipment consist of the following:

	December 31, 2017	December 31, 2016
	(in thousands)	
Land, buildings and leasehold improvements	$2,220	$2,095
Machinery and equipment	7,758	7,224
Computer equipment and software	9,149	8,115
Furniture and fixtures	1,243	1,274
Automobiles	120	196
	20,490	18,904
Less: accumulated depreciation	(16,350)	(14,608)
Property, plant and equipment, net	$4,140	$4,296

7. Acquisitions

As further discussed in Note 25 (Subsequent Events) on January 31, 2018, the Company completed the acquisition of Data Sciences International, Inc.

HEKA Elektronik

On January 8, 2015, the Company, through its wholly-owned Ealing Scientific Limited and Multi-Channel Systems MCS GmbH (MCS) subsidiaries, acquired all of the issued and outstanding shares of HEKA Elektronik (HEKA) for approximately $5.9 million, or $4.5 million, net of cash acquired. Included in the acquisition of HEKA were: HEKA Electronik Dr. Schulze GmbH, based in Lambrecht, Germany (HEKA Germany); HEKA Electronics Incorporated, based in Chester, Nova Scotia, Canada (HEKA Canada); and HEKA Instruments Incorporated, based in Bellmore, New York. The Company funded the acquisition from its existing cash balances.

HEKA is a developer, manufacturer and marketer of sophisticated electrophysiology instrumentation and software for biomedical and industrial research applications. This acquisition is complementary to the electrophysiology line currently offered by the Company’s wholly-owned Warner Instruments and MCS subsidiaries.

The aggregate purchase price for this acquisition was allocated to tangible and intangible assets acquired as follows:

	(in thousands)
Tangible assets	$ 4,165
Liabilities assumed	(2,426)
Net assets	1,739
Goodwill and intangible assets:	
Goodwill	1,668
Trade name	774
Customer relationships	1,627
Developed technology	1,338
Non-compete agreements	27
Deferred tax liabilities	(1,245)
Total goodwill and intangible assets, net of tax	4,189
Acquisition purchase price	$ 5,928

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Goodwill recorded as a result of the acquisition of HEKA is not deductible for tax purposes.

In the second quarter of 2016, an immaterial correction was made to the allocation of the aggregate purchase price to the tangible and intangible assets acquired to increase both accrued liabilities and goodwill by $50,000 as of June 30, 2016. This correction has been reflected in the table above.

The results of operations for HEKA have been included in the Company's consolidated financial statements from the date of acquisition.

The following consolidated pro forma information is based on the assumption that the acquisition of HEKA occurred on January 1, 2015. Accordingly, the historical results have been adjusted to reflect amortization expense that would have been recognized on such a pro forma basis. The pro forma information is presented for comparative purposes only and is not necessarily indicative of the financial position or results of operations which would have been reported had we completed the acquisition during these periods or which might be reported in the future.

	Year Ended December 31, 2015 (in thousands)
Pro Forma	
Revenues	$ 108,761
Net (loss) income	(19,027)

Direct transaction costs recorded in other expense, net, in relation to all current or prospective acquisitions in the Company's consolidated statements of operations were $0.5 million, $0.1 million and $1.2 million for the years ended December 31, 2017, 2016 and 2015, respectively.

8. Dispositions

As further discussed in Note 25 (Subsequent Events) on January 22, 2018, the Company sold substantially all the assets of its wholly owned subsidiary, Denville Scientific, Inc.

AHN Biotechnologie GmbH

On October 26, 2016, the Company sold the operations of its AHN Biotechnologie GmbH subsidiary (AHN), a manufacturer of liquid handling products, located in Nordhausen, Germany for gross cash proceeds of approximately $1.7 million. Proceeds received at closing, net of cash on hand, were approximately $1.4 million. The results of operations of AHN, through the date of sale, were reported in the Company's consolidated statements of operations for the year ended December 31, 2016.

As a result of the initiation of plans to sell the operations of AHN, during the third quarter of 2016, the Company evaluated the long-lived assets of AHN for impairment, pursuant to ASC 360-10. Based on the impairment analysis, the carrying amount of the long-lived assets exceeded the fair value of the long-lived assets as determined using the probability weighted present value of future cash flows. Consequently, the Company recognized an impairment charge of $0.7 million for the year ended December 31, 2016 in operating expenses within its statements of operations. Of the overall charge, approximately $0.1 million was allocated to AHN's intangible assets (trade name and customer relationships), while $0.6 million was allocated to its property, plant and equipment (machinery and equipment).

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Upon the closing of the transaction, the Company recorded a loss on sale of $1.2 million for the year ended December 31, 2016 in operating expenses within the statements of operations. On October 26, 2016, the major classes of assets and liabilities of AHN disposed of, including an allocation of goodwill, were comprised of the following:

	(in thousands)
Assets	
Accounts receivable, net	$ 279
Inventory	438
Property, plant and equipment, net	919
Amortizable intangibles, net	196
Allocation of goodwill	484
Liabilities	
Accounts payable and accrued expenses	$ 245

9. Goodwill and Other Intangible Assets

Intangible assets consist of the following:

	December 31, 2017 (in thousands)		December 31, 2016		Weighted Average Life	(a)
Amortizable intangible assets:	Gross	Accumulated Amortization	Gross	Accumulated Amortization		
Existing technology	$16,173	$ (13,179)	$15,082	$ (11,710)	6.5	Years
Trade names	7,646	(4,060)	7,379	(3,479)	7.1	Years
Distribution agreements/customer relationships	23,744	(14,413)	22,976	(12,862)	8.1	Years
Patents	223	(174)	204	(119)	1.2	Years
Total amortizable intangible assets	47,786	$ (31,826)	45,641	$ (28,170)		
Indefinite-lived intangible assets:						
Goodwill	39,969		38,032			
Other indefinite-lived intangible assets	1,244		1,209			
Total goodwill and other indefinite-lived intangible assets	41,213		39,241			
Total intangible assets	$88,999		$84,882			

(a) Weighted average life as of December 31, 2017.

The change in the carrying amount of goodwill for the years ended December 31, 2017 and 2016 is as follows:

	(in thousands)
Balance at December 31, 2015	$ 40,357
Adjustment to purchase price allocation of prior year acquisition	50
Adjustment to goodwill for AHN disposition	(484)
Effect of change in currency translation	(1,891)
Balance at December 31, 2016	38,032
Effect of change in currency translation	1,937
Balance at December 31, 2017	$ 39,969

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Intangible asset amortization expense was $2.4 million, $2.7 million and $2.8 million for the years ended December 31, 2017, 2016 and 2015, respectively. Amortization expense of existing amortizable intangible assets is currently estimated to be $2.4 million for the year ending December 31, 2018, $2.2 million for the year ending December 31, 2019, $2.2 million for the year ending December 31, 2020, $2.2 million for the year ending December 31, 2021 and $2.1 million for the year ending December 31, 2022.

10. Restructuring and Other Exit Costs

During 2014 and 2015, the Company entered into various restructuring plans, which included eliminating certain positions made redundant as a result of its site consolidations, as well as a realignment of its commercial sales team. These restructuring plans also included the relocation of the distribution operations of the Company's Denville Scientific subsidiary from New Jersey to North Carolina, as well as the consolidation of the manufacturing operations of its Biochrom subsidiary to its headquarters in Holliston, MA. Activity and liability balances related to these charges for the year ended December 31, 2016, were as follows:

	Severance Costs	Other	Total
	(in thousands)		
Restructuring balance at December 31, 2015	$132	$-	$132
Restructuring charges	-	23	23
Non-cash reversal of restructuring charges	(27)	-	(27)
Cash payments	(104)	(28)	(132)
Effect of change in currency translation	(1)	5	4
Restructuring balance at December 31, 2016	$-	$-	$-

For the year ended December 31, 2015, the activity and liability balances related to these charges were as follows:

	Severance Costs	Other	Total
	(in thousands)		
Restructuring balance at December 31, 2014	$626	$-	$626
Restructuring charges	434	439	873
Non-cash reversal of restructuring charges	(85)	-	(85)
Cash payments	(833)	(439)	(1,272)
Effect of change in currency translation	(10)	-	(10)
Restructuring balance at December 31, 2015	$132	$-	$132

Aggregate net restructuring charges for the years ended December 31, 2017, 2016 and 2015 were as follows:

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Restructuring (credits) charges	$-	$(4)	$788

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11. Long Term Debt

On August 7, 2009, the Company entered into an Amended and Restated Revolving Credit Loan Agreement related to a $20.0 million revolving credit facility with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co as lenders (as amended, the 2009 Credit Agreement). On March 29, 2013, the Company entered into a Second Amended and Restated Revolving Credit Agreement (as amended, the 2013 Credit Agreement) with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co, as lenders that amended and restated the 2009 Credit Agreement. Between September 2011 and May 2017, the Company entered into a series of amendments that among other things did the following:

- on September 30, 2011, reduced interest rates to the London Interbank Offered Rate plus 3.0%;
- on March 29, 2013, converted existing loan advances into a term loan in the principal amount of $15.0 million (the 2013 Term Loan), provided a revolving credit facility in the maximum principal amount of $25.0 million (the 2013 Revolving Line) and a delayed draw term loan (the 2013 DDTL) of up to $15.0 million;
- on October 31, 2013, reduced the 2013 DDTL from up to $15.0 million to up to $10.0 million;
- on April 24, 2015, extended the maturity date of the 2013 Revolving Line to March 29, 2018 and reduced the interest rates on the 2013 Revolving Line, 2013 Term Loan and 2013 DDTL;
- on June 30, 2015, amended its quarterly minimum fixed charge coverage financial covenant;
- on March 9, 2016, amended the principal payment amortization of the 2013 Term Loan and 2013 DDTL to five years, as well as amended its quarterly minimum fixed charge coverage financial covenant; and
- on May 2, 2017, entered into a Third Amended and Restated Revolving Credit Agreement (as amended, the Credit Agreement) with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co, as lenders that amended and restated the 2013 Credit Agreement.

The Credit Agreement was entered into to, among other things, consolidate, combine and restate the outstanding indebtedness, on the date of the Credit Agreement, into a term loan (the Term Loan) in the principal amount of $14.0 million, and also provide for a $25.0 million revolving line of credit (the Revolving Line). The Term Loan and the Revolving Line each have a maturity date of May 1, 2022. Borrowings under the Term Loan accrue interest at a rate based on either the effective LIBOR for certain interest periods selected by the Company, or a daily floating rate based on the BBA LIBOR as published by Reuters (or other commercially available source providing quotations of BBA LIBOR), plus in either case, a margin of 2.75%. Additionally, the Revolving Line accrues interest at a rate based on either the effective LIBOR for certain interest periods selected by the Company, or a daily floating rate based on the

BBA LIBOR, plus in either case, a margin of 2.25%.

The Term Loan and loans under the Revolving Line evidenced by the Credit Agreement, or the Loans, are guaranteed by all of the Company's direct and indirect domestic subsidiaries, and secured by substantially all of the assets of the Company and the guarantors. The Loans are subject to restrictive covenants under the Credit Agreement, and financial covenants that require the Company and its subsidiaries to maintain certain financial ratios on a consolidated basis, including a maximum leverage, minimum fixed charge coverage and minimum working capital. Prepayment of the Loans is allowed by the Credit Agreement at any time during the terms of the Loans. The Loans also contain limitations on the Company's ability to incur additional indebtedness and requires lender approval for acquisitions funded with cash, promissory notes and/or other consideration in excess of $6.0 million and for acquisitions funded solely with equity in excess of $10.0 million.

As of December 31, 2017 and December 31, 2016, the Company had borrowings of $11.7 million and $13.7 million, net of deferred financing costs, respectively, outstanding under its Credit Agreement. The carrying value of the debt approximates fair value because the interest rate under the obligation approximates market rates of interest available to the Company for similar instruments.

As of December 31, 2017, the weighted effective interest rates, net of the impact of the Company's interest rate swaps, on its Term Loan was 4.61%.

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As of December 31, 2017 and December 31, 2016, the Company's borrowings were comprised of:

	December 31, 2017	December 31, 2016
	(in thousands)	
Long-term debt:		
Term loan	$11,899	$5,400
DDTL	-	4,400
Revolving line	-	4,050
Total unamortized deferred financing costs	(151)	(104)
Total debt	11,748	13,746
Less: current installments	(2,800)	(2,450)
Current unamortized deferred financing costs	35	78
Long-term debt	$8,983	$11,374

The aggregate amounts of debt maturing during the next five years are as follows:

	(in thousands)
2018	$ 11,899
2019	-
2020	-
2021	-
2022	-
Total	$ 11,899

As further discussed in Note 25, on January 22, 2018, the Company terminated the Credit Agreement and all outstanding amounts under the agreement were repaid in full. At the time of repayment, there was approximately $11.9 million of debt balances outstanding. Accordingly, the table above reflects the repayment of the debt in 2018. Additionally, as further disclosed in Note 25, on January 31, 2018, the Company entered into a financing agreement with Cerberus Business Finance, LLC, which provided for a $64.0 million term loan and up to a $25.0 million revolving line of credit. The $64.0 million term loan has a maturity of five years. The payment schedule of this financing agreement is detailed in Note 25.

12. Derivatives

The Company uses interest-rate-related derivative instruments to manage its exposure related to changes in interest rates on its variable-rate debt instruments. The Company does not enter into derivative instruments for any purpose other than cash flow hedging. The Company does not speculate using derivative instruments.

By using derivative financial instruments to hedge exposures to changes in interest rates, the Company exposes itself to credit risk and market risk. Credit risk is the failure of the counterparty to perform under the terms of the derivative contract. When the fair value of a derivative contract is positive, the counterparty owes the Company, which creates credit risk for the Company. When the fair value of a derivative contract is negative, the Company owes the counterparty and, therefore, the Company is not exposed to the counterparty's credit risk in those circumstances. The Company minimizes counterparty credit risk in derivative instruments by entering into transactions with carefully selected major financial institutions based upon their credit profile.

Market risk is the adverse effect on the value of a derivative instrument that results from a change in interest rates. The market risk associated with interest-rate contracts is managed by establishing and monitoring parameters that limit the types and degree of market risk that may be undertaken.

The Company assesses interest rate risk by continually identifying and monitoring changes in interest rate exposures that may adversely impact expected future cash flows and by evaluating hedging opportunities. The Company maintains risk management control systems to monitor interest rate risk attributable to both the Company's outstanding or forecasted debt obligations as well as the Company's offsetting hedge positions. The risk management control systems involve the use of analytical techniques, including cash flow sensitivity analysis, to estimate the expected impact of changes in interest rates on the Company's future cash flows.

The Company uses variable-rate London Interbank Offered Rate (LIBOR) debt to finance its operations. The debt obligations expose the Company to variability in interest payments due to changes in interest rates. Management believes that it is prudent to limit the variability of a portion of its interest payments. To meet this objective, management enters into LIBOR based interest rate swap agreements to manage fluctuations in cash flows resulting from changes in the benchmark interest rate of LIBOR. These swaps change the variable-rate cash flow exposure on the debt obligations to fixed cash flows. Under the terms of the interest rate swaps, the Company receives LIBOR based variable interest rate payments and makes fixed interest rate payments, thereby creating the equivalent of fixed-rate debt for the notional amount of its debt hedged.

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As disclosed in Note 11, on May 2, 2017, the Company entered into a Credit Agreement that amended its then existing credit facility with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co. as lenders. Immediately after entering into this Credit Agreement, the Company entered into an interest rate swap contract with Bank of America with a notional amount of $14.0 million and a termination date of March 30, 2022 in order to hedge the risk of changes in the effective benchmark interest rate (LIBOR) associated with the Company's Term Loan. The swap contract converted specific variable-rate debt into fixed-rate debt and fixed the LIBOR rate associated with the Term Loan at 1.86% plus a bank margin of 2.75%. The interest rate swap was designated as a cash flow hedge instrument in accordance with ASC 815 "Derivatives and Hedging".

The notional amount of the Company's derivative instruments as of December 31, 2017 was $11.9 million.

The following table presents the notional amount and fair value of the Company's derivative instruments as of December 31, 2017 and December 31, 2016.

		December 31, 2017 Notional Amount	December 31, 2017 Fair Value (a)
Derivatives designated as hedging instruments under ASC 815	Balance sheet classification	(in thousands)	
Interest rate swaps	Other assets	$ 11,900	$ 37

		December 31, 2016 Notional Amount	December 31, 2016 Fair Value (a)
Derivatives designated as hedging instruments under ASC 815	Balance sheet classification	(in thousands)	
Interest rate swaps	Other assets	$ 5,500	$ -

(a) See Note 13 for the fair value measurements related to these financial instruments.

All of the Company's derivative instruments are designated as hedging instruments.

The Company has structured its interest rate swap agreements to be 100% effective and as a result, there was no impact to earnings resulting from hedge ineffectiveness. Changes in the fair value of interest rate swaps designated as

hedging instruments that effectively offset the variability of cash flows associated with variable-rate, long-term debt obligations are reported in accumulated other comprehensive income ("AOCI"). These amounts subsequently are reclassified into interest expense as a yield adjustment of the hedged interest payments in the same period in which the related interest affects earnings. The Company's interest rate swap agreement was deemed to be fully effective in accordance with ASC 815, and, as such, unrealized gains and losses related to these derivatives were recorded as AOCI.

The following table summarizes the effect of derivatives designated as cash flow hedging instruments and their classification within comprehensive loss for the years ended December 31, 2017, 2016 and 2015:

Derivatives in Hedging Relationships	Amount of gain or (loss) recognized in OCI on derivative (effective portion) Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Interest rate swaps	$(24)	$(29)	$(85)

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The following table summarizes the reclassifications out of accumulated other comprehensive loss for the years ended December 31, 2017, 2016 and 2015:

Details about AOCI Components	Amount reclassified from AOCI into income (effective portion)			Location of amount reclassified from AOCI into income (effective portion)
	Year Ended December 31,			
	2017	2016	2015	
	(in thousands)			
Interest rate swaps	$61	$39	$93	Interest expense

As of December 31, 2017, the deferred gains or losses on derivative instruments accumulated in AOCI expected to be reclassified to earnings during the next twelve months were immaterial.

As disclosed in Note 25, on January 22, 2018, the Company terminated its Credit Agreement with Bank of America, as agent, and Bank of America and Brown Brothers Harriman & Co. as lenders. As a result of terminating this Credit Agreement, the Company unwound the interest rate swap contract and received an immaterial amount in proceeds. In addition, as further described in Note 25, in February 2018, the Company entered into a new interest rate swap agreement with PNC bank as a result of entering into the previously described financing agreement with Cerberus Financing LLC. ..

13. Fair Value Measurements

Fair value measurement is defined as the price that would be received to sell an asset or paid to transfer a liability in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants at the measurement date. A fair value hierarchy is established, which prioritizes the inputs used in measuring fair value into three broad levels as follows:

Level 1—Quoted prices in active markets for identical assets or liabilities.

Level 2—Inputs, other than the quoted prices in active markets, that are observable either directly or indirectly.

Level 3—Unobservable inputs based on the Company’s own assumptions.

The following tables present the fair value hierarchy for those liabilities measured at fair value on a recurring basis:

(In thousands)	Fair Value as of December 31, 2017 Level 1	Level 2	Level 3	Total
Assets (Liabilities):				
Interest rate swap agreements	$-	$ 37	$ -	$ 37

(In thousands)	Fair Value as of December 31, 2016 Level 1	Level 2	Level 3	Total
Assets (Liabilities):				
Interest rate swap agreements	$-	$-	$-	$-

The Company uses the market approach technique to value its financial liabilities. The Company's financial liabilities carried at fair value include derivative instruments used to hedge the Company's interest rate risks. The fair value of the Company's interest rate swap agreements was based on LIBOR yield curves at the reporting date.

14. Leases

The Company has noncancelable operating leases for office and warehouse space expiring at various dates through 2022 and thereafter. Rent expense, which is recorded on a straight-line basis, was $1.9 million, $1.8 million and $2.1 million for the years ended December 31, 2017, 2016 and 2015, respectively.

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Future minimum lease payments for operating leases, with initial or remaining terms in excess of one year at December 31, 2017, are as follows:

	Operating Leases
	(in thousands)
2018	$1,744
2019	1,657
2020	1,501
2021	1,110
2022	1,089
Thereafter	1,873
Net minimum lease payments	$8,974

As further discussed in Note 25, on January 22, 2018, the Company sold substantially all the assets of Denville Scientific, an operating subsidiary. Additionally, as discussed in Note 25, the Company acquired DSI in January 2018, and as such the table above, which is as of December 31, 2017 excludes both DSI and Denville's future payments under operating leases.

15. Accrued Expenses

Accrued expenses consist of:

	December 31,	
	2017	2016
	(in thousands)	
Accrued compensation and payroll	$1,772	$1,468
Accrued professional fees	580	1,105
Warranty costs	246	193
Other	1,953	1,784
Total	$4,551	$4,550

16. Income Tax

Income tax expense attributable to income from operations for the years ended December 31, 2017, 2016 and 2015 consisted of:

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Current income tax expense:			
Federal and state	$262	$170	$(4)
Foreign	297	790	677
	559	960	673
Deferred income tax (benefit) expense:			
Federal and state	(2,357)	166	15,598
Foreign	575	103	(840)
	(1,782)	269	14,758
Total income tax (benefit) expense	$(1,223)	$1,229	$15,431

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Income tax expense for the years ended December 31, 2017, 2016 and 2015 differed from the amount computed by applying the U.S. federal income tax rate of 34% to pre-tax operations income as a result of the following:

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Computed "expected" income tax (benefit) expense	$(710)	$(1,046)	$(1,227)
Increase (decrease) in income taxes resulting from:			
Permanent differences, net	(108)	(128)	32
Foreign tax rate differential	23	165	(12)
State income taxes, net of federal income tax benefit	(71)	(93)	82
Non-deductible stock compensation expense	174	110	(161)
Impact of foreign rate change	-	30	89
Impact of U.S. rate change	2,521	-	-
Tax credits	(14)	(89)	(169)
Change in reserve for uncertain tax position	(58)	127	35
Impact of change to prior year tax accruals	72	291	370
Impact of adoption of ASU 2016-09, *Improvements to Employee*			
Share-based Payment Accounting	(486)	-	-
U.S. tax on foreign dividends	3,149	497	-
Foreign withholding taxes	38	74	-
Conversion of U.S. foreign tax credits from credit to deduction	648	1,772	-
Non-deductible loss on subsidiary stock sale	-	501	-
Change in valuation allowance allocated to income			
tax expense (benefit)	(6,393)	(983)	16,401
Other	(8)	1	(9)
Total income tax (benefit) expense	$(1,223)	$1,229	$15,431

Income tax (benefit) expense is based on the following pre-tax loss from operations for the years ended December 31, 2017, 2016 and 2015:

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Domestic	$(3,129)	$(3,107)	$(3,331)
Foreign	1,041	29	(277)
Total	$(2,088)	$(3,078)	$(3,608)

The tax effects of temporary differences that give rise to significant components of the deferred tax assets and deferred tax liabilities from operations at December 31, 2017 and 2016 are as follows:

	December 31,	
	2017	2016
	(in thousands)	
Deferred tax assets:		
Accounts receivable	$93	$170
Inventory	891	1,336
Operating loss and credit carryforwards	8,287	12,586
Property, plant and equipment	3	5
Pension liabilities	151	631
Contingent consideration	2,273	3,262
Stock compensation expense	1,667	2,076
Other assets	119	23
Total gross deferred assets	13,484	20,089
Less: valuation allowance	(11,447)	(17,840)
Deferred tax assets	$2,037	$2,249
Deferred tax liabilities:		
Indefinite-lived intangible assets	$3,166	$4,567
Definite-lived intangible assets	2,383	2,593
Other accrued liabilities	270	349
Total deferred tax liabilities	5,819	7,509
Net deferred tax liabilities	$(3,782)	$(5,260)

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Certain prior year amounts in the above table have been reclassified for consistency with the current year presentation. These reclassifications had no effect on the Company's consolidated financial statements.

The Company adopted the provisions of ASU 2016-09, *Improvements to Employee Share-based Payment Accounting,* on January 1, 2017. Upon adoption, the company recorded previously unrecognized excess tax benefits from the exercise of employee stock options as an increase in its deferred tax asset for net operating losses of approximately $0.5 million. The tax benefit of this increased deferred tax asset is fully offset by an increase in the valuation allowance. Following adoption, excess tax benefits or tax deficit is reflected as income tax benefit or expense in the year the tax impact is generated. Approximately $96 thousand of tax deficit was recorded as income tax expense in 2017. Prior to the adoption of ASU 2016-09, these excess tax benefits could only be recognized when the related tax deduction reduces income taxes payable and the benefit would be reflected as a credit to additional paid-in capital if realized.

The amounts recorded as deferred tax assets as of December 31, 2017 and 2016 represent the amount of tax benefits of existing deductible temporary differences and carryforwards that are more likely than not to be realized through the generation of sufficient future taxable income within the carryforward period. Significant management judgment is required in determining any valuation allowance recorded against deferred tax assets and liabilities. During the year ended December 31, 2015, the Company determined that it was more likely than not that its U.S. deferred tax assets would not be realized and therefore recorded a net increase to the valuation allowance of $16.4 million to offset U.S. deferred tax assets net of deferred tax liabilities except for deferred tax liabilities associated with certain indefinite-lived intangible assets. The Company's judgment was based on consideration of all available evidence. At December 31, 2017 and 2016, the Company continues to maintain a valuation allowance against substantially all net U.S. deferred tax assets, exclusive of deferred tax liabilities associated with certain indefinite-lived intangible assets. During the year ended December 31, 2017, the Company determined that it was more likely than not that deferred tax assets of certain foreign subsidiaries would not be realized and therefore recorded a valuation allowance of $0.5 million on net deferred tax assets.

On December 22, 2017, tax reform legislation known as the Tax Cuts and Jobs Act (the Tax Act) was signed into law. The Tax Act makes broad and complex changes to the U.S. Internal Revenue Code, including the reduction of the corporate income tax rate from 35% to 21% and the implementation of a modified territorial tax system; the latter includes a one-time transition tax on previously unremitted earnings of foreign subsidiaries. Recent SEC guidance under Staff Accounting Bulletin No. 118, Income Tax Accounting Implications of the Tax Cuts and Jobs Act (SAB 118) provides for a measurement-period approach for the recording of income tax effects related to tax reform for which the accounting is incomplete. The accounting for the impact of the Tax Act is incomplete, however the Company has recorded provisional estimates for the impact of changes related to the revaluation of deferred taxes, the impact of the mandatory repatriation of foreign earnings after electing the utilization of existing tax attributes, and for the reduction in valuation allowance on net federal deferred tax assets. Since these provisions were based on estimates, the Company will continue to measure the impact of these areas and record any changes in subsequent quarters when information and guidance become available. Those areas include the analysis of various elections available including the transition tax, state-tax impact and adoption by the various states, completion of foreign earnings and profits calculations and additional guidance from the Treasury on various provisions under the new law.

Other law changes implemented by the Act such as changes to the calculation for Section 162(m) executive compensation deduction, interest deduction limitation and Global Intangible Low Taxed Income (GILTI), and others will not have any impact on the Company until the year ended December 31, 2018. The Company will continue to monitor guidance regarding these changes for how it will impact the financial statements in later periods.

At December 31, 2017, the Company had federal net operating loss carryforwards of $14.4 million, which begin to expire in 2021 and state net operating loss carryforwards of $8.6 million, which begin to expire in 2018. Approximately $8.0 million of federal net operating loss carryforwards are expected to be utilized during 2017 to offset the transition impact. The Company also had research and development tax credit carryforwards of $1.7 million which begin to expire in 2020. The Company had $0.4 million of alternative minimum tax credit carryforwards which are not subject to expiration and become refundable under the Tax Act beginning in 2018 subject to sequestration. In addition, the Company had a total of $1.1 million of state investment tax credit carryforwards, research and development tax credit carryforwards, and EZ credit carryforwards, which begin to expire in 2018. Approximately $3.3 million of net operating losses are subject to an annual limitation of $0.7 million imposed by change in ownership provisions of Section 382 of the Internal Revenue Code. As mentioned above, these net operating loss and credit carryforwards have full valuation allowances set up against them.

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Undistributed earnings of the Company's foreign subsidiaries amounted to approximately $49.2 million, $48.6 million, and $48.7 million at December 31, 2017, 2016 and 2015, respectively. As of December 31, 2017, the Company changed its indefinite reinvestment assertion to provide that all foreign earnings above the level required for local operating expenses would be repatriated to the U.S. in tax years after 2017. Prior to 2017, this modified assertion only applied to the Company's subsidiaries in France and Canada. At December 31, 2017, as the Company was considering a potential U.S. acquisition, the Company changed its assertion and it was anticipated that U.S. needs would require repatriation of all foreign subsidiaries' earnings rather than just France and Canada. As a result of the Tax Act, all prior unremitted earnings are deemed paid and included in the current provision under the one-time repatriation tax calculation. Therefore, as a result of the change in this assertion, only $38 thousand of additional withholding has been accrued as of December 31, 2017.

In 2016, the Company recorded a tax reserve in the amount of $59 thousand related to the disposition of a foreign subsidiary. Additionally in 2016, the Company recorded a reserve for $62 thousand related to issues raised in an ongoing German income tax audit. In 2017, the Company recorded a $21 thousand adjustment to the reserve related to the disposition of a foreign subsidiary. Also in 2017, the German income tax audit was settled for $30 thousand and $32 thousand of the remaining reserve was reversed. A reconciliation of uncertain tax liabilities is as follows:

	(in thousands)
Balance at December 31, 2015	$ 285
Additions based on current year tax positions	59
Additions based on tax positions of prior years	62
Balance at December 31, 2016	406
Decreases based on tax positions of prior years	(53)
Settlements	(30)
Balance at December 31, 2017	$ 323

At December 31, 2017 and 2016 the amount of unrecognized tax benefits that would affect the Company's effective tax rate was $0.3 million and $0.4 million, respectively. The Company classifies interest and penalties related to unrecognized tax benefits as a component of income tax expense. For the years ended December 31, 2017 and 2016, respectively, interest recognized in the consolidated statement of operations was immaterial, and there were no penalties recognized.

The Company or one of its subsidiaries files income tax returns in the U.S. federal jurisdiction, and various states and foreign jurisdictions. With few exceptions, the Company is no longer subject to income tax examinations by tax authorities in foreign jurisdictions for years before 2013. In the U.S., the Company's net operating loss and tax credit carryforward amounts remain subject to federal and state examination for tax years starting in 2000 as a result of tax losses incurred in prior years. There are currently no pending federal or state tax examinations. The Company is subject to audits by various taxing jurisdictions. Additional reserves are established when necessary. No ongoing audits are expected to have a material impact.

17. Employee Benefit Plans

The Company sponsors profit sharing retirement plans for its U.S. employees, which includes employee savings plans established under Section 401(k) of the U.S. Internal Revenue Code (the 401(k) Plans). The 401(k) Plans cover substantially all full-time employees who meet certain eligibility requirements. Contributions to the profit sharing retirement plans are at the discretion of management. For the years ended December 31, 2017, 2016 and 2015, the Company contributed approximately $0.6 million, $0.6 million and $0.5 million, respectively, to the 401(k) Plans.

The Company’s subsidiary in the United Kingdom, Biochrom, maintains contributory, defined benefit or defined contribution pension plans for substantially all of its employees. These defined benefit pension plans have been closed to new employees since 2014, as well as closed to the future accrual of benefits for existing employees. The provisions of FASB ASC 715-20 require that the funded status of the Company’s pension plans be recognized in its balance sheet. FASB ASC 715-20 does not change the measurement or income statement recognition of these plans, although it does require that plan assets and benefit obligations be measured as of the balance sheet date. The Company has historically measured the plan assets and benefit obligations as of the balance sheet date.

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The components of the Company's defined benefit pension expense were as follows:

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Components of net periodic benefit cost:			
Interest cost	$524	$632	$711
Expected return on plan assets	(663)	(683)	(668)
Net amortization loss	362	304	306
Net periodic benefit cost	$223	$253	$349

The measurement date is December 31 for these plans. The funded status of the Company's defined benefit pension plans and the amount recognized in the consolidated balance sheets at December 31, 2017 and 2016 is as follows:

	December 31,	
	2017	2016
	(in thousands)	
Change in benefit obligation:		
Balance at beginning of year	$19,214	$18,582
Interest cost	524	632
Actuarial loss	26	4,636
Benefits paid	(514)	(982)
Currency translation adjustment	1,876	(3,654)
Balance at end of year	$21,126	$19,214

	December 31,	
	2017	2016
	(in thousands)	
Change in fair value of plan assets:		
Balance at beginning of year	$16,252	$15,767
Actual return on plan assets	1,871	3,868
Employer contributions	689	694
Benefits paid	(514)	(982)
Currency translation adjustment	1,674	(3,095)
Balance at end of year	$19,972	$16,252

	December 31,	
	2017	2016
	(in thousands)	
Change in benefit obligation:		

Funded status	$(1,154)	$(2,962)
Unrecognized net loss	N/A	N/A
Net amount recognized	$(1,154)	$(2,962)

The accumulated benefit obligation for all defined benefit pension plans was $21.1 million and $19.2 million at December 31, 2017 and 2016, respectively.

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The amounts recognized in the consolidated balance sheets consist of:

	December 31,	
	2017	2016
	(in thousands)	
Deferred income tax assets	$196	$504
Other long term liabilities	(1,154)	(2,962)
Net amount recognized	$(958)	$(2,458)

The amounts recognized in accumulated other comprehensive loss, net of tax consist of:

	December 31,	
	2017	2016
	(in thousands)	
Underfunded status of pension plans	$(958)	$(2,458)
Net amount recognized	$(958)	$(2,458)

The weighted average assumptions used in determining the net pension cost for these plans follows:

	Year Ended December 31,		
	2017	2016	2015
Discount rate	2.43%	2.62%	3.57%
Expected return on assets	3.86%	4.68%	4.43%

The discount rate assumptions used for pension accounting reflect the prevailing rates available on high-quality, fixed-income debt instruments with terms that match the average expected duration of the Company's defined benefit pension plan obligations. The Company uses the iBoxx AA 15yr+ index, which matches the average duration of its pension plan liability of approximately 15 years. With the current base of assets in the pension plans, a one percent increase/decrease in the discount rate assumption would decrease/increase annual pension expense by approximately $12,000.

The Company's mix of pension plan investments among asset classes also affects the long-term expected rate of return on plan assets. As of December 31, 2017, the Company's actual asset mix approximated its target mix. Differences between actual and expected returns are recognized in the calculation of net periodic pension (income)/cost over the average remaining expected future working lifetime, which is approximately 15 years, of active plan participants.

With the current base of assets, a one percent increase/decrease in the asset return assumption would decrease/increase annual pension expense by approximately $200,000.

The fair value and asset allocations of the Company's pension benefits as of December 31, 2017 and 2016 measurement dates were as follows:

	December 31, 2017 (in thousands)		2016	
Asset category:				
Equity securities	$10,774	54 %	$8,577	53 %
Debt securities	3,204	16 %	7,447	46 %
Liability driven investment funds	4,685	24 %	-	0 %
Cash and cash equivalents	856	4 %	228	1 %
Other	453	2 %	-	0 %
Total	$19,972	100%	$16,252	100%

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Financial reporting standards define a fair value hierarchy that consists of three levels. The fair values of the plan assets by fair value hierarchy level as of December 31, 2017 and 2016 is as follows:

	December 31,	
	2017	2016
	(in thousands)	
Quoted Prices in Active Markets for Identical Assets (Level 1)	$856	$228
Significant Other Observable Inputs (Level 2)	19,116	16,024
Significant Other Unobservable Inputs (Level 3)	-	-
Total	$19,972	$16,252

Level 1 assets consist of cash and cash equivalents held in the pension plans at December 31, 2017. The Level 2 assets primarily consist of investments in private investment funds that are valued using the net asset values provided by the trust or fund, including an insurance contract. Although these funds are not traded in an active market with quoted prices, the investments underlying the net asset value are based on quoted prices.

The Company expects to contribute approximately $0.7 million to its pension plans during 2018.

The benefits expected to be paid from the pension plans are $0.5 million in 2018, $0.6 million in 2019, $0.6 million in 2020, $0.6 million in 2021 and $0.7 million in 2022. The expected benefits to be paid in the five years from 2023—2027 are $4.2 million. The expected benefits are based on the same assumptions used to measure the Company’s benefit obligation at December 31, 2017.

18. Commitments and Contingent Liabilities

From time to time, the Company may be involved in various claims and legal proceedings arising in the ordinary course of business. The Company is not currently a party to any such material claims or proceedings.

19. Capital Stock

Common Stock

On February 5, 2008, the Company's Board of Directors adopted a Shareholder Rights Plan and declared a dividend distribution of one preferred stock purchase right for each outstanding share of the Company's common stock to shareholders of record as of the close of business on February 6, 2008. Initially, these rights would not be exercisable and would trade with the shares of the Company's common stock. Under the Shareholder Rights Plan, the rights generally would become exercisable if a person became an "acquiring person" by acquiring 20% or more of the common stock of the Company or if a person commences a tender offer that could result in that person owning 20% or more of the common stock of the Company. If a person became an acquiring person, each holder of a right (other than the acquiring person) would be entitled to purchase, at the then-current exercise price, such number of shares of preferred stock which are equivalent to shares of the Company's common stock having a value of twice the exercise price of the right. If the Company were acquired in a merger or other business combination transaction after any such event, each holder of a right would then be entitled to purchase, at the then-current exercise price, shares of the acquiring company's common stock having a value of twice the exercise price of the right. The Shareholder Rights Plan expired in accordance with its terms on the close of business on February 6, 2018.

Preferred Stock

The Company's Board of Directors has the authority to issue up to 5.0 million shares of preferred stock and to determine the price privileges and other terms of the shares. The Board of Directors may exercise this authority without any further approval of stockholders. As of December 31, 2017, the Company had no preferred stock issued or outstanding.

Employee Stock Purchase Plan (as amended, the "ESPP")

In 2000, the Company approved the ESPP. Under this ESPP, participating employees can authorize the Company to withhold a portion of their base pay during consecutive six-month payment periods for the purchase of shares of the Company's common stock. At the conclusion of the period, participating employees can purchase shares of the Company's common stock at 85% of the lower of the fair market value of the Company's common stock at the beginning or end of the period. Shares are issued under the ESPP for the six-month periods ending June 30 and December 31. Under this plan, 1,050,000 shares of common stock are authorized for issuance of which 801,454 shares were issued as of December 31, 2017. During the years ended December 31, 2017, 2016 and 2015, the Company issued 76,215 shares, 81,228 shares and 58,823 shares, respectively, of the Company's common stock under the ESPP.

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Third Amended and Restated 2000 Stock Option and Incentive Plan (as amended, the "Third A&R Plan")

The Second Amendment to the Third A&R Plan (the "Amendment") was adopted by the Board of Directors on April 3, 2015. Such Amendment was approved by the stockholders at the Company's 2015 Annual Meeting of Stockholders. Pursuant to the Amendment, the aggregate number of shares authorized for issuance under the Third A&R Plan was increased by 2,500,000 shares to 17,508,929.

Through December 31, 2017, 2016 and 2015, incentive stock options to purchase 10,218,057 shares and non-qualified stock options to purchase 13,369,074, 13,131,374 and 13,088,374 shares, respectively, had been granted to employees and directors under the Stock Plans. Generally, both the incentive stock options and non-qualified stock options become fully vested over a range of one to four-year periods.

Restricted Stock Units with a Market Condition (the "Market Condition RSU's")

On August 3, 2015, the Compensation Committee of the Board of Directors of the Company approved and granted deferred stock awards of Market Condition RSU's to members of the Company's management team under the Third A&R Plan. The vesting of these Market Condition RSU's is cliff-based and linked to the achievement of a relative total shareholder return of the Company's common stock from August 3, 2015 to the earlier of (i) August 3, 2018 or (ii) upon a change of control (measured relative to the Russell 3000 index and based on the 20-day trading average price before each such date). As of December 31, 2017, the target number of these restricted stock units that may be earned is 164,127 shares; the maximum amount is 150% of the target number.

Stock-Based Payment Awards

The Company accounts for stock-based payment awards in accordance with the provisions of FASB ASC 718, which requires it to recognize compensation expense for all stock-based payment awards made to employees and directors including stock options, restricted stock units, Market Condition RSU's and employee stock purchases related to the ESPP.

FASB ASC 718 requires companies to estimate the fair value of stock-based payment awards, except restricted stock units, on the date of grant using an option-pricing model. The value of the award is recognized as expense as it vests over the requisite service periods in the Company's consolidated statements of operations.

The Company adopted ASU 2016-09 as of January 1, 2017. As disclosed in footnote 2, as a result of this adoption, the Company has elected as an accounting policy to account for forfeitures for service based awards as they occur, with no adjustment for estimated forfeitures. The Company recognized as of January 1, 2017, a cumulative effect adjustment of $0.1 million to reduce retained earnings as required under the modified retrospective approach.

The Company values stock-based payment awards, except restricted stock units, using the Black-Scholes option-pricing model. The Company values the Market Condition RSU's using a Monte-Carlo valuation simulation. The determination of fair value of stock-based payment awards on the date of grant using an option-pricing model or Monte-Carlo valuation simulation is affected by its stock price as well as assumptions regarding certain variables. These variables include, but are not limited to its expected stock price volatility over the term of the awards and actual and projected stock option exercise behaviors. The Company records stock compensation expense on a straight-line basis over the requisite service period for all awards granted since the adoption of FASB ASC 718.

Earnings per share

Basic earnings per share is based upon net income divided by the number of weighted average common shares outstanding during the period. The calculation of diluted earnings per share assumes conversion of stock options, restricted stock units and Market Condition RSU's into common stock using the treasury method. The weighted average number of shares used to compute basic and diluted earnings per share consists of the following:

	Year Ended December 31,		
	2017	2016	2015
Basic	34,753,325	34,211,521	33,592,775
Effect of assumed conversion of employee and director stock options, restricted stock units and Market Condition RSU's	-	-	-
Diluted	34,753,325	34,211,521	33,592,775

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Excluded from the shares used in calculating the diluted earnings per common share in the above table are options, restricted stock units and Market Condition RSU's of approximately 5,741,298, 5,351,261 and 5,521,283 shares of common stock for the years ended December 31, 2017, 2016 and 2015, respectively, as the impact of these shares would be anti-dilutive.

General Option Information

The following is a summary of stock option and the restricted stock unit activity:

	Stock Options		Restricted Stock Units		Market Condition RSU's	
	Stock Options Outstanding	Weighted Average Exercise Price	Restricted Stock Units Outstanding	Grant Date Fair Value	Market Condition RSU's Outstanding	Grant Date Fair Value
Balance at December 31, 2014	6,263,112	$ 3.42	306,397	$ 4.30	-	$ -
Granted	945,000	5.31	254,685	5.56	196,785	4.81
Exercised	(1,772,062)	3.04	-	-	-	-
Vested (RSUs)	-	-	(237,188)	5.65	-	-
Cancelled / forfeited	(413,864)	4.15	(10,335)	5.56	(11,247)	4.81
Balance at December 31, 2015	5,022,186	3.85	313,559	5.29	185,538	4.81
Granted	43,000	3.10	1,095,190	2.92	-	4.81
Exercised	(374,772)	2.80	-	-	-	-
Vested (RSUs)	-	-	(301,520)	4.45	-	-
Cancelled / forfeited	(593,596)	3.84	(34,576)	3.89	(3,388)	4.81
Balance at December 31, 2016	4,096,818	3.94	1,072,653	3.15	182,150	4.81
Granted	237,700	3.24	1,298,371	2.49	-	-
Exercised	(143,391)	2.48	-	-	-	-
Vested (RSUs)	-	-	(488,570)	3.08	-	-
Cancelled / forfeited	(410,883)	3.93	(85,527)	3.05	(18,023)	4.81
Balance at December 31, 2017	3,780,244	$ 3.95	1,796,927	$ 2.69	164,127	$ 4.81

The Company's policy is to issue stock available from its registered but unissued stock pool through its transfer agent to satisfy stock option exercises and vesting of the restricted stock units.

The following table summarizes information concerning currently outstanding and exercisable options as of December 31, 2017 (Aggregate Intrinsic Value, in thousands):

	Options Outstanding				Options Exercisable			
Range of Exercise Price	Shares Outstanding at Dec. 31, 2017	Weighted Average Remaining Contractual Life in Years	Weighted Average Exercise Price	Aggregate Intrinsic Value	Shares Exercisable at Dec. 31, 2017	Weighted Average Remaining Contractual Life in Years	Weighted Average Exercise Price	Aggregate Intrinsic Value
$2.02-2.37	415,024	1.22	$ 2.20	$ 457	415,024	1.22	$ 2.20	$ 457
2.38-2.94	357,095	4.78	2.58	257	315,845	4.25	2.57	231
2.95-3.59	321,239	7.89	3.30	-	79,039	2.93	3.35	-
3.60-3.95	277,429	5.47	3.65	-	273,679	5.46	3.65	-
3.96-4.11	252,282	3.49	4.04	-	250,782	3.47	4.04	-
4.12-4.17	607,875	6.41	4.12	-	452,750	6.41	4.12	-
4.18-4.26	71,500	6.66	4.21	-	55,500	6.63	4.21	-
4.27-4.41	750,000	5.88	4.31	-	750,000	5.88	4.31	-
4.42-5.51	462,300	7.14	5.37	-	273,175	7.11	5.31	-
5.52-5.63	265,500	7.41	5.56	-	132,750	7.41	5.56	-
$2.02-5.63	3,780,244	5.61	$ 3.95	$ 714	2,998,544	5.02	$ 3.84	$ 688

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The aggregate intrinsic value in the preceding table represents the total pre-tax intrinsic value, based on the Company's closing stock price of $3.30 as of December 31, 2017, which would have been received by the option holders had all option holders exercised their options as of that date. The aggregate intrinsic value of options exercised for the years ended December 31, 2017 and 2016 was approximately $0.1 million, respectively. The aggregate intrinsic value of options exercised for the year ended December 31, 2015 was $0.8 million. The total number of in-the-money options that were exercisable as of December 31, 2017 was 824,869.

For the year ended December 31, 2017, the total compensation costs related to unvested awards not yet recognized is $4.0 million and the weighted average period over which it is expected to be recognized is 2.18 years.

Valuation and Expense Information under Stock-Based-Payment Accounting

Stock-based compensation expense related to stock options, restricted stock units, Market Condition RSU's and the employee stock purchase plan for the years ended December 31, 2017, 2016 and 2015 was allocated as follows:

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Cost of revenues	$63	$60	$70
Sales and marketing	595	546	418
General and administrative	2,703	2,780	2,170
Research and development	139	111	97
Total stock-based compensation	$3,500	$3,497	$2,755

On April 28, 2015, the Company announced the appointment of James Green to its Board of Directors and the retirement of Robert Dishman from its Board of Directors. As part of Dr. Dishman's retirement, the Company (i) awarded an unrestricted stock award to Dr. Dishman on April 28, 2015, having an aggregate cash value of $80,000, (ii) accelerated the vesting of all outstanding stock options and restricted stock units that were unvested as of April 28, 2015, and (iii) extended the post-retirement option exercise period for each option to the earlier to occur of the respective scheduled expiration date or April 28, 2016. Total compensation expense recognized as part of general and administrative expenses for the year ended December 31, 2015, as part of these modifications, was approximately $0.1 million.

The Company did not capitalize any stock-based compensation.

The weighted-average estimated fair value per share of stock options granted during 2017, 2016 and 2015 was $1.32, $1.21 and $2.12, respectively, using the Black Scholes option-pricing model with the following weighted-average assumptions:

	Year Ended December 31,		
	2017	2016	2015
Volatility	41.63%	41.97%	40.97%
Risk-free interest rate	2.03%	1.29%	1.72%
Expected holding period (in years)	5.41 years	5.21 years	5.50 years
Dividend yield	-%	-%	-%

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The weighted average fair value of the Market Condition RSU's granted under the Third A&R Plan during the year ended December 31, 2015 was $4.81. The following assumptions were used to estimate the fair value, using a Monte-Carlo valuation simulation, of the Market Condition RSU's granted during the year ended December 31, 2015:

	Year Ended December 31, 2015	
Volatility	35.88	%
Risk-free interest rate	0.99	%
Correlation coefficient	0.25	%
Dividend yield	-	%

The Company used historical volatility to calculate the expected volatility as of December 31, 2017. Historical volatility was determined by calculating the mean reversion of the daily adjusted closing stock price. The risk-free interest rate assumption is based upon observed U.S. Treasury bill interest rates (risk-free) appropriate for the term of the Company's stock options. The expected holding period of stock options represents the period of time options are expected to be outstanding and were based on historical experience. The vesting period ranges from one to four years and the contractual life is ten years.

Stock-based compensation expense recognized in the consolidated statements of operations for the years ended December 31, 2017, 2016 and 2015 is recognized on awards as they vest and was reduced for annualized estimated forfeitures of 0.00%, 8.41% and 8.06%, respectively. As previously noted, the Company adopted ASU 2016-09 as of January 1, 2017, and accordingly recorded a cumulative effect adjustment for this adoption. As of that date onward, the Company has accounted for forfeitures as they occur. Prior to the adoption of ASU 2016-09, stock-based-payment accounting required forfeitures to be estimated at the time of grant and revised, if necessary, in subsequent periods if actual forfeitures differ from those estimates.

20. Related Party Transactions

As part of the acquisitions of MCS and Triangle BioSystems, Inc. (TBSI), the Company signed lease agreements with the former owners of the acquired companies. The principals of such former owners were employees of the Company as of December 31, 2017. Pursuant to a lease agreement, the Company incurred rent expense of approximately $0.2 million to the former owners of MCS for each of the years ended December 31, 2017 and 2016 and 2015, respectively. Pursuant to a lease agreement, the Company incurred rent expense of approximately $42,000 to the former owner of TBSI for each of the years ended December 31, 2017 and 2016 and 2015, respectively.

21. Segment and Related Information

Operating segments are determined by products and services provided by each segment, internal organization structure, the manner in which operations are managed, criteria used by the Chief Operating Decision Maker, or CODM, to assess the segment performance, as well as resource allocation and the availability of discrete financial information. The Company has one operating segment. As such, segment results and consolidated results are the same.

The following tables summarize selected financial information of the Company's continuing operations by geographic location:

Revenues originating from the following geographic areas consist of:

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
United States	$66,198	$65,179	$64,766
Germany	11,162	13,477	15,755
United Kingdom	15,042	16,421	18,051
Rest of the world	9,480	9,444	10,092
Total revenues	$101,882	$104,521	$108,664

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Long-lived assets by geographic area consist of the following:

	December 31,	
	2017	2016
	(in thousands)	
United States	$10,127	$12,004
Germany	5,793	5,504
United Kingdom	966	918
Rest of the world	3,214	3,341
Total long-lived assets (1)	$20,100	$21,767

(1) Total long-lived assets includes property, plant and equipment, net and amortizable intangible assets, net.

Net assets by geographic area consist of the following:

	December 31,	
	2017	2016
	(in thousands)	
United States	$30,698	$22,312
Germany	18,354	18,512
United Kingdom	14,376	17,908
Rest of the world	17,472	18,866
Total net assets	$80,900	$77,598

22. Allowance for Doubtful Accounts

Allowance for doubtful accounts is based on the Company's assessment of the collectability of customer accounts. A rollforward of allowance for doubtful accounts is as follows:

	Beginning Balance	Charged (credited) to Bad Debt Expense (Recoveries)	Charged to Allowance (1)	Other (2)	Ending Balance
	(in thousands)				
Year ended December 31, 2015	$328	(4)	4	(18)	$ 310
Year ended December 31, 2016	$310	309	11	(19)	$ 611
Year ended December 31, 2017	$611	(109)	(68)	20	$ 454

(1) Consists of accounts written off, net of recoveries.

(2) Consists of the effect of currency translation.

23. Warranties

Warranties are estimated and accrued at the time revenues are recorded. A rollforward of the Company's product warranty accrual is as follows:

	Beginning Balance	Payments	Additions/ (Credits)	Ending Balance
	(in thousands)			
Year ended December 31, 2015	$252	(81)	(24)	$ 147
Year ended December 31, 2016	$147	(97)	143	$ 193
Year ended December 31, 2017	$193	(7)	60	$ 246

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24. Quarterly Financial Information (unaudited)

Statement of Operations Data:

2017	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Fiscal Year
	(in thousands, except per share data)				
Revenues	$24,156	$25,213	$25,050	$27,463	$101,882
Cost of revenues	12,657	13,926	13,411	14,291	54,285
Gross profit	11,499	11,287	11,639	13,172	47,597
Total operating expenses	12,138	11,286	11,775	12,499	47,698
Operating (loss) income	(639)	1	(136)	673	(101)
Other (expense)	(404)	(463)	(274)	(846)	(1,987)
Loss before income taxes	(1,043)	(462)	(410)	(173)	(2,088)
Income tax expense (benefit)	23	(81)	7	(1,172)	(1,223)
Net (loss) income	$(1,066)	$(381)	$(417)	$999	$(865)
Loss per share:					
Basic (loss) earnings per common share	$(0.03)	$(0.01)	$(0.01)	$0.03	$(0.02)
Diluted (loss) earnings per common share	$(0.03)	$(0.01)	$(0.01)	$0.03	$(0.02)

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Statement of Operations Data:

2016	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Fiscal Year
	(in thousands, except per share data)				
Revenues	$26,963	$26,136	$25,007	$26,415	$104,521
Cost of revenues	14,018	14,461	13,317	14,310	56,106
Gross profit	12,945	11,675	11,690	12,105	48,415
Total operating expenses	13,166	12,515	12,503	13,228	51,412
Operating loss	(221)	(840)	(813)	(1,123)	(2,997)
Other (expense) income, net	(222)	73	(67)	135	(81)
Loss before income taxes	(443)	(767)	(880)	(988)	(3,078)
Income tax expense (benefit)	193	(54)	758	332	1,229
Net loss	$(636)	$(713)	$(1,638)	$(1,320)	$(4,307)
Loss per share:					
Basic loss per common share	$(0.02)	$(0.02)	$(0.05)	$(0.04)	$(0.13)
Diluted loss per common share	$(0.02)	$(0.02)	$(0.05)	$(0.04)	$(0.13)

25. Subsequent Events

Denville Transaction

On January 22, 2018, the Company sold substantially all the assets of its wholly owned subsidiary, Denville Scientific, Inc. (Denville), for approximately $20.0 million, which includes a $3.0 million earn-out provision (the Denville Transaction). Upon the closing of the transaction, the Company received $17.0 million. The remaining $3.0 million represents consideration that is contingent on Denville achieving certain performance metrics over a period of two years. Denville is a Charlotte, North Carolina-based life science research consumables distributor. The results of operations and financial position of Denville have been reported in the Company's consolidated statements of operations and balance sheet for all periods presented.

As a result of the Company's initiation of plans to sell the operations of Denville during the fourth quarter of 2017, management conducted an evaluation of Denville's assets for impairment. Based on this evaluation, which consisted of comparing the probable cash flows to the net book value of the assets, management concluded that the assets were not impaired.

As of December 31, 2017, the major classes of assets and liabilities of Denville, which were reported in the Company's consolidated balance sheet, were comprised of the following:

	(in thousands)
Assets	
Accounts receivable, net	$ 2,854
Inventory	4,457
Property, plant and equipment, net	396
Amortizable intangible assets, net	5,930
Liabilities	
Accounts payable and accrued expenses	$ 1,720

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Termination of Third Amended and Restated Credit Agreement

On January 22, 2018, in connection with the closing of the Denville Transaction, the Company terminated the Third Amended and Restated Credit Agreement, dated as of May 1, 2017, among the Company, Brown Brothers Harriman & Co. and each of the other lenders party thereto, and Bank of America, as administrative agent. All outstanding amounts under the agreement were repaid in full using a portion of the proceeds of the Denville Transaction. At the time of repayment, there was approximately $11.9 million outstanding.

Interest Rate Swap

As a result of terminating the Third Amended and Restated Credit Agreement, the Company unwound its existing swap agreement and received an immaterial amount of proceeds. On February 16, 2018, the Company entered into a new interest rate swap contract with PNC bank with a notional amount of $36.0 million and a termination date of January 31, 2023 in order to hedge the risk of changes in the effective benchmark interest rate (LIBOR) associated with the Financing Agreement (defined below). The swap contract converted specific variable-rate debt into fixed-rate debt and fixed the LIBOR rate associated with a portion of the term loan under the Financing Agreement at 2.72%.

Data Sciences International Transaction

On January 31, 2018, the Company acquired all of the issued and outstanding shares of Data Sciences International, Inc. (DSI), a Delaware corporation for approximately $70.0 million. The Company funded the acquisition from its existing cash balances, the remaining proceeds of the Denville Transaction and the proceeds of the Financing Agreement discussed below.

DSI, a St. Paul, Minnesota-based life science research company, is a recognized leader in physiologic monitoring focused on delivering preclinical products, systems, services and solutions to its customers. Its customers include pharmaceutical and biotechnology companies, as well as contract research organizations, academic labs and government researchers. This acquisition diversifies the Company’s customer base into the biopharmaceutical and contract research organization markets.

The Company is in the process of determining the fair value of the various tangible and intangible assets acquired as a result of this acquisition.

Financing Agreement

On January 31, 2018, the Company entered into a financing agreement by and among the Company and certain subsidiaries of the Company parties thereto, as borrowers (collectively, the Borrower), certain subsidiaries of the Company parties thereto, as guarantors, various lenders from time to time party thereto (the Lenders), and Cerberus Business Finance, LLC, as collateral agent and administrative agent for the Lenders (the Financing Agreement).

The Financing Agreement provides for senior secured credit facilities (the Senior Secured Credit Facilities) comprised of a $64.0 million term loan and up to a $25.0 million revolving line of credit. The proceeds of the term loan and $4.8 million of advances under the revolving line of credit were used to fund a portion of the DSI acquisition, and to pay fees and expenses related thereto and the closing of the Senior Secured Credit Facilities. In addition, the revolving facility is available for use by the Company and its subsidiaries for general corporate and working capital needs, and other purposes to the extent permitted by the Financing Agreement. The Senior Secured Credit Facilities have a maturity of five years. At the closing date of the Financing Agreement, the Company had approximately $14.5 million of available borrowing capacity under the revolving line of credit.

Commencing on March 31, 2018, the outstanding term loans will amortize in equal quarterly installments equal to $0.4 million per quarter on such date and during each of the next three quarters thereafter, $0.6 million per quarter during the next four quarters thereafter and $0.8 million per quarter thereafter, with a balloon payment at maturity.

The obligations of the Borrower under the Senior Secured Credit Facilities are unconditionally guaranteed by the Company and certain of the Company’s existing and subsequently acquired or organized subsidiaries. The Senior Secured Credit Facilities and related guarantees are secured on a first-priority basis (subject to certain liens permitted under the Financing Agreement) by a lien on substantially all the tangible and intangible assets of the Borrower and the subsidiary guarantors, including all of the capital stock held by such obligors (subject to a 65% limitation on pledges of capital stock of foreign subsidiaries), subject to certain exceptions.

Interest on all loans under the Senior Secured Credit Facilities is paid monthly. Borrowings under the Financing Agreement accrue interest at a per annum rate equal to, at the Borrower’s option, a base rate plus 4.75% or a LIBOR rate plus 6.25%. The loans are also subject to a 1.25% interest rate floor for LIBOR loans and a 4.25% interest rate floor for base rate loans.

The Financing Agreement contains customary representations and warranties and affirmative covenants applicable to the Company and its subsidiaries and also contains certain restrictive covenants, including, among others, limitations on the incurrence of additional debt, liens on property, acquisitions and investments, loans and guarantees, mergers, consolidations, liquidations and dissolutions, asset sales, dividends and other payments in respect of the Company’s capital stock, prepayments of certain debt, transactions with affiliates and modifications of organizational documents, material contracts, affiliated practice agreements and certain debt agreements. The Financing Agreement also contains customary events of default.

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SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by undersigned thereunto duly authorized.

HARVARD BIOSCIENCE, INC.

Date: March 16, 2018 By: /s/ JEFFREY A. DUCHEMIN
Jeffrey A. Duchemin
Chief Executive Officer

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated:

Signature	Title	Date
/s/ JEFFREY A. DUCHEMIN **Jeffrey A. Duchemin**	Chief Executive Officer and Director (Principal Executive Officer)	March 16, 2018
/s/ ROBERT E. GAGNON **Robert E. Gagnon**	Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)	March 16, 2018
/s/ JAMES GREEN **James Green**	Director	March 16, 2018
/s/ JOHN F. KENNEDY **John F. Kennedy**	Director	March 16, 2018
/s/ EARL R. LEWIS	Director	March 16, 2018

Earl R. Lewis

/s/ BERTRAND LOY

Director March 16, 2018

Bertrand Loy

/s/ GEORGE UVEGES

Director March 16, 2018

George Uveges

/s/ THOMAS W. LOEWALD

Director March 16, 2018

Thomas W. Loewald

/s/ KATHERINE A. EADE

Director March 16, 2018

Katherine A. Eade

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EXHIBIT INDEX

The following exhibits are filed as part of this Annual Report on Form 10-K. Where such filing is made by incorporation by reference to a previously filed document, such document is identified.

Exhibit Number	Description	Method of Filing
2.1§	Separation and Distribution Agreement between Harvard Bioscience, Inc. and Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.) dated as of October 31, 2013	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed November 6, 2013) and incorporated by reference thereto
2.2§	Share Purchase Agreement between Biochrom Limited, as Buyer, and Multi-Channel Systems Holding GmbH, as Seller, dated as of October 1, 2014	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed October 1, 2014) and incorporated by reference thereto
2.3§	Stock Purchase Agreement by and among Harvard Bioscience, Inc., as Buyer, Triangle BioSystems, Inc., and the sellers party thereto dated as of October 1, 2014	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed October 1, 2014) and incorporated by reference thereto
2.4§	Agreement for the Sale and Purchase of All Shares in HEKA GmbH by and among Multi Channel Systems MCS GmbH, as Purchaser, Dr. Peter Schulze GmbH & Co. KG, as Seller, and Dr. Peter Schulze, as Guarantor, dated as of January 8, 2015	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 9, 2015) and incorporated by reference thereto
2.5§	Agreement for the Sale and Purchase of All Shares in HEKA Canada between Ealing Scientific Limited, as Purchaser, and Dr. Peter Schulze, as Seller, dated as of January 8, 2015	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 9, 2015) and incorporated by reference thereto
2.6§	Merger Agreement, dated as of January 22, 2018, between Harvard Bioscience, Inc., Plymouth Sub, Inc. and Data Sciences International, Inc.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 26, 2018) and incorporated by reference thereto
2.7§	Purchase Agreement, dated as of January 22, 2018, between Harvard Bioscience, Inc., Denville Scientific, Inc. and Thomas Scientific, LLC	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 26, 2018) and incorporated by reference thereto
3(i)	Second Amended and Restated Certificate of Incorporation of Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on November 9, 2000)

		and incorporated by reference thereto
3(ii)	Amended and Restated By-laws of Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on November 9, 2000) and incorporated by reference thereto
3.1	Amendment No. 1 to Amended and Restated Bylaws of Harvard Bioscience, Inc. (as adopted October 30, 2007)	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed on November 1, 2007) and incorporated by reference thereto

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3.2	Certificate of Designations, Preferences and Rights of a Series of Preferred Stock of Harvard Bioscience, Inc. classifying and designating the Series A Junior Participating Cumulative Preferred Stock	Previously filed as an exhibit to the Company's Registration Statement on Form 8-A (filed February 8, 2008) and incorporated by reference thereto
3.3	Certificate of Elimination of Series A Junior Participating Cumulative Preferred Stock, dated as of February 27, 2018	Previously filed as an exhibit to the Company's Registration Statement on Form 8-A/A (filed March 2, 2018) and incorporated by reference thereto
4.1	Specimen certificate for shares of Common Stock, $0.01 par value, of Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on November 9, 2000) and incorporated by reference thereto
4.2	Amended and Restated Securityholders' Agreement dated as of March 2, 1999 by and among Harvard Apparatus, Inc., Pioneer Partnership II, Pioneer Capital Corp., First New England Capital, L.P. and Citizens Capital, Inc. and Chane Graziano and David Green	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on October 25, 2000) and incorporated by reference thereto
4.3	Shareholders Rights Agreement, dated as of February 5, 2008 between Harvard Bioscience, Inc., and Registrar and Transfer Company, as Rights Agent	Previously filed as an exhibit to the Company's Registration Statement on Form 8-A (filed February 8, 2008) and incorporated by reference thereto
10.1	Harvard Apparatus, Inc. 1996 Stock Option and Grant Plan	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on October 25, 2000) and incorporated by reference thereto
10.2	Harvard Bioscience, Inc. Third Amended and Restated 2000 Stock Option and Incentive Plan	Previously disclosed in the Company's Proxy Statement on Schedule 14A (filed April 15, 2011) and incorporated by reference thereto
10.3	Harvard Bioscience, Inc. Employee Stock Purchase Plan	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on November 9, 2000) and incorporated by reference thereto
10.4	Form of Director Indemnification Agreement	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on October 25, 2000) and incorporated by reference thereto
10.5	Lease of Unit 22 Phase I Cambridge Science Park, Milton Road, Cambridge dated May 8, 2008 between The Master Fellows and Scholars of Trinity College Cambridge and Biochrom Limited.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 11, 2009) and

		incorporated by reference thereto
10.6	Lease, dated February 23, 2004, by and between William Cash Forman and Hoefer, Inc.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 15, 2004) and incorporated by reference thereto
10.7 +	Trademark License Agreement, dated December 19, 2002, by and between Harvard Bioscience, Inc. and President and Fellows of Harvard College.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed May 15, 2003) and incorporated by reference thereto

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10.8	Lease Agreement Between Seven October Hill, LLC and Harvard Bioscience, Inc. dated December 30, 2005.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 4, 2006) and incorporated by reference thereto
10.9	Form of Incentive Stock Option Agreement (Executive Officers).	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2006) and incorporated by reference thereto
10.10	Form of Non-Qualified Stock Option Agreement (Executive Officers).	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2006) and incorporated by reference thereto
10.11	Form of Non-Qualified Stock Option Agreement (Non-Employee Directors).	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2006) and incorporated by reference thereto
10.12	Amended and Restated Revolving Credit Loan Agreement, dated as of August 7, 2009, by and among Harvard Bioscience, Inc. and the Lenders from time to time party thereto, including Bank of America, N.A. (both in its capacity as "Lender" and in its capacity as "Agent"), and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed August 13, 2009) and incorporated by reference thereto
10.13	Amendment No. 2, dated as of May 22, 2010, to Lease Agreement, as subsequently amended, between Seven October Hill LLC and Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed June 3, 2010) and incorporated by reference thereto
10.14	Form of Deferred Stock Award Agreement under the Harvard Bioscience, Inc. Second Amended and Restated 2000 Stock Option And Incentive Plan, as amended	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2011) and incorporated by reference thereto
10.15	Director Compensation Arrangements	Filed with this report
10.16	Amendment No. 1 to the Harvard Bioscience, Inc. Employee Stock Purchase Plan, effective as of January 1, 2012	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 14, 2014) and incorporated by reference thereto
10.17	First Amendment to Harvard Bioscience, Inc. Third Amended and Restated 2000 Stock Option and Incentive Plan, effective as of March 9, 2013	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 14, 2014) and incorporated by reference thereto
10.18	Second Amended and Restated Revolving Credit Agreement, dated as of March 29, 2013, by and among Harvard Bioscience, Inc. and the Lenders	Previously filed as an exhibit to the Company's Current Report on Form

	from time to time party thereto, including Bank of America, N.A. and Brown Brothers Harriman & Co.	8-K (filed April 3, 2013) and incorporated by reference thereto
10.19	Amendment No. 2 to the Harvard Bioscience, Inc. Employee Stock Purchase Plan, effective as of May 23, 2013	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 14, 2014) and incorporated by reference thereto
10.20	First Amendment to Second Amended and Restated Credit Agreement dated as of May 30, 2013, with an effective date as of April 30, 2013, by and among Harvard Bioscience, Inc. Bank of America, N.A. and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 14, 2014) and incorporated by reference thereto

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10.21 #	Employment Agreement, dated August 26, 2013, between Harvard Bioscience, Inc. and Jeffrey A. Duchemin	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed August 29, 2013) and incorporated by reference thereto
10.22 #	Offer letter dated September 30, 2013 between Harvard Bioscience, Inc. and Yong Sun	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed February 19, 2014) and incorporated by reference thereto
10.23 #	Employment Agreement, dated October 2, 2013, between Harvard Bioscience, Inc. and Robert E. Gagnon	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed October 16, 2013) and incorporated by reference thereto
10.24	Second Amendment to Second Amended and Restated Credit Agreement and Waiver dated as of October 31, 2013, by and among Harvard Bioscience, Inc. Bank of America, N.A. and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 14, 2014) and incorporated by reference thereto
10.25	Intellectual Property Matters Agreement between Harvard Bioscience, Inc. and Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.) dated as of October 31, 2013.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed November 6, 2013) and incorporated by reference thereto
10.26	Product Distribution Agreement between Harvard Bioscience, Inc. and Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.) dated as of October 31, 2013.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed November 6, 2013) and incorporated by reference thereto
10.27	Tax Sharing Agreement between Harvard Bioscience, Inc. and Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.) dated as of October 31, 2013.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed November 6, 2013) and incorporated by reference thereto
10.28	Transition Services Agreement between Harvard Bioscience, Inc. and Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.) dated as of October 31, 2013.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed November 6, 2013) and incorporated by reference thereto
10.29 #	Amendment to Employment Agreement between Harvard Bioscience, Inc. and Jeffrey A. Duchemin, effective July 30, 2014.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed July 31, 2014) and incorporated by reference thereto
10.30 #	Amendment to Employment Agreement between Harvard Bioscience, Inc. and Robert E. Gagnon, effective July 30, 2014.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed July 31, 2014) and incorporated by reference

		thereto
10.31	Amendment No. 3, dated as of May 30, 2014, to Lease Agreement, as subsequently amended, between Seven October Hill LLC and Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed August 7, 2014) and incorporated by reference thereto
10.32 #	Second Amendment to Employment Agreement, dated as of March 1, 2015, between Harvard Bioscience, Inc. and Jeffrey A. Duchemin	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed May 7, 2015) and incorporated by reference thereto

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10.33	Third Amendment to Second Amended and Restated Credit Agreement and Waiver dated as of April 24, 2015, by and among Harvard Bioscience, Inc. Bank of America, N.A. and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed August 6, 2015) and incorporated by reference thereto
10.34	Fourth Amendment to Second Amended and Restated Credit Agreement and Waiver dated as of June, 30, 2015, by and among Harvard Bioscience, Inc. Bank of America, N.A. and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed August 6, 2015) and incorporated by reference thereto
10.35	Form of Deferred Stock Award Agreement under the Harvard Bioscience, Inc. Third Amended and Restated 2000 Stock Option And Incentive Plan, as amended	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed November 5, 2015) and incorporated by reference thereto
10.36	Fifth Amendment to Second Amended and Restated Credit Agreement and Waiver dated as of November 5, 2015, by and among Harvard Bioscience, Inc. Bank of America, N.A. and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed April 29, 2016) and incorporated by reference thereto
10.37	Sixth Amendment to Second Amended and Restated Credit Agreement dated as of March 9, 2016, by and among Harvard Bioscience, Inc. Bank of America, N.A. and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed May 16, 2016) and incorporated by reference thereto
10.38	Limited Consent and Waiver dated as of May 5, 2016 by and among Harvard Bioscience, Inc., Bank of America, N.A and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed August 4, 2016) and incorporated by reference thereto
10.39 #	Third Amendment to Employment Agreement, dated as of May 26, 2016, between Harvard Bioscience, Inc. and Jeffrey A. Duchemin	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed May 27, 2016) and incorporated by reference thereto
10.40 #	Second Amendment to Employment Agreement, dated as of May 26, 2016, between Harvard Bioscience, Inc. and Robert E. Gagnon	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed May 27, 2016) and incorporated by reference thereto
10.41 #	Employment Agreement, dated as of May 26, 2016, between Harvard Bioscience, Inc. and Yong Sun	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed May 27, 2016) and incorporated by reference thereto
10.42	Limited Consent and Waiver dated as of November 1, 2016, and effective as of October 26, 2016 by and among Harvard Bioscience, Inc., Bank of America, N.A and Brown Brothers Harriman & Co.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 17, 2017) and incorporated

		by reference thereto
10.43	Lease Agreement, dated as of August 15, 2008, between AX US L.P. (as assigned to it by New Brighton 14th Street LLC), Ryan Companies US, Inc. and Data Sciences International, Inc. (as assigned to it by Transoma Medical, Inc.)	Filed with this report
10.44	First Amendment to Lease Agreement, dated as of February 26, 2008, between AX US L.P. (as assigned to it by New Brighton 14th Street LLC), Ryan Companies US, Inc. and Data Sciences International, Inc. (as assigned to it by Transoma Medical, Inc.)	Filed with this report

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10.45	Second Amendment to Lease Agreement, dated as of August 4, 2008, between AX US L.P. (as assigned to it by New Brighton 14th Street LLC), Ryan Companies US, Inc. and Data Sciences International, Inc. (as assigned to it by Transoma Medical, Inc.)	Filed with this report
10.46	Financing Agreement, dated as of January 31, 2018, between Harvard Bioscience, Inc., each of the borrowers named therein, the lenders from time to time party thereto, and Cerberus Business Finance, LLC	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed February 2, 2018) and incorporated by reference thereto
16.1	Letter from KPMG to the Securities and Exchange Commission, dated as of May 9, 2017	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed May 11, 2017) and incorporated by reference thereto
21.1	Subsidiaries of the Registrant	Filed with this report
23.1	Consent of Grant Thornton LLP	Filed with this report
23.2	Consent of KPMG LLP	Filed with this report
31.1	Certification of Chief Financial Officer of Harvard Bioscience, Inc., pursuant to Rules 13a-15(e) and 15d-15(e), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	Filed with this report
31.2	Certification of Chief Executive Officer of Harvard Bioscience, Inc., pursuant to Rules 13a-15(e) and 15d-15(e), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	Filed with this report
32.1	Certification of Chief Financial Officer of Harvard Bioscience, Inc., pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	*
32.2	Certification of Chief Executive Officer of Harvard Bioscience, Inc., pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	*

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101.INS	XBRL Instance Document	Filed with this report
101.SCH	XBRL Taxonomy Extension Schema Document	Filed with this report
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document	Filed with this report
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document	Filed with this report
101.LAB	XBRL Taxonomy Extension Label Linkbase Document	Filed with this report
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document	Filed with this report

+ Certain portions of this document have been granted confidential treatment by the Securities and Exchange Commission (the Commission).

* This certification shall not be deemed “filed” for purposes of Section 18 of the Securities Exchange Act of 1934, or otherwise subject to the liability of that section, nor shall it be deemed to be incorporated by reference into any filing under the Securities Act of 1933 or the Securities Exchange Act of 1934

Management contract or compensatory plan or arrangement.

The schedules and exhibits to the Separation and Distribution Agreement have been omitted. A copy of any omitted schedule or exhibit will be furnished to the SEC supplementally upon request.

§

The Company will furnish to stockholders a copy of any exhibit without charge upon written request.