UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, DC 20549

FORM 10-Q

☒ **Quarterly report pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934**

For the quarterly period ended September 30, 2018

☐ **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 **(State or Other Jurisdiction of Incorporation or Organization)**	**04-3306140** **(IRS Employer Identification No.)**
84 October Hill Road, Holliston, MA **(Address of Principal Executive Offices)**	**01746** **(Zip Code)**

(508) 893-8999
(Registrant's telephone number, including area code)

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

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

Indicate by check mark 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.

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

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

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

Indicate the number of shares outstanding of each of the issuer's classes of common stock, as of the latest practicable date.

As of October 25, 2018, there were 37,293,918 shares of common stock, par value $0.01 per share, outstanding.

HARVARD BIOSCIENCE, INC.

FORM 10-Q
For the Quarter Ended September 30, 2018

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PART I. FINANCIAL INFORMATION

Item 1. Financial Statements.

HARVARD BIOSCIENCE, INC.
CONSOLIDATED BALANCE SHEETS
(Unaudited, in thousands, except share and per share data)

	September 30, 2018	December 31, 2017
Assets		
Current assets:		
Cash and cash equivalents	$ 6,661	$ 5,192
Accounts receivable, net of allowance for doubtful accounts of $301 and $193, respectively	17,880	13,382
Inventories	25,739	16,848
Other receivables and other assets	4,248	3,709
Current assets held for sale	-	8,404
Total current assets	54,528	47,535
Property, plant and equipment, net	5,392	3,743
Deferred income tax assets	179	182
Amortizable intangible assets, net	46,110	10,030
Goodwill	55,801	36,336
Other indefinite lived intangible assets	1,238	1,244
Other assets	1,792	324
Long term assets held for sale	-	9,960
Total assets	$ 165,040	$ 109,354
Liabilities and Stockholders' Equity		
Current liabilities:		
Current portion, long-term debt	$ 1,799	$ 2,765
Accounts payable	5,392	4,410
Deferred revenue	3,267	505
Accrued income taxes	576	395
Accrued expenses	6,301	3,816
Other liabilities - current	1,926	293
Current liabilities held for sale	-	1,857
Total current liabilities	19,261	14,041
Long-term debt, less current installments	59,247	8,983
Deferred income tax liabilities	2,122	2,653
Other long term liabilities	3,451	1,466
Long term liabilities held for sale	-	1,311
Total liabilities	84,081	28,454
Commitments and contingencies		
Stockholders' equity:		
Preferred stock, par value $0.01 per share, 5,000,000 shares authorized	-	-
Common stock, par value $0.01 per share, 80,000,000 shares authorized; 45,032,925 and 42,763,985 shares issued and 37,287,418 and 35,018,478 shares outstanding, respectively	435	419
Additional paid-in-capital	225,530	218,792
Accumulated deficit	(122,751)	(116,967)
Accumulated other comprehensive loss	(11,587)	(10,676)
Treasury stock at cost, 7,745,507 common shares	(10,668)	(10,668)
Total stockholders' equity	80,959	80,900
Total liabilities and stockholders' equity	$ 165,040	$ 109,354

See accompanying notes to unaudited consolidated financial statements.

HARVARD BIOSCIENCE, INC.
CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE INCOME (LOSS)
(Unaudited, in thousands, except per share data)

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
Revenues	$ 28,635	$ 18,717	$ 86,916	$ 55,761
Cost of revenues	12,818	9,217	42,475	27,611
Gross profit	15,817	9,500	44,441	28,150
Sales and marketing expenses	6,021	3,635	17,976	10,663
General and administrative expenses	4,655	4,317	15,297	13,219
Research and development expenses	2,783	1,538	7,943	4,119
Amortization of intangible assets	1,468	400	3,983	1,158
Total operating expenses	14,927	9,890	45,199	29,159
Operating income (loss)	890	(390)	(758)	(1,009)
Other expense:				
Foreign exchange	(26)	(73)	(28)	(488)
Interest expense, net	(1,458)	(189)	(3,835)	(532)
Other expense, net	(314)	(12)	(3,399)	(117)
Other expense, net	(1,798)	(274)	(7,262)	(1,137)
Loss from continuing operations before income taxes	(908)	(664)	(8,020)	(2,146)
Income tax benefit	(652)	(19)	(416)	(141)
Loss from continuing operations	(256)	(645)	(7,604)	(2,005)
Discontinued operations:				
Income from discontinued operations before income taxes	-	254	937	231
Income tax expense (benefit)	-	26	(883)	90
Income from discontinued operations	-	228	1,820	141
Net loss	$ (256)	$ (417)	$ (5,784)	$ (1,864)
Loss per share:				
Basic loss per common share from continuing operations	$ (0.01)	$ (0.02)	$ (0.21)	$ (0.06)
Basic earnings per common share from discontinued operations	-	0.01	0.05	-
Basic loss per common share	$ (0.01)	$ (0.01)	$ (0.16)	$ (0.05)
Diluted loss per common share from continuing operations	$ (0.01)	$ (0.02)	$ (0.21)	$ (0.06)
Diluted earnings per common share from discontinued operations	-	0.01	0.05	-
Diluted loss per common share	$ (0.01)	$ (0.01)	$ (0.16)	$ (0.05)
Weighted average common shares:				
Basic	36,947	34,840	36,170	34,706
Diluted	36,947	34,840	36,170	34,706
Comprehensive income (loss):				
Net loss	$ (256)	$ (417)	$ (5,784)	$ (1,864)
Foreign currency translation adjustments	395	1,181	(1,037)	4,189
Derivatives qualifying as hedges, net of tax:				
Gain (loss) on derivative instruments designated and qualifying as cash flow hedges	126	-	27	(89)
Amounts reclassified from accumulated other comprehensive loss to net loss	55	21	99	43
Total comprehensive income (loss)	$ 320	$ 785	$ (6,695)	$ 2,279

See accompanying notes to unaudited consolidated financial statements.

HARVARD BIOSCIENCE, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS
(Unaudited, in thousands)

	Nine Months Ended September 30, 2018	Nine Months Ended September 30, 2017
Cash flows from operating activities:		
Net loss	$ (5,784)	$ (1,864)
Adjustments to reconcile net loss to net cash provided by operating activities:		
Stock compensation expense	2,232	2,604
Depreciation	1,474	1,009
Gain on sale of Denville	(1,251)	-
Gain on disposal of fixed assets	(3)	-
Amortization of catalog costs	20	31
Provision for allowance for doubtful accounts	3	1
Amortization of intangible assets	4,030	1,825
Amortization of deferred financing costs	511	36
Deferred income taxes	49	-
Changes in operating assets and liabilities:		
Decrease in accounts receivable	918	1,000
Decrease (increase) in inventories	2,112	(608)
Increase in other receivables and other assets	(1,184)	(563)
Decrease in trade accounts payable	(442)	(786)
Increase in accrued income taxes	211	35
Decrease in accrued expenses	(1,968)	(830)
Increase in deferred revenue	1,929	99
(Decrease) increase in other liabilities	(2,566)	7
Net cash provided by operating activities	291	1,996
Cash flows used in investing activities:		
Additions to property, plant and equipment	(891)	(677)
Additions to catalog costs	(24)	(39)
Acquisition, net of cash acquired	(68,008)	-
Disposition, net of cash sold	15,754	-
Net cash used in investing activities	(53,169)	(716)
Cash flows provided by (used in) financing activities:		
Proceeds from issuance of debt	70,800	2,250
Repayments of debt	(19,947)	(3,502)
Payments of debt issuance costs	(1,967)	-
Net proceeds from (net taxes paid for) issuance of common stock	4,521	(101)
Net cash provided by (used in) financing activities	53,407	(1,353)
Effect of exchange rate changes on cash	399	313
Increase in cash and cash equivalents	928	240
Cash and cash equivalents at the beginning of period, including cash included in assets held for sale	5,733	5,596
Cash and cash equivalents at the end of period	$ 6,661	$ 5,836
Supplemental disclosures of cash flow information:		
Cash paid for interest	$ 3,509	$ 503
Cash refunded for income taxes	$ (170)	$ (96)

See accompanying notes to unaudited consolidated financial statements.

HARVARD BIOSCIENCE, INC.
NOTES TO UNAUDITED CONSOLIDATED FINANCIAL STATEMENTS

1. Basis of Presentation and Summary of Significant Accounting Policies

Basis of Presentation

The unaudited consolidated financial statements of Harvard Bioscience, Inc. and its wholly-owned subsidiaries (collectively, Harvard Bioscience or the Company) as of September 30, 2018 and for the nine months ended September 30, 2018 and 2017 have been prepared by the Company pursuant to the rules and regulations of the Securities and Exchange Commission (SEC). Certain information and footnote disclosures normally included in financial statements prepared in accordance with U.S. generally accepted accounting principles (U.S. GAAP) have been condensed or omitted pursuant to such rules and regulations. The December 31, 2017 consolidated balance sheet was derived from audited financial statements, but does not include all disclosures required by U.S. GAAP. However, the Company believes that the disclosures are adequate to make the information presented not misleading. These unaudited consolidated financial statements should be read in conjunction with the consolidated financial statements and the notes thereto included in the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017, which was filed with the SEC on March 16, 2018.

In the opinion of management, all adjustments, which include normal recurring adjustments necessary to present a fair statement of financial position as of September 30, 2018, results of operations and comprehensive income (loss) for the three and nine months ended September 30, 2018 and 2017 and cash flows for the nine months ended September 30, 2018 and 2017, as applicable, have been made. The results of operations for the three and nine months ended September 30, 2018 are not necessarily indicative of the operating results for the full fiscal year or any future periods.

Reclassifications

As disclosed in Note 5, on January 22, 2018, the Company sold substantially all the assets of its operating subsidiary, Denville Scientific, Inc. (Denville). The sale of Denville represented a strategic shift that has and will have a major effect on the Company's operations and financial results. As such and pursuant to Accounting Standards Codification (ASC) 205-20 – *Presentation of Financial Statements - Discontinued Operations*, the operating results of Denville for the three and nine months ended September 30, 2018 and 2017 have been presented in discontinued operations in the consolidated statements of operations. Additionally, the assets and liabilities of Denville as of December 31, 2017 have been recast in the consolidated balance sheet and presented as held for sale. These reclassifications and adjustments had no effect on total amounts within the consolidated balance sheet, consolidated statements of operations and comprehensive income (loss), consolidated statements of cash flows for any of the periods presented.

Summary of Significant Accounting Policies

The accounting policies underlying the accompanying unaudited consolidated financial statements are those set forth in Note 2 to the consolidated financial statements included in the Company's Annual Report on Form 10-K for the year ended December 31, 2017, which was filed with the SEC on March 16, 2018. Except for the accounting for revenue arising from contracts with customers as noted below there have been no material changes in the company's significant accounting policies during the nine months ended September 30, 2018.

Revenue recognition

Nature of contracts and customers

The Company's contracts are primarily of short duration and are mostly based on the receipt and fulfilment of purchase orders. The purchase orders are binding and include pricing and all other relevant terms and conditions.

The Company's customers are primarily research scientists at universities, hospitals, government laboratories, including the United States National Institute of Health (NIH), contract research organizations, pharmaceutical and biotechnology companies. The Company also has global and regional distribution partners, and original equipment manufacturer (OEM) customers who incorporate its products into their products under their own brands.

Performance obligations

The Company's performance obligations under its revenue contracts consist of its instruments, equipment, accessories, services, maintenance and extended warranties. Equipment also includes software that functions together with the tangible equipment to deliver its essential functionality. Contracts with customers may contain multiple promises such as delivery of hardware, software, professional services or post-contract support services. These promises are accounted for as separate performance obligations if they are distinct. For contracts with customers that contain multiple performance obligations, the transaction price is allocated to the separate performance obligations based on estimated relative standalone selling price, which does not materially differ from the stated price in the contract.

Instruments, equipment and accessories consist of a range of products that are used in life sciences research. Revenues from the sales of these items are recognized when transfer of control of these products to the customer occurs. Transfer of control occurs when the Company has a right to payment, and the customer has legal title to the asset and the customer or their selected carrier has possession, which is typically upon shipment. Sales on these items are therefore generally recognized at a point in time.

The Company's equipment revenue also includes the sale of wireless implantable monitors that are used for life science research purposes. The Company sells these wireless implantable monitors to pharmaceutical companies, contract research organizations and academic laboratories. In addition to sales generated from new and existing customers, these implantable devices are also sold under a program called the "exchange program". Under this program, customers may return an implantable monitor to the Company after use, and if the returned monitor can be reprocessed and resold, they may, in exchange, purchase a replacement implantable monitor of the same model at a lower price than a new monitor. The implantable monitors that are returned by customers are reprocessed and made available for future sale. The initial sale of implantable monitors and subsequent sale of replacement implantable monitors are independent transactions. The Company has no obligation in connection with the initial sale to sell replacement implantable monitors at any future date under any fixed terms and may refuse returned implantable monitors that cannot be recovered or are obsolete. The Company has concluded that the offer to its customers that they may purchase a discounted product in the future is not a material right based on the applicable guidance within ASC 606.

Service revenues consist of installation, training, data analysis, and surgeries performed on research animals. Maintenance revenue consists of post-contract support provided in relation to software that is embedded within the equipment that is sold to the customer. The Company provides standard warranties that promise the customer that the product will work as promised. These standard warranties are not a separate performance obligation. Extended warranties relate to warranties that are separately priced, and purchased in addition to a standard warranty, and are therefore a separate performance obligation. The Company has made the judgment that the customer benefits as the Company performs over the period of the contract, and therefore revenues from service, maintenance and warranty contracts are recognized over time. The Company uses the input method to recognize revenue over time, based on time elapsed, which is generally on a straight-line basis over the service period. The period over which maintenance and warranty contracts is recognized is typically one year. The period over which service revenues is recognized is generally less than one month.

For sales for which transfer of control occurs upon shipment, the Company accounts for shipping and handling costs as fulfilment costs. As such, the Company records the amounts billed to the customer for shipping costs as revenue and the costs within cost of revenues upon shipment. For sales, for which control transfers to customers after shipment, the Company has elected to account for shipping and handling as activities to fulfill the promise to transfer the goods to the customer. The Company therefore accrues for the costs of shipping undelivered items in the period of shipment.

Revenues expected to be recognized related to any and all remaining performance obligations are generally expected to be recognized in one year or less, as the majority of the Company's contracts have a term of less than one year.

Variable Consideration

The nature of the Company's contracts gives rise to certain types of variable consideration, including in limited cases volume and payment discounts. The Company analyzes sales that could include variable consideration, and estimates the expected or most likely amount of revenue after returns, trade-ins, discounts, rebates, credits, and incentives. Product returns are estimated and accrued for, based on historical information. In making these estimates, the Company considers whether the amount of variable consideration is constrained and is included in revenue only to the extent that it is probable that a significant reversal of the revenue recognized will not occur when the uncertainty associated with the variable consideration is subsequently resolved. Variable consideration, and its impact on the Company's revenue recognition, was not material in any of the periods presented.

The Company's payment terms are generally from zero to sixty days from the time of invoicing, which generally occurs at the time of shipment or prior to services being performed. Payment terms vary by the type of its customers and the products or services offered.

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.

Deferred revenue

The Company records deferred revenue when cash is collected from customers prior to satisfaction of the Company's performance obligation to the customer. Deferred revenue consists of amounts deferred related to service contracts and revenue deferred as a result of payments received in advance from customers. Deferred revenue is generally expected to be recognized within one year.

The amounts included in deferred revenue from advanced payments relate to amounts that are prepaid for wireless implantable monitors under the exchange program. The Company has made the judgment that these payments do not represent a significant financing component as the customer can exercise their discretion as to when they can obtain the products that they have made a prepayment for.

Advanced payments received from customers are recorded as a liability, and revenue is recognized when the Company's performance obligations are completed. Performance obligations are completed when the product is shipped or delivered to the customer, or at the end of the exchange program if goods are not acquired prior to the termination of the contract period.

Allowance for doubtful accounts

The allowance for doubtful accounts reflects the Company's best estimate of probable losses inherent in the accounts receivable balance. The Company determines the allowance based on known troubled accounts, historical experience, and other currently available evidence.

Disaggregation of revenue

Refer to Note 17 for revenue disaggregated by type and by geographic region as well as further information about the allowance for doubtful accounts and deferred revenue balances.

2. Recently Issued Accounting Pronouncements

In February 2016, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (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. A modified retrospective transition approach is required for leases existing at, or entered into after, the beginning of the earliest comparative period presented in the financial statements, with certain practical expedients available. The Company expects to utilize a practical expedient in its method of adoption of the standard. Under this expedient, which is a "current-period adjustment method," the Company would apply ASC 842 as of January 2019 and record a cumulative-effect adjustment to retained earnings as of that date.

The Company has collected information on its leases and is in the process of evaluating and applying the requirements of the standard to 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, the Company expects that the new standard will have a material effect on its consolidated balance sheet related to the recognition of new assets and lease liabilities. The Company expects to finalize its classification of leases as well as the effective interest rate to be applied in determining the lease liabilities during the fourth quarter of 2018. The Company's future commitments under lease obligations are summarized in Note 12.

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, *Derivatives and Hedging*. 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

In May 2014, the FASB issued 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 adopted this standard as of January 1, 2018 using the modified retrospective approach, and applied the guidance to contracts that were not completed at the date of adoption. The Company's significant revenue streams currently consist primarily of product revenue transactions, service, maintenance and extended warranty transactions on certain product sales. The timing of recognizing revenues for these revenue streams did not materially change. Additionally, the adoption of ASU 2014-09 did not have a material impact on the Company's financial position, results of operations, equity or cash flows as of the adoption date or for the three months ended March 31, 2018. The Company's updated revenue recognition policy is described in Note 1 and disaggregated revenue disclosures required under ASC 2014-09 are presented in Note 17.

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. 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, 2017	$ (9,755)	$ 37	$ (958)	$ (10,676)
Other comprehensive income before reclassifications	(1,037)	27	-	(1,010)
Amounts reclassified from AOCI	-	99	-	99
Other comprehensive income	(1,037)	126	-	(911)
Balance at September 30, 2018	$ (10,792)	$ 163	$ (958)	$ (11,587)

4. Acquisition

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 $70.6 million. The Company funded the acquisition from its existing cash balances, excess proceeds from the Denville Transaction discussed in Note 5, and proceeds from the Financing Agreement discussed in Note 14.

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

		(in thousands)
Tangible assets	$	32,525
Liabilities assumed		(11,587)
Net assets		20,938
Goodwill and intangible assets:		
Goodwill		19,348
Amortizable intangible assets:		
Trade name		3,524
Developed technology		25,570
Customer relationships		9,837
In-process research and development		1,387
Total amortizable intangible assets		40,318
Deferred tax liabilities, net		(10,020)
Total goodwill and intangible assets, net of tax		49,646
Acquisition purchase price	$	70,584

Tangible assets and liabilities assumed, as referenced above, preliminarily consist of the following:

Cash acquired	$	2,576
Accounts receivable, net		5,069
Inventories		11,512
Other current assets		809
Property, plant and equipment, net		2,090
Deferred income tax assets, net		10,469
Tangible assets	$	32,525
Accounts payable and accrued liabilities	$	5,639
Deferred revenue including customer advances		2,976
Other long term liabilities		2,972
Liabilities assumed	$	11,587

The preliminary allocation of the purchase price for DSI was based on estimates of the fair value of the net assets acquired and is subject to adjustment upon finalization of the valuation of the acquired intangible assets and the related deferred taxes. Measurements of these items inherently require significant estimates and assumptions. During the three months ended June 30, 2018, the Company made adjustments to the preliminary allocation of the purchase price presented in the March 31, 2018 Form 10-Q. The adjustments included a decrease of $1.6 million to other long term liabilities, an increase of $1.4 million to deferred tax liabilities, an increase of $0.6 million to the purchase price related to a net working capital adjustment, and an increase of $0.6 million to goodwill.

The weighted-average amortization periods for definite-lived intangible assets acquired are 9.4 years for tradenames, 8.2 years for developed technology, 12.4 years for customer relationships and 7.4 years for in-process research and development assets. The weighted average amortization period for all definite-lived intangible assets acquired is 9.3 years.

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

The results of operations for DSI have been included in the Company's consolidated financial statements from the date of acquisition. The revenues of DSI included in the Company's consolidated statement of operations from the date of acquisition were approximately $29.3 million for the eight-month period ended September 30, 2018. The net loss of DSI included in the Company's consolidated statement of operations for the same period was approximately $31 thousand. Included in the net loss was a $3.8 million charge recognized in cost of revenues related to purchase accounting inventory fair value step up amortization. The total inventory fair value step up was preliminarily valued at $3.8 million and was recognized into cost of revenues over one inventory turn, or approximately five and a half months. Also included in the net loss of DSI is $2.9 million of intangible asset amortization expense.

The following consolidated pro forma information is based on the assumption that the acquisition of DSI occurred on January 1, 2017. Accordingly, the historical results have been adjusted to reflect amortization expense, interest expense and other purchase accounting adjustments 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 the Company completed the acquisition during these periods or which might be reported in the future.

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
	(in thousands)			
Pro Forma				
Revenues	$ 28,713	$ 27,997	$ 90,384	$ 88,547
Income (loss) from continuing operations	155	(1,845)	(236)	(9,719)

Direct acquisition costs recorded in other expense, net in the Company's consolidated statements of operations were $3.0 million and $0 for the nine months ended September 30, 2018 and 2017, respectively.

5. Discontinued Operations

On January 22, 2018, the Company sold substantially all the assets of its wholly owned subsidiary, 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 $15.7 million. The $3.0 million earn-out provision represents consideration that is contingent on Denville achieving certain performance metrics over a period of two years.

The following table is a reconciliation of the carrying amounts of major assets and liabilities of Denville classified as held for sale in the Company's consolidated balance sheet as of December 31, 2017.

	December 31, 2017
	(in thousands)
Carrying amounts of major classes of assets	
Cash	$ 541
Accounts receivable, net	2,854
Inventories	4,505
Other receivables and other assets	504
Current assets held for sale	8,404
Property, plant and equipment	397
Amortizable intangible assets	5,930
Allocation of goodwill	3,633
Long term assets held for sale	9,960
Total assets of the disposal group classified as held for sale in the consolidated balance sheet	$ 18,364
Carrying amounts of major classes of liabilities	
Accounts payable and accrued expenses	$ 1,736
Other current liabilities	121
Current liabilities held for sale	1,857
Deferred income tax liabilities	1,311
Long term liabilities held for sale	1,311
Total liabilities of the disposal group classified as held for sale in the consolidated balance sheet	$ 3,168

The following table is a reconciliation of the major line items of income from discontinued operations presented within the Company's consolidated statements of operations for the three and nine months ended September 30, 2018 and 2017.

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
	(in thousands)		(in thousands)	
Revenues	$ -	$ 6,333	$ 893	$ 18,658
Cost of revenues	-	(4,194)	(534)	(12,383)
Operating and other expenses	-	(1,885)	(673)	(6,044)
Gain on disposal of discontinued operations	-	-	1,251	-
Income from discontinued operations before income taxes	$ -	$ 254	$ 937	$ 231
Income tax expense (benefit)	-	26	(883)	90
Income from discontinued operations	-	228	1,820	141

Included within the adjustments to reconcile net loss to net cash provided by operating activities in the Company's consolidated statements of cash flows for the nine months ended September 30, 2018 and 2017, was amortization of intangible assets for Denville of $47 thousand and $0.7 million, respectively. Depreciation and capital expenditures for Denville were immaterial for both periods presented.

6. Goodwill and Other Intangible Assets

Intangible assets consist of the following:

	September 30, 2018		December 31, 2017		Weighted Average Life	(a)
	(in thousands)					
Amortizable intangible assets:	Gross	Accumulated Amortization	Gross	Accumulated Amortization		
Existing technology	$ 41,536	$ (15,516)	$ 16,173	$ (13,179)	7.3	Years
Trade names	7,882	(2,718)	4,443	(2,280)	7.9	Years
Distribution agreements/customer relationships	22,808	(9,240)	13,197	(8,373)	10.8	Years
In-process research and development	1,387	(47)	-	-	7.2	Years
Patents	218	(200)	223	(174)	0.4	Years
Total amortizable intangible assets	73,831	$ (27,721)	34,036	$ (24,006)		
Indefinite-lived intangible assets:						
Goodwill	55,801		36,336			
Other indefinite-lived intangible assets	1,238		1,244			
Total goodwill and other indefinite-lived intangible assets	57,039		37,580			
Total intangible assets, gross	$ 130,870		$ 71,616			

(a) Weighted average life as of September 30, 2018.

The balances presented in the tables above and below exclude intangible assets and allocated goodwill of Denville as of December 31, 2017. Both balances are reported as long term assets held for sale as of December 31, 2017. Refer to Note 5 for further details.

The change in the carrying amount of goodwill for the nine months ended September 30, 2018 is as follows:

	(in thousands)
Balance at December 31, 2017	$ 36,336
Goodwill arising from business combination	19,348
Effect of change in currency translation	117
Balance at September 30, 2018	$ 55,801

Amortization of intangible assets

Intangible asset amortization expense from continuing operations was $1.5 million and $0.4 million for the three months ended September 30, 2018 and 2017, respectively. Intangible asset amortization expense from continuing operations was $4.0 million and $1.2 million for the nine months ended September 30, 2018 and 2017, respectively. Amortization expense of existing amortizable intangible assets is currently estimated to be $5.6 million for the year ending December 31, 2018, $5.8 million for the year ending December 31, 2019, $5.8 million for the year ending December 31, 2020, $5.7 million for the year ending December 31, 2021 and $5.7 million for the year ending December 31, 2022.

7. Inventories

Inventories consist of the following:

	September 30, 2018	December 31, 2017
	(in thousands)	
Finished goods	$ 7,569	$ 5,779
Work in process	3,849	1,042
Raw materials	14,321	10,027
Total	$ 25,739	$ 16,848

8. Property, Plant and Equipment

As of September 30, 2018 and December 31, 2017, property, plant and equipment consist of the following:

	September 30, 2018	December 31, 2017
	(in thousands)	
Land, buildings and leasehold improvements	$ 2,478	$ 2,197
Machinery and equipment	8,711	7,022
Computer equipment and software	9,519	8,819
Furniture and fixtures	1,789	1,139
Automobiles	117	120
	22,614	19,297
Less: accumulated depreciation	(17,222)	(15,554)
Property, plant and equipment, net	$ 5,392	$ 3,743

9. Related Party Transactions

As part of the acquisitions of Multi Channel Systems MCS GmbH (MCS) and Triangle BioSystems, Inc. (TBSI) in 2014, the Company signed lease agreements with the former owners of the acquired companies. The principals of such former owners of MCS and TBSI were employees of the Company as of September 30, 2018 and 2017. Pursuant to a lease agreement, the Company made rent payments of approximately $77 thousand and $64 thousand to the former owners of MCS for the three months ended September 30, 2018 and 2017, respectively. The Company made rent payments of approximately $10 thousand to the former owner of TBSI for both the three months ended September 30, 2018 and 2017.

The Company made rent payments of approximately $0.2 million to the former owners of MCS for both the nine months ended September 30, 2018 and 2017. The Company made rent payments of approximately $32 thousand to the former owner of TBSI for both the nine months ended September 30, 2018 and 2017.

10. 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)\ Credits	Additions	Ending Balance
	(in thousands)			
Year ended December 31, 2017	$ 193	(7)	60	$ 246
Nine months ended September 30, 2018	$ 246	5	140	$ 391

11. Employee Benefit Plans

The Company's subsidiary in the United Kingdom, Biochrom Limited, maintains contributory, defined benefit 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 components of the Company's defined benefit pension expense were as follows:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
	(in thousands)			
Components of net periodic benefit cost:				
Interest cost	$ 121	$ 141	$ 371	$ 399
Expected return on plan assets	(187)	(179)	(575)	(505)
Net amortization loss	53	98	163	276
Curtailment gain	(41)	-	(41)	-
Net periodic benefit (income) cost	$ (54)	$ 60	$ (82)	$ 170

For the three months ended September 30, 2018 and 2017, the Company contributed $0.2 million, for both periods, to its defined benefit pension plans. For the nine months ended September 30, 2018 and 2017, the Company contributed $0.5 million for both periods, to its defined benefit pension plans. The Company expects to contribute approximately $0.2 million to its defined benefit pension plans during the remainder of 2018.

The Company had an underfunded pension liability of approximately $1.2 million as of September 30, 2018 and December 31, 2017, respectively, included in the other long term liabilities line item in the consolidated balance sheets.

12. Leases

The Company has noncancelable operating leases for office and warehouse space expiring at various dates through 2023 and thereafter. Rent payments are estimated to be $3.4 million for the year ended December 31, 2018. Rent payments for continuing operations were approximately $0.9 million and $0.5 million for the three months ended September 30, 2018 and 2017, respectively. Rent payments for continuing operations were approximately $2.6 million and $1.3 million for the nine months ended September 30, 2018 and 2017, respectively.

Future minimum lease payments for operating leases, with initial or remaining terms in excess of one year at September 30, 2018, are as follows:

	Operating Leases
	(in thousands)
2019	$ 3,217
2020	2,317
2021	1,130
2022	1,091
2023	1,093
Thereafter	772
Net minimum lease payments	$ 9,620

13. 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. These rights were not initially exercisable and would trade with the shares of the Company's common stock. The rights would become exercisable under various conditions according to the terms of the plan. The Shareholder Rights Plan expired, with no rights having become exercisable, 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 September 30, 2018, 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. On May 18, 2017, the stockholders of the Company approved an increase of 300,000 shares of common stock in the number of shares available for issuance under the ESPP. Following such amendment, 1,050,000 shares of common stock are authorized for issuance, of which 826,361 shares were issued as of September 30, 2018. There were 24,907 and 36,902 shares issued under the ESPP during the nine months ended September 30, 2018 and 2017, respectively.

Stock Option and Equity Incentive Plans

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

The Third Amendment to the Third A&R Plan (the Amendment) was adopted by the Board of Directors on April 2, 2018. Such Amendment was approved by the stockholders at the Company's 2018 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 3,400,000 shares to 20,908,929.

Restricted Stock Units with a Market Condition (the Market Condition RSUs)

On August 3, 2015, the Compensation Committee of the Board of Directors of the Company approved and granted deferred stock awards of Market Condition RSUs (the 2015 Market Condition RSUs) to certain members of the Company's management team under the Third A&R Plan. The vesting of these 2015 Market Condition RSUs was 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 August 3, 2018, certain of the target total shareholder returns were achieved, and as a result, 69,667 of the 2015 Market Condition RSUs vested. The remaining 2015 Market Condition RSUs did not vest and were canceled.

On May 24, 2018, the Compensation Committee of the Board of Directors of the Company approved and granted deferred stock awards of Market Condition RSUs (the 2018 Market Condition RSUs) to certain members of the Company's management team under the Third A&R Plan. The vesting of the 2018 Market Condition RSUs is based on a graded-vesting schedule (one third at the end of each year for three years) and linked to the achievement of a relative total shareholder return of the Company's common stock from May 24, 2018 to the earlier of (i) May 24, 2019 or (ii) upon a change of control (measured relative to the NASDAQ Biotechnology index and based on the 20-day trading average price before each such date). As of September 30, 2018, the target number of these restricted stock units that may be earned is 116,944 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 RSUs and employee stock purchases related to the ESPP.

The Company adopted ASU 2016-09 as of January 1, 2017. 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.

Stock option and restricted stock unit activity under the Company's Third A&R Plan for the nine months ended September 30, 2018 was as follows:

	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, 2017	3,780,244	$ 3.95	1,796,927	$ 2.69	164,127	$ 4.81
Granted	50,000	4.84	608,189	4.34	156,944	4.19
Exercised	(1,689,755)	3.50	-	-	-	-
Vested (RSUs)	-	-	(824,843)	2.87	(69,667)	4.81
Cancelled / forfeited	(204,391)	4.96	(346,462)	2.82	(134,460)	4.63
Balance at September 30, 2018	1,936,098	$ 4.26	1,233,811	$ 3.35	116,944	$ 4.19

The weighted average fair value of the options granted under the Third A&R Plan during the three months ended September 30, 2018 and 2017 was $2.34 and $1.24, respectively. The weighted average fair value of the options granted under the Third A&R Plan during the nine months ended September 30, 2018 and 2017 was $1.97 and $1.17, respectively. The following assumptions were used to estimate the fair value, using the Black-Scholes option pricing model, of stock options granted during the three and nine months ended September 30, 2018 and 2017:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
Volatility	43.38%	41.99%	42.63%	41.30%
Risk-free interest rate	2.78%	1.74%	2.81%	1.88%
Expected holding period (in years)	4.77years	5.10years	4.90years	5.16years
Dividend yield	-%	-%	-%	-%

The weighted average fair value of the 2018 Market Condition RSUs which were granted under the Third A&R Plan during the nine months ended September 30, 2018 was $4.19. There were no Market Condition RSUs granted during the three and nine months ended September 30, 2017. The following assumptions were used to estimate the fair value, using a Monte-Carlo valuation simulation, of the Market Condition RSUs granted during the nine months ended September 30, 2018:

	Nine Months Ended September 30, 2018
Volatility	44.02%
Risk-free interest rate	2.27%
Correlation coefficient	0.07%
Dividend yield	-%

The Company used historical volatility to calculate the expected volatility for each grant as of the grant date. 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 and Market Condition RSUs. The expected holding period of stock options represents the period of time options are expected to be outstanding and is based on historical experience. The vesting period ranges from one to four years and the contractual life is ten years. The correlation coefficient, used to value the Market Condition RSUs, represents the way in which entities move in relation to the NASDAQ Biotechnology index as a whole.

Stock-based compensation expense related to stock options, restricted stock units, Market Condition RSUs and the ESPP for the three and nine months ended September 30, 2018 and 2017 was allocated as follows:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
	(in thousands)			
Cost of revenues	$ 19	$ 16	$ 45	$ 45
Sales and marketing	105	150	331	395
General and administrative	308	706	1,581	1,989
Research and development	54	36	125	102
Discontinued operations	-	25	150	73
Total stock-based compensation	$ 486	$ 933	$ 2,232	$ 2,604

The Company did not capitalize any stock-based compensation.

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 RSUs 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:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
Basic	36,947,052	34,840,324	36,169,536	34,705,947
Effect of assumed conversion of employee and director stock options, restricted stock units and Market Condition RSUs	-	-	-	-
Diluted	36,947,052	34,840,324	36,169,536	34,705,947

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 RSUs of approximately 3,286,853 and 5,789,838 shares of common stock for the three and nine months ended September 30, 2018 and 2017, respectively, as the impact of these shares would be anti-dilutive.

14. Long Term Debt

On January 22, 2018, in connection with the closing of the Denville Transaction, the Company terminated the Third Amended and Restated Credit Agreement (the Credit Agreement), 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.

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). On August 16, 2018, the Company and Cerberus Business Finance, LLC entered into a First Amendment to the Financing Agreement, which such amendment modified certain provisions related to the borrowing base and reporting, among other things.

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.

Commencing on March 31, 2018, the outstanding term loans 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 London Interbank Offered Rate (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. As of September 30, 2018, the Company was in compliance with all financial covenants contained in the Financing Agreement, was subject to covenant and working capital borrowing restrictions and had available borrowing capacity under its Financing Agreement of $8.5 million.

As of September 30, 2018 and December 31, 2017, the Company had borrowings net of debt issuance costs of $61.0 million and $11.7 million respectively, outstanding. 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 September 30, 2018, the weighted effective interest rate, net of the impact of the Company's interest rate swap, on its term loan was 8.76%.

As of September 30, 2018 and December 31, 2017, the Company's borrowings were comprised of:

	September 30, 2018	December 31, 2017
	(in thousands)	
Long-term debt:		
Term loan	$ 62,752	$ 11,899
Total unamortized deferred financing costs	(1,706)	(151)
Total debt	61,046	11,748
Less: current installments	(2,200)	(2,800)
Current unamortized deferred financing costs	401	35
Long-term debt	$ 59,247	$ 8,983

15. 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 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.

As disclosed in Note 14, on January 31, 2018, the Company entered into a Financing Agreement comprised of a $64.0 million term loan and up to a $25.0 million revolving line of credit. Shortly after entering into this Credit Agreement, the Company entered into an interest rate swap contract with PNC Bank with a notional amount of $36.0 million and a termination date of January 1, 2023 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 a portion of the term loan under the Financing Agreement at 2.72%. 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 September 30, 2018 was $34.7 million.

The following table presents the notional amount and fair value of the Company's derivative instruments as of September 30, 2018 and December 31, 2017.

		September 30, 2018 Notional Amount	September 30, 2018 Fair Value (a)
Derivatives designated as hedging instruments under ASC 815	**Balance sheet classification**	(in thousands)	
Interest rate swaps	Other assets (long term liabilities)	$ 34,663	$ 163

		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 (long term liabilities)	$ 11,900	$ 37

(a) See Note 16 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 three and nine months ended September 30, 2018 and 2017:

Derivatives in Hedging Relationships	Amount of gain (loss) recognized in OCI on derivative (effective portion)			
	Three Months Ended September 30,		Nine Months Ended September 30,	
	2018	2017	2018	2017
	(in thousands)			
Interest rate swaps	$ 126	$ -	$ 27	$ (89)

The following table summarizes the reclassifications out of accumulated other comprehensive loss for the nine months ended September 30, 2018 and 2017:

Details about AOCI Components	Amount reclassified from AOCI into income (effective portion)				Location of amount reclassified from AOCI into income (effective portion)
	Three Months Ended September 30,		Nine Months Ended September 30,		
	2018	2017	2018	2017	
	(in thousands)				
Interest rate swaps	$ 55	$ 21	$ 99	$ 43	Interest expense

As of September 30, 2018, $54 thousand of deferred losses on derivative instruments accumulated in AOCI are expected to be reclassified to earnings during the next twelve months. Transactions and events expected to occur over the next twelve months that will necessitate reclassifying these derivatives' losses to earnings include the repricing of variable-rate debt. As a result of terminating the Credit Agreement, as discussed in Note 14, the Company unwound its previous May 2017 interest rate swap contract and received $0.1 million in proceeds.

16. 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 assets or liabilities measured at fair value on a recurring basis:

	Fair Value as of September 30, 2018			
(In thousands)	Level 1	Level 2	Level 3	Total
Assets (Liabilities):				
Interest rate swap agreements	$ -	$ 163	$ -	$ 163

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

The Company uses the market approach technique to value its financial liabilities. The Company's financial assets and 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.

17. Revenues

The following table represents a disaggregation of revenue from contracts with customers. Revenue from continuing operations originating from the following geographic areas for the three and nine months ended September 30, 2018 and 2017 consist of:

	Three Months Ended September 30, 2018 (in thousands)				
	United States	United Kingdom	Germany	Rest of the world	Total
Instruments, equipment and accessories	$ 19,458	$ 3,098	$ 2,479	$ 2,124	$ 27,159
Service, maintenance and warranty contracts	1,077	297	79	23	1,476
Total revenues	$ 20,535	$ 3,395	$ 2,558	$ 2,147	$ 28,635

	Three Months Ended September 30, 2017 (in thousands)				
	United States	United Kingdom	Germany	Rest of the world	Total
Instruments, equipment and accessories	$ 9,758	$ 3,299	$ 2,675	$ 2,242	$ 17,974
Service, maintenance and warranty contracts	380	232	114	17	743
Total revenues	$ 10,138	$ 3,531	$ 2,789	$ 2,259	$ 18,717

	Nine Months Ended September 30, 2018 (in thousands)				
	United States	United Kingdom	Germany	Rest of the world	Total
Instruments, equipment and accessories	$ 56,153	$ 10,685	$ 9,485	$ 6,524	$ 82,847
Service, maintenance and warranty contracts	3,107	631	277	54	4,069
Total revenues	$ 59,260	$ 11,316	$ 9,762	$ 6,578	$ 86,916

	Nine Months Ended September 30, 2017 (in thousands)				
	United States	United Kingdom	Germany	Rest of the world	Total
Instruments, equipment and accessories	$ 29,901	$ 10,125	$ 6,886	$ 6,644	$ 53,556
Service, maintenance and warranty contracts	1,200	648	293	64	2,205
Total revenues	$ 31,101	$ 10,773	$ 7,179	$ 6,708	$ 55,761

Refer to Note 1 for the Company's revenue recognition policies.

Deferred revenue

As of September 30, 2018, the Company had approximately $3.3 million in deferred revenue comprised of revenue deferred from service contracts and revenue deferred from advance payments. Changes in deferred revenue from service contracts and advance payments from customers during the period were as follows:

	Nine Months Ended September 30, 2018		
	(in thousands)		
	Service Contracts	**Customer Advances**	**Total**
Balance, beginning of period	$ 505	$ -	$ 505
Addition due to business combination	848	2,128	2,976
Deferral of revenue	3,084	434	3,518
Recognition of deferred revenue	(2,933)	(793)	(3,726)
Effect of foreign currency translation	(6)	-	(6)
Balance, end of period	$ 1,498	$ 1,769	$ 3,267

Allowance for doubtful accounts

Activity in the allowance for doubtful accounts was as follows:

	Nine Months Ended September 30, 2018
	(in thousands)
Balance, beginning of period	$ 193
Addition due to business combination	102
Bad debt expense	3
Charged to allowance	(23)
Effect of foreign currency translation	26
Balance, end of period	$ 301

Acquisition of DSI

As discussed in Note 4, the Company acquired DSI, a previously privately held company on January 31, 2018. The Company has adopted ASC 606 with respect to DSI as of January 31, 2018. The tables, revenue recognition policies applied, and product descriptions noted above are thus inclusive of, and reflect revenues of DSI for the periods from the acquisition date.

18. Income Tax

Income tax from continuing operations was a benefit of approximately $0.7 million and $19 thousand for the three months ended September 30, 2018 and 2017, respectively. The effective tax rate on continuing operations was 71.8% for the three months ended September 30, 2018 compared with 2.9% for the same period in 2017.

Tax benefit for the three months ended September 30, 2018 reflects a benefit determined under the annualized effective tax method. The income tax benefit for the three months ended September 30, 2017 reflects the incremental expense associated with the actual results for the three-month period as described below.

Discrete items included in the tax benefit for the three months ended September 30, 2018 included foreign currency gains and losses and withholding taxes. Discrete items included in the tax benefit for the three months ended September 30, 2017 are changes to reserves for uncertain tax positions and tax impact of stock-based compensation.

Income tax from continuing operations was a benefit of approximately $0.4 million and $0.1 million for the nine months ended September 30, 2018 and 2017, respectively. The effective tax rate on continuing operations was 5.2% for the nine months ended September 30, 2018 compared with 6.6% for the same period in 2017.

Tax benefit for the nine months ended September 30, 2018 reflects benefit determined under the annualized effective tax method. The tax benefit for the three and nine month periods ended September 30, 2017 was based on actual results for the three and nine months periods rather than an annual effective rate estimated for the entire year. In 2017 the Company determined that using a year-to-date approach resulted in a better estimate of income tax expense/benefit based on its forecast of pre-tax income/loss, the mix of taxable income/loss across several jurisdictions with different statutory tax rates, and the impact of the full valuation allowance against U.S. deferred tax assets. The impact of recent events including U.S. tax reform and a major acquisition in January 2018 have significantly contributed to a change in the Company's determination regarding the use of the year-to-date method, which has been discontinued effective in the first quarter of 2018, the annualized effective tax rate method is used instead.

On December 22, 2017, tax reform legislation known as the Tax Cuts and Jobs Act (the Tax Act) was signed into law. For the year ended December 31, 2017, the Company recorded provisional amounts relating to the revaluation of deferred tax assets and liabilities, 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. In accordance with SEC guidance in Staff Accounting Bulletin No. 118, the Company is utilizing the measurement period approach for the income tax effects of tax reform for which the accounting is incomplete. Since these provisions are still 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.

As part of the 2017 Tax Act, there is a provision for the taxation of certain off-shore earnings referred to as the Global Intangible Low-Taxed Income ("GILTI") provision. In connection with this new provision, the Company has recorded current expense within the period but continues the process of determining its final accounting policy in regard to this new tax.

The difference between the Company's effective tax rate period over period was primarily attributable to higher pre-tax income at certain individual subsidiaries in 2018 versus 2017, despite an overall pre-tax loss in both periods, as well as the impact of non-deductible acquisition costs and certain provisions of U.S. tax reform in 2018. An additional factor was the impact of changes in the valuation allowance position recorded in certain countries.

For the three months ended September 30, 2018, no income tax expense or benefit was recorded for discontinued operations. In the same period in 2017, income tax expense for discontinued operations was $26 thousand.

For the nine months ended September 30, 2018, an income tax benefit of $0.9 million was recorded for discontinued operations. In the same period in 2017, income tax expense for discontinued operations was $90 thousand.

The Company adopted ASU 2016-09 as of January 1, 2017. As a result, 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 a net impact of $0. In addition, vesting of restricted stock units during the nine months ended September 30, 2018 has been recognized in the current period's income statement.

Item 2. ***Management's Discussion and Analysis of Financial Condition and Results of Operations.***

Forward-Looking Statements

This Quarterly Report on Form 10-Q 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 (the Exchange Act). The forward-looking statements are principally, but not exclusively, contained in "Item 2: 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, 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," "potential," "objectives," "optimistic," "strategy," "goals," "sees," "new," "guidance," "future," "continue," "drive," "growth," "long-term," "projects," "develop," "possible," "emerging," "opportunity," "pursue" 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. Factors that may cause our actual results to differ materially from those in the forward-looking statements include reductions in customers' research budgets or government funding; domestic and global economic conditions; economic, political and other risks associated with international revenues and operations; newly enacted U.S. government tax reform; currency exchange rate fluctuations; economic and political conditions generally and those affecting pharmaceutical and biotechnology industries; the seasonal nature of purchasing in Europe; our failure to expand into foreign countries and international markets; our inability to manage our growth; competition from our competitors; failure or inadequacy of the our information technology structure; impact of difficulties implementing our enterprise resource planning systems; information security incidents or cybersecurity breaches; our failure to identify potential acquisition candidates and successfully close such acquisitions with favorable pricing or integrate acquired businesses or technologies; unanticipated costs relating to acquisitions and known and unknown costs arising in connection with our consolidation of business functions and any restructuring initiatives; failure of any banking institution in which we deposit our funds or its failure to provide services; our substantial debt and our ability to meet the financial covenants contained in our credit facility; our failure to raise or generate capital necessary to implement our acquisition and expansion strategy; the failure of Biostage to indemnify us for any liabilities associated with Biostage's business; impact of any impairment of our goodwill or intangible assets; our ability to retain key personnel; failure or inadequacy or our information technology structure; rising commodity and precious metals costs; our ability to protect our intellectual property and operate without infringing on others' intellectual property; exposure to product and other liability claims; global stock market volatility, currency exchange rate fluctuations and regulatory changes caused by the United Kingdom's likely exit from the European Union; plus other factors described under the heading "Item 1A. Risk Factors" in our Annual Report on Form 10-K for the year ended December 31, 2017, or described in our other public filings. Our results may also be affected by factors of which we are not currently aware. 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.

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 around the world 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, Italy Canada, and China.

Led by President and CEO Jeffrey A. Duchemin, we are pursuing a strategy to grow the business through strategic, accretive acquisitions, including five acquisitions since the fourth quarter of 2014. In January 2018, we acquired Data Sciences International, Inc. (DSI) for approximately $70.6 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.

We have also 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).

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 breadth 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;
- strategic acquisitions;
- operational efficiencies; and
- new product development;

Components of Operating Income

As previously described above, on January 22, 2018, we sold substantially all the assets of our operating subsidiary, Denville. The sale of Denville represented a strategic shift that has and will have a major effect on our operations and financial results. As such and pursuant to the accounting standards, the operating results of Denville for the three and nine months ended September 30, 2018 and 2017 have been presented in discontinued operations in the consolidated statements of operations. Therefore the amounts and percentages discussed below exclude the revenues and expenses of Denville unless otherwise described.

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 included in continuing operations represented approximately 63% and 57% of our revenues for the three months ended September 30, 2018 and 2017, respectively. Revenues from direct sales to end users included in continuing operations represented approximately 58% and 55% of our revenues for the nine months ended September 30, 2018 and 2017, respectively.

Our products consist of instruments, consumables, and systems that are made up of several individual products. Sales prices of these products range from under $100 to over $100,000, although are mostly priced in the range of $5,000 to $15,000. 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. Following the acquisition of DSI, our products and services also include wireless monitors, data acquisition and analysis products and software, and ancillary services including post-contract customer support, training and installation.

We use distributors for both our catalog products and our higher priced products, as well as for sales in locations where we do not have subsidiaries or where we have existing distributors in place from acquired businesses. For the three months ended September 30, 2018 and 2017, approximately 37% and 43% of our total revenues from continuing operations, respectively, were derived from sales to distributors. For the nine months ended September 30, 2018 and 2017, approximately 42% and 45% of our total revenues from continuing operations, respectively, were derived from sales to distributors.

For the three months ended September 30, 2018 and 2017, approximately 86% and 83% of our revenues from continuing operations, respectively, were derived from products we manufacture and approximately 14% and 17%, 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. For the nine months ended September 30, 2018 and 2017, approximately 87% and 82% of our revenues from continuing operations, respectively, were derived from products we manufacture and approximately 13% and 18%, 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.

For the three months ended September 30, 2018 and 2017, approximately 28% and 46% of our revenues from continuing operations, respectively, were derived from sales made by our non-United States operations. For the nine months ended September 30, 2018 and 2017, approximately 32% and 44% of our revenues from continuing operations, respectively, were derived from sales made by our non-United States operations. As discussed later under “Selected Results of Operations”, the increase in revenues is primarily attributable to currency translation and the acquisition of DSI.

Changes in the relative proportion of our revenue sources between direct sales and distribution sales, and the proportion of U.S. and non-U.S sales are primarily the result of the acquisition of DSI.

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, information technology infrastructure, 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. Grants received from governmental entities related to research projects 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.

Stock-based compensation expenses. Stock-based compensation expense for the three months ended September 30, 2018 and 2017 was $0.5 million and $0.9 million, respectively. These amounts include stock-based compensation related to discontinued operations of $0 and $25 thousand, respectively. Stock-based compensation expense for the nine months ended September 30, 2018 and 2017 was $2.2 million and $2.6 million, respectively. Included in stock-based compensation expense for the nine months ended September 30, 2018 and 2017 was stock-based compensation related to discontinued operations of $0.2 million and $73 thousand, 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 income (loss) from discontinued operations.

Selected Results of Operations

Three Months Ended September 30, 2018 compared to Three Months Ended September 30, 2017

	Three Months Ended September 30, 2018	Three Months Ended September 30, 2017	Dollar Change	% Change
	(dollars in thousands)			
Revenues	$ 28,635	$ 18,717	$ 9,918	53.0%
Cost of revenues	12,818	9,217	3,601	39.1%
Gross margin percentage	55.2%	50.8%	N/A	8.8%
Sales and marketing expenses	6,021	3,635	2,386	65.6%
General and administrative expenses	4,655	4,317	338	7.8%
Research and development expenses	2,783	1,538	1,245	80.9%
Amortization of intangible assets	1,468	400	1,068	267.0%
Other expense, net	1,798	274	1,524	556.2%
Income from discontinued operations	-	228	(228)	-100.0%

Unless otherwise described, the amounts and percentages in the table above and those amounts and percentages discussed below exclude the revenues and expenses of Denville.

Revenues

Revenues for the three months ended September 30, 2018 were $28.6 million, an increase of approximately 53.0%, or $9.9 million, compared to revenues of $18.7 million for the three months ended September 30, 2017.

The increase in revenues reflects the addition of revenues from DSI in the quarter of approximately $11.1 million, while currency translation negatively impacted revenues in the quarter by approximately $0.1 million.

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

	For the Three Months Ended September 30, 2018
Organic and DSI change	53.6%
Foreign exchange effect	-0.6%
Total revenue change	53.0%

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 $12.8 million for the three months ended September 30, 2018, an increase of $3.6 million, or 39.1%, compared with $9.2 million for the three months ended September 30, 2017. The increase in cost of revenues was primarily due to the increase in revenues in comparison to the prior period, as a result of the acquisition of DSI. Gross profit margin as a percentage of revenues increased to 55.2% for the three months ended September 30, 2018 compared with 50.8% for 2017. The increase in gross profit margin is primarily attributable to the effect of higher margin products following the acquisition of DSI.

Sales and marketing expenses

Sales and marketing expenses increased $2.4 million or 65.6% to $6.0 million for the three months ended September 30, 2018 compared to $3.6 million during the same period in 2017. The increase in sales and marketing expenses was primarily due to the impact of the acquisition of DSI.

General and administrative expenses

General and administrative expenses were $4.7 million for the three months ended September 30, 2018, an increase of $0.4 million, or 7.8%, compared with $4.3 million for the three months ended September 30, 2017. The increase in these expenses was primarily attributable to the impact of the acquisition of DSI and largely offset by a decrease in stock-based compensation expense, employee costs and professional services fees.

Research and development expenses

Research and development expenses were $2.8 million for the three months ended September 30, 2018, an increase of $1.3 million, or 80.9%, compared with $1.5 million for the three months ended September 30, 2017. The increase in expense was primarily due to the impact of the acquisition of DSI.

Amortization of intangible assets

Amortization of intangible asset expenses was $1.5 million and $0.4 million for the three months ended September 30, 2018 and 2017, respectively. The increase in amortization expense was primarily due to the addition of definite-lived intangible assets as a result of the DSI acquisition.

Other expense, net

Other expense, net, from continuing operations was $1.8 million and $0.3 million for the three months ended September 30, 2018 and 2017, respectively. Included in other expense, net for three months ended September 30, 2018 and 2017 was interest expense of $1.5 million and $0.2 million, respectively. The increase in interest expense was primarily due to a higher debt balance during the third quarter of 2018 as compared to the same period in 2017.

Income taxes

Income tax from continuing operations was a benefit of approximately $0.7 million and $19 thousand for the three months ended September 30, 2018 and 2017, respectively. Tax benefit for the three months ended September 30, 2018 reflects a benefit determined under the annualized effective tax method. Tax benefit for the three months ended September 30, 2017 reflects the benefit associated with the actual results for the three-month period. Discrete items included in the tax expense for the three months ended September 30, 2018 included foreign currency gains and losses, withholding taxes and the reversal of a reserve for uncertain tax positions due to lapse in the statute of limitations. Discrete items for the three months ended September 30, 2017 included changes to reserves for uncertain tax positions and tax impact of stock-based compensation.

On December 22, 2017, tax reform legislation known as the Tax Cuts and Jobs Act (the “Tax Act”) was signed into law. For the year ended December 31, 2017, we recorded provisional amounts relating to the revaluation of deferred tax assets and liabilities, 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 are still based on estimates, we will continue to measure the impact of these areas and record any changes in subsequent quarters when information and guidance become available.

As part of the 2017 Tax Act, there is a provision for the taxation of certain off-shore earnings referred to as the Global Intangible Low-Taxed Income (“GILTI”) provision. In connection with this new provision, we have recorded current expense within the period but continues the process of determining its final accounting policy in regard to this new tax.

The difference between our effective tax rate period over period was primarily attributable to higher pre-tax income at certain individual subsidiaries in 2018 versus 2017, despite an overall pre-tax loss in both periods, as well as the impact of non-deductible acquisition costs and certain provisions of U.S. tax reform in 2018. An additional factor was the impact of changes in the valuation allowance position recorded in certain countries.

We have operations in the UK and several European countries where we historically had material current and deferred income tax balances related to those activities. As such, the UK's 2016 decision to withdraw from the European Union or the EU could have a material effect on our current and deferred income taxes. In March 2017, the UK initiated, through letter submission to the EU, a formal two-year process to officially withdraw its membership. During this two-year period, the UK and EU member states are expected to negotiate many provisions in the UK bilateral agreements and tax treaties with EU member states as well as EU rules governing the income tax treatment of deferred intercompany profits. The final outcome of these negotiations will not be known until both the EU and the UK approve them and the UK enacts the related changes in its tax laws. EU law will cease to apply in the UK at the end of the two-year process in March 2019, unless the negotiations are extended. The letter submission in March 2017 is an administrative step required to begin the formal withdrawal process and is not considered a tax law enactment under ASC 740. Additionally, in order to ensure that all EU laws remain in place until specifically repealed, the UK government has announced its intention to enact a 'Repeal Bill' which enshrines all EU law into domestic UK legislation. As of the filing date of this Form 10-Q, this Repeal Bill has not been enacted. Consequently, we plan to adjust our current and deferred taxes when tax law changes related to UK's withdrawal from the EU are actually enacted and/or when EU law ceases to apply in the UK.

Income from discontinued operations

Discontinued operations resulted in income of $0 for the three months ended September 30, 2018 and $0.2 million for the same period in the prior year. On January 22, 2018, we sold substantially all the assets of Denville, for approximately $20.0 million, which includes a $3.0 million earn-out provision (the Denville Transaction). The results of Denville were presented in discontinued operations for both the three months ended September 30, 2018 and 2017.

Nine Months Ended September 30, 2018 compared to Nine Months Ended September 30, 2017

	Nine Months Ended September 30,		Dollar	%
	2018	2017	Change	Change
	(dollars in thousands)			
Revenues	$ 86,916	$ 55,761	$ 31,155	55.9%
Cost of product revenues	42,475	27,611	14,864	53.8%
Gross margin percentage	51.1%	50.5%	N/A	1.3%
Sales and marketing expenses	17,976	10,663	7,313	68.6%
General and administrative expenses	15,297	13,219	2,078	15.7%
Research and development expenses	7,943	4,119	3,824	92.8%
Amortization of intangible assets	3,983	1,158	2,825	244.0%
Other expense, net	7,262	1,137	6,125	538.7%
Income from discontinued operations	1,820	141	1,679	1190.8%

Unless otherwise described, the amounts and percentages in the table above and those amounts and percentages discussed below exclude the revenues and expenses of Denville.

Revenues

Revenues for the nine months ended September 30, 2018 were $86.9 million, an increase of 55.9%, or $31.2 million, compared to revenues of $55.8 million for the same period in 2017.

The increase in revenues reflects the addition of revenues from DSI in the nine months ended September 30, 2018 of approximately $29.3 million, while the impact of currency translation positively impacted revenues in the period by approximately $1.5 million. The favorability in currency translation in the nine months period was primarily from the strengthening of the euro and British pound against the U.S. dollar.

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

	For the Nine Months Ended September 30, 2018
Organic and DSI change	53.2%
Foreign exchange effect	2.7%
Total revenue change	55.9%

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 increased $14.9 million, or 53.8%, to $42.5 million for the nine months ended September 30, 2018 compared with $27.6 million for the nine months ended September 30, 2017. The increase in cost of revenues was primarily due to the increase in revenues, including the effect on cost of revenues of the acquisition of DSI which was approximately $10.5 million. Gross profit margin as a percentage of revenues increased to 51.1% for the nine months ended September 30, 2018 compared with 50.5% for 2017. The increase in gross profit margin is primarily attributable to the effect of higher margin products following the acquisition of DSI. The increase in gross profit margin was offset by the effect of a $3.8 million charge recognized in cost of revenues during the nine-months period ended September 30, 2018 related to a purchase accounting inventory fair value step up amortization. This inventory fair value step up was fully recognized into cost of revenues over one inventory turn, or approximately six months.

Sales and marketing expenses

Sales and marketing expenses increased $7.3 million, or 68.6%, to $18.0 million for the nine months ended September 30, 2018 compared with $10.7 million for the nine months ended September 30, 2017. The increase in sales and marketing expenses was primarily due to the impact of the acquisition of DSI, with the rest of the increase being attributable to increases in employee and consulting costs.

General and administrative expenses

General and administrative expenses increased $2.1 million, or 15.7%, to $15.3 million for the nine months ended September 30, 2018 compared with $13.2 million for the nine months ended September 30, 2017. The increase was primarily attributable to the impact of the acquisition of DSI. This increase was partially offset by a decrease in stock-based compensation expense and employee costs.

Research and development expenses

Research and development expenses were $7.9 million for the nine months ended September 30, 2018, an increase of $3.8 million, or 92.8%, compared with $4.1 million for the nine months ended September 30, 2017. The increase was primarily due to the impact of the acquisition of DSI.

Amortization of intangible assets

Amortization of intangible asset expenses was $4.0 million and $1.2 million for the nine months ended September 30, 2018 and 2017, respectively. The increase in amortization expense was primarily due to the addition of definite-lived intangible assets as a result of the DSI acquisition.

Other expense, net

Other expense, net, was $7.3 million and $1.1 million for the nine months ended September 30, 2018 and 2017, respectively. The increase in other expense, net was primarily due to an increase in interest expense as a result of higher debt balances during the current period compared to the same period last year as well as transaction costs incurred this year of approximately $3.2 million, related to the acquisition of DSI and divestiture of Denville. These increases were offset by a decrease in foreign currency losses as compared to the prior period. Interest expense was $3.8 million and $0.5 million for the nine months ended September 30, 2018 and 2017, respectively. Currency exchange rate fluctuations included as a component of net loss resulted in approximately $28 thousand and $0.5 million in currency losses during the nine months ended September 30, 2018 and 2017, respectively.

Income taxes

Income tax from continuing operations was a benefit of $0.4 million and $0.1 million for the nine months ended September 30, 2018 and 2017, respectively. The effective income tax rate was 5.2% for the nine months ended September 30, 2018, compared with 6.6% for the same period in 2017.

Tax benefit for the nine months ended September 30, 2018 reflects a benefit determined under the annualized effective tax method. The tax benefit for the nine-month period ended September 30, 2017 reflects actual results for the nine-month period rather than an annual effective rate estimated for the entire year. In 2017 we determined that using a year-to-date approach resulted in a better estimate of income tax expense/benefit based on our forecast of pre-tax income/loss, the mix of taxable income/loss across several jurisdictions with different statutory tax rates, and the impact of the full valuation allowance against U.S. deferred tax assets. The impact of recent events including U.S. tax reform and a major acquisition in January 2018 have significantly contributed to a change in our determination regarding the use of the year-to-date method, which has been discontinued effective in the first quarter of 2018, the annualized effective tax rate method is used instead.

The difference between our effective tax rate period over period was primarily attributable to higher pre-tax income at certain individual subsidiaries in 2018 versus 2017 despite an overall pre-tax loss in both periods, as well as the impact of non-deductible acquisition costs and certain provisions of U.S. tax reform in 2018. An additional factor was the impact of changes in the valuation allowance position recorded in certain countries.

We have operations in the UK and several European countries where we historically had material current and deferred income tax balances related to those activities. As such, the UK's 2016 decision to withdraw from the European Union or the EU could have a material effect on our current and deferred income taxes. In March 2017, the UK initiated, through letter submission to the EU, a formal two-year process to officially withdraw its membership. During this two-year period, the UK and EU member states are expected to negotiate many provisions in the UK bilateral agreements and tax treaties with EU member states as well as EU rules governing the income tax treatment of deferred intercompany profits. The final outcome of these negotiations will not be known until both the EU and the UK approve them and the UK enacts the related changes in its tax laws. EU law will cease to apply in the UK at the end of the two-year process in March 2019, unless the negotiations are extended. The letter submission in March 2017 is an administrative step required to begin the formal withdrawal process and is not considered a tax law enactment under ASC 740. Additionally, in order to ensure that all EU laws remain in place until specifically repealed, the UK government has announced its intention to enact a 'Repeal Bill' which enshrines all EU law into domestic UK legislation. As of the filing date of this Form 10-Q, this Repeal Bill has not been enacted. Consequently, we plan to adjust our current and deferred taxes when tax law changes related to UK's withdrawal from the EU are actually enacted and/or when EU law ceases to apply in the UK.

Income from discontinued operations

Discontinued operations resulted in income of $1.8 million for the nine months ended September 30, 2018 and $0.1 million for the same period in the prior year. On January 22, 2018, we sold substantially all the assets of Denville, for approximately $20.0 million, which includes a $3.0 million earn-out provision (the Denville Transaction). The results of Denville were presented in discontinued operations for both the nine months ended September 30, 2018 and 2017. The income from discontinued operations for the nine months ended September 30, 2018 included a gain on sale of Denville of $1.3 million and an income tax benefit of $0.9 million. The income tax benefit was mainly due to the reversal of deferred tax liabilities associated with indefinite lived intangibles following the Denville Transaction.

Liquidity and Capital Resources

Historically, we have financed our business through cash provided by operating activities, bank borrowings, and the issuance of common stock. Our liquidity requirements arise primarily from investing activities, including funding of acquisitions, and other capital expenditures.

On January 22, 2018, we sold the operations of Denville, and received approximately $15.8 million, net of cash on hand. Simultaneously, we retired the existing debt balances of approximately $11.9 million. On January 31, 2018, we entered into a financing agreement, which comprised of a $64.0 term loan and up to a $25.0 million line of credit. Finally, on January 31, 2018, we acquired DSI for approximately $68.0 million, net of cash acquired.

As of September 30, 2018, we held cash and cash equivalents from continuing operations of $6.7 million, compared with $5.2 million at December 31, 2017. As of September 30, 2018 and December 31, 2017, we had $61.0 million and $11.7 million of borrowings outstanding under our credit facility, net of deferred financing costs, respectively. Total debt, net of cash and cash equivalents was $54.4 million at September 30, 2018, compared to $6.6 million at December 31, 2017. In addition, we had an underfunded United Kingdom pension liability of approximately $1.2 million at September 30, 2018 and December 31, 2017, respectively.

As of September 30, 2018 and December 31, 2017, cash and cash equivalents held by our foreign subsidiaries was $3.2 million and $4.8 million, respectively. 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 fourth quarter 2017 provision under the required one-time repatriation tax calculation. Prior to 2017, this modified assertion only applied to our subsidiaries in France and Canada. Therefore, as a result of this change in assertion, only $38 thousand of additional withholding has been accrued as of December 31, 2017. At September 30, 2018, the accrued withholding tax has been reduced to $29 thousand related to amounts determined to be available for repatriation.

Condensed Cash Flow Statements
(unaudited)

	Nine Months Ended September 30,	
	2018	**2017**
	(in thousands)	
Cash flows from operations:		
Net loss	$ (5,784)	$ (1,864)
Other adjustments to operating cash flows	7,065	5,506
Changes in assets and liabilities	(990)	(1,646)
Net cash provided by operating activities	291	1,996
Investing activities:		
Additions to property, plant and equipment	(891)	(677)
Acquisition, net of cash acquired	(68,008)	-
Disposition, net of cash sold	15,754	-
Other investing activities	(24)	(39)
Net cash used in investing activities	(53,169)	(716)
Financing activities:		
Net proceeds from issuance of debt	50,853	(1,252)
Other financing activities	2,554	(101)
Net cash provided by (used in) financing activities	53,407	(1,353)
Effect of exchange rate changes on cash	399	313
Increase in cash and cash equivalents	$ 928	$ 240

Our operating activities provided cash of $0.3 million and $2.0 million for the nine months ended September 30, 2018 and 2017, respectively. The decrease in net cash flow from operations was primarily due to the increase in net loss as well as the effect of changes in working capital period over period.

Our investing activities used cash of $53.2 million and $0.7 million for the nine months ended September 30, 2018 and 2017, respectively. Investing activities during the nine months ended September 30, 2018 primarily consisted of $68.0 million paid for the acquisition of DSI and $15.8 million received from the disposition of Denville. Investing activities during the nine months ended September 30, 2017 primarily included cash used for purchases of property, plant and equipment. We spent $0.9 million and $0.7 million on capital expenditures during the nine months ended September 30, 2018 and 2017, respectively.

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 nine months ended September 30, 2018, financing activities provided cash of $53.4 million, compared with $1.4 million of cash used by financing activities for the nine months ended September 30, 2017. During the nine months ended September 30, 2018, we borrowed $70.8 million, repaid $19.9 million of debt and ended the quarter with $61.0 million of borrowings, net of deferred financing costs of $1.7 million. During the nine months ended September 30, 2017, we borrowed $2.3 million under our credit facility, repaid $3.5 million of debt under our credit facility and term loans and ended the quarter with $12.4 million of borrowings, net of deferred financing costs of $0.2 million. Net cash proceeds from the issuance of common stock for the nine months ended September 30, 2018 was $4.5 million. Net cash paid for tax withholdings from the issuance from common stock, related to the vesting of restricted stock units was $0.1 million for the nine months ended September 30, 2017.

Borrowing Arrangements

On January 22, 2018, in connection with the closing of the sale of Denville, we terminated the Third Amended and Restated Credit Agreement (the Credit Agreement), dated as of May 1, 2017, among us, 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 sale. At the time of repayment, there was approximately $11.9 million of borrowings outstanding.

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 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). On August 16, 2018, we and Cerberus Business Finance, LLC entered into a First Amendment to the Financing Agreement, which such amendment modified certain provisions relating to the borrowing base and reporting, among other things.

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, 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 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 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 our 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.

As of September 30, 2018 and December 31, 2017, we had borrowings net of debt issuance costs of $61.0 million and $11.7 million respectively, outstanding. 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 September 30, 2018, we were in compliance with all financial covenants contained in the Financing Agreement, were subject to covenant and working capital borrowing restrictions and had available borrowing capacity under our Financing Agreement of $8.5 million.

As of September 30, 2018, the weighted effective interest rate, net of the impact of our interest rate swap, on our Term Loan was 8.76%.

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 and capital expenditures for the next 12 months and beyond. We may however need to incur additional debt or raise 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.

Critical Accounting Policies

The critical accounting policies underlying the accompanying unaudited consolidated financial statements are those set forth in Part II, Item 7 included in our Annual Report on Form 10-K for the fiscal year ended December 31, 2017, which was filed with the SEC on March 16, 2018.

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, the euro, the Canadian dollar and the Swedish krona.

During the three months ended September 30, 2018, changes in foreign currency exchange rates 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 $0.1 million and a favorable effect on expenses of approximately $0.1 million. During the nine months ended September 30, 2018, changes in foreign currency exchange rates resulted in a favorable translation effect on our consolidated revenues and a favorable effect on our consolidated net loss. Changes in foreign currency exchange rates resulted in a favorable effect on revenues of approximately $1.5 million and an unfavorable effect on expenses of approximately $1.4 million.

The gain associated with the translation of foreign equity into U.S. dollars included as a component of comprehensive gain (loss) during the three months ended September 30, 2018, was approximately $0.4 million, compared to a gain of $1.2 million for the three months ended September 30, 2017. The loss associated with the translation of foreign equity into U.S. dollars included as a component of comprehensive gain (loss) during the nine months ended September 30, 2018, was approximately $1.0 million, compared to a gain of $4.2 million for the nine months ended September 30, 2017.

In addition, currency exchange rate fluctuations included as a component of net loss resulted in approximately $26 thousand and $0.1 million in currency losses during the three months ended September 30, 2018 and 2017, respectively. Currency exchange rate fluctuations included as a component of net loss resulted in approximately $28 thousand and $0.5 million in currency losses during the nine months ended September 30, 2018 and 2017, respectively.

Recently Issued Accounting Pronouncements

In February 2016, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (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. A modified retrospective transition approach is required for leases existing at, or entered into after, the beginning of the earliest comparative period presented in the financial statements, with certain practical expedients available. We expect to utilize a practical expedient in our method of adoption of the standard. Under this expedient, which is a "current-period adjustment method," we would apply ASC 842 as of January 2019 and record a cumulative-effect adjustment to retained earnings as of that date.

We have collected information on our leases and are in the process of evaluating and applying the requirements of the standard to 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, we expect that the new standard will have a material effect on our consolidated balance sheet related to the recognition of new assets and lease liabilities. We expect to finalize our classification of leases as well as the effective interest rate to be applied in determining the lease liabilities during the fourth quarter of 2018. Our future commitments under lease obligations are summarized in Note 12.

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 *Derivatives and Hedging*. 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 has not yet determined the impact of the adoption on its consolidated financial position, results of operations and cash flows.

Recently Adopted Accounting Pronouncements

In May 2014, the FASB issued 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 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 service, maintenance and extended warranty transactions on certain product sales. The timing of recognizing revenues for these revenue streams did not materially change. Additionally, there were no material changes to business processes, systems and controls. Our updated revenue recognition policy and additional disclosures are presented in Note 17.

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.

Item 3. ***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 September 30, 2018, we had $61.0 million outstanding under our Financing Agreement, net of deferred financing costs.

As noted above under the heading "Borrowing Arrangements", 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 September 30, 2018, the weighted effective interest rates, net of the impact of our interest rate swaps, on our Term Loan was 8.76%. 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 as of September 30, 2018 is quantified and summarized as follows:

If compared to the rate as of September 30, 2018	Interest expense increase
	(in thousands)
Interest rates increase by 1%	$ 280
Interest rates increase by 2%	$ 559

Item 4. ***Controls and Procedures.***

Disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act) are designed to ensure that information required to be disclosed in reports filed or submitted under the Exchange Act is recorded, processed, summarized, and reported within the time periods specified in SEC rules and forms and that such information is accumulated and communicated to management, including the Chief Executive Officer and the Principal Financial Officer, to allow timely decisions regarding required disclosures.

As required by Rules 13a-15(e) and 15d-15(e) under the Exchange Act, our management, under the supervision and with the participation of our Chief Executive Officer and Principal Financial Officer, conducted an evaluation of the effectiveness of the design and operation of our disclosure controls and procedures as of September 30, 2018. Our disclosure controls and procedures are designed to provide reasonable assurance that information required to be disclosed by us in the reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and our management necessarily was required to apply its judgment in evaluating and implementing our disclosure controls and procedures. Based upon the evaluation described above, our management concluded that our disclosure controls and procedures for the periods covered by this report were effective, as of the end of the period covered by this Quarterly Report on Form 10-Q, 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 Principal Financial Officer, to allow timely decisions regarding required disclosures, and is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms.

We continue to review our internal controls over financial reporting, and may from time to time make changes aimed at enhancing their effectiveness and to ensure that our systems evolve with our business. There were no changes in our internal controls over financial reporting that occurred during the nine months ended September 30, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

PART II. OTHER INFORMATION

Item 1A. ***Risk Factors.***

To our knowledge, and except to the extent additional factual information disclosed in this Quarterly Report on Form 10-Q relates to such risk factors, there has been no material changes in the risk factors described in "Item 1A. Risk Factors" in our Annual Report on Form 10-K for the year ended December 31, 2017, which was filed with the SEC on March 16, 2018.

Item 6. ***Exhibits.***

Exhibit Index	
10.1	First Amendment to Financing Agreement, dated as of August 16, 2018, between Harvard Bioscience, Inc., each of the borrowers named therein, the lenders from time to time party thereto, and Cerberus Business Finance, LLC.
31.1	Certification of Vice President, Corporate Controller (Principal Financial Officer) of Harvard Bioscience, Inc., pursuant to Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
31.2	Certification of Chief Executive Officer of Harvard Bioscience, Inc., pursuant to Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
32.1*	Certification of Vice President, Corporate Controller (Principal 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.
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101.SCH	XBRL Taxonomy Extension Schema Document
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document
101.LAB	XBRL Taxonomy Extension Labels Linkbase Document
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document

* 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.

SIGNATURES

Pursuant to the requirements 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.

Date: November 1, 2018

HARVARD BIOSCIENCE, INC.

By: /S/ JEFFREY A. DUCHEMIN
Jeffrey A. Duchemin
Chief Executive Officer

By: /S/ COREY W. MANCHESTER
Corey W. Manchester
Vice President, Corporate Controller
(Principal Financial Officer)

INDEX TO EXHIBITS

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Exhibit 10.1

FIRST AMENDMENT TO FINANCING AGREEMENT

FIRST AMENDMENT, dated as of August 16, 2018 (this "Amendment"), to the Financing Agreement, dated as of January 31, 2018 (as the same may be amended, restated, supplemented or otherwise modified from time to time, including any replacement agreement therefor, the "Financing Agreement"), by and among Harvard Bioscience, Inc., a Delaware corporation (the "Parent" or the "Borrowing Agent"), each subsidiary of the Parent listed as a "Borrower" on the signature pages thereto (together with the Parent and each other Person that executes a joinder agreement and becomes a "Borrower" thereunder, each a "Borrower" and collectively, the "Borrowers"), the Guarantors (as defined therein) from time to time party thereto, the lenders from time to time party thereto (each a "Lender" and collectively, the "Lenders"), Cerberus Business Finance, LLC, a Delaware limited liability company, as collateral agent for the Lenders (in such capacity, together with its successors and assigns in such capacity, the "Collateral Agent"), and PNC Bank, National Association, as administrative agent for the Lenders (in such capacity, together with its successors and assigns in such capacity, the "Administrative Agent" and together with the Collateral Agent, each an "Agent" and, collectively, the "Agents").

WHEREAS, the Loan Parties have requested, and the Agents and the Lenders have agreed, subject to the terms and conditions set forth herein, to amend the Financing Agreement on the terms and conditions set forth below.

NOW THEREFORE, in consideration of the premises and other good and valuable consideration, the parties hereto hereby agree as follows:

1. Definitions. All terms used herein that are defined in the Financing Agreement and not otherwise defined herein shall have the meanings assigned to them in the Financing Agreement.

2. Amendments.

(a) Section 1.01 of the Financing Agreement is hereby amended by adding the following definition in appropriate alphabetical order:

"'Borrowing Base Limited Option Period' means the period (x) beginning on the date on which the Administrative Agent receives written notice from the Borrowing Agent stating that the Loan Parties have elected to limit the Borrowing Base calculation to the assets of the Loan Parties constituting the Parent and Surviving Borrower located in the United States, which period may commence solely to the extent there does not exist an Event of Default and Availability (calculated after giving effect to the limitation referred to in this subclause (x)) is not less than or equal to $2,000,000, and (y) ending upon the earlier of (i) the date on which the Administrative Agent receives written notice from the Borrowing Agent stating that the Loan Parties have elected to terminate such limitation on the Borrowing Base calculation and (ii) at the option of the Collateral Agent, at any time during the existence of an Event of Default or if Availability (after giving effect to the Borrowing Base limitation referred to in subclause (x) above) is less than or equal to $2,000,000. Notwithstanding the foregoing, the initial Borrowing Base Limited Option Period commenced on April 30, 2018."

(b) The paragraph immediately after the formula set forth in the definition of "Borrowing Base" in Section 1.01 of the Financing Agreement is hereby amended and restated in its entirety to read as follows:

"Notwithstanding anything to the contrary in the defined term "Borrowing Base" or any other related definition or provision in this Agreement, (A) none of the Eligible Inventory located at the Foreign Loan Parties' locations in Canada or the United Kingdom shall be included in the Borrowing Base until the Administrative Agent shall have received field examinations and/or appraisals of such Eligible Inventory, in each case in form and substance reasonably acceptable to Administrative Agent in its Permitted Discretion, (B) during the Borrowing Base Limited Option Period, the value attributable to the Eligible Accounts, Eligible Inventory and Eligible Work-in-Process contained in the determination of the Borrowing Base shall include only such assets of the Loan Parties constituting the Parent and the Surviving Borrower located in the United States and not any such assets that are not located in the United States or the assets of any other Loan Party, (C) to the extent that the Borrowing Base Limited Option Period terminates for any reason, the Borrowing Base may include the Eligible Accounts, Eligible Inventory and Eligible Work-in-Process of Biochrom US, Inc. in the determination of the Borrowing Base with the aggregate value attributable thereto not to exceed $1,750,000 until the Agents shall have received a Field Survey and Audit and appraisal of such assets in form and substance satisfactory to the Agents and the Eligible Accounts, Eligible Inventory and Eligible Work-in-Process of all other Loan Parties and any assets of the Parent and the Surviving Borrower not located in the United States shall not be included in the determination of the Borrowing Base until the Agents receive a Field Survey and Audit and appraisal of such assets in form and substance satisfactory to the Agents and (D) during the Borrowing Base Limited Option Period, certain categories of Collateral that are not eligible for inclusion in the Borrowing Base and the respective amounts thereof shall be set forth on Schedule 1.01(F), and such categories and amounts may be updated or otherwise changed based on the results of the most recent Field Survey and Audit as determined by the Administrative Agent in its Permitted Discretion. The Field Survey and Audits and appraisals referenced in clause (C) above shall be at the expense of the Borrowers and shall be in addition to those referenced in the last sentence of Section 2.06(c)."

(c) The last sentence of Section 2.06(c) of the Financing Agreement is hereby amended and restated in its entirety to read as follows:

"The foregoing notwithstanding, so long as no Event of Default shall have occurred and be continuing, the Borrowers shall not be obligated to reimburse the Agents or Lenders for more than two Field Survey and Audits and one inventory appraisal in any twelve month period, provided, that, during the Borrowing Base Limited Option Period, the Borrowers shall only be obligated to reimburse such expenses to the extent attributable to the Field Survey and Audits and appraisals of the assets and operations of the Parent and the Surviving Borrower located in the United States."

(d) Section 7.01(a)(i) of the Financing Agreement is hereby amended and restated in its entirety to read as follows:

"within 30 days after the end of each fiscal month of the Parent and its Subsidiaries commencing with the first fiscal month of the Parent and its Subsidiaries ending after the Effective Date, internally prepared consolidated and consolidating balance sheets, statements of operations and retained earnings as at the end of such fiscal month, and for the period commencing at the end of the immediately preceding Fiscal Year and ending with the end of such fiscal month, setting forth in each case in comparative form the figures for the corresponding date or period set forth in (A) the financial statements for the immediately preceding Fiscal Year, and (B) the Projections, all in reasonable detail and certified by an Authorized Officer of the Parent as fairly presenting, in all material respects, the financial position of the Parent and its Subsidiaries as at the end of such fiscal month and the results of operations and retained earnings of the Parent and its Subsidiaries for such fiscal month and for such year-to-date period, in accordance with GAAP applied in a manner consistent with that of the most recent audited financial statements furnished to the Agents and the Lenders, subject to the absence of footnotes and normal year-end adjustments;"

(e) The following proviso is hereby added to the end of Section 7.01(a)(v) of the Financing Agreement immediately prior to the semicolon thereto as follows:

"; provided, that, during the Borrowing Base Limited Option Period, such reports required pursuant to this Section 7.01(a)(v) shall be limited to assets of the Parent and the Surviving Borrower located in the United States"

(f) Schedule 1.01(F) set forth in Annex A hereto shall be appended to the end of the Financing Agreement.

3. Acknowledgement.

(a) Pursuant to Section 5.03(a)(i) of the Financing Agreement, the Loan Parties were required to furnish to the Collateral Agent, within 90 days after the Effective Date (or such later date as determined by the Agents in their sole discretion), all Cash Management Agreements that, in the reasonable judgment of the Agents, are required for the Loan Parties to comply with the Loan Documents as of the Effective Date, each duly executed by, in addition to the applicable Loan Party, the applicable financial institution. Notwithstanding anything contained in the Financing Agreement, the Agents and the Lenders acknowledge and agree that all Cash Management Agreements required to be furnished to the Collateral Agent pursuant to Section 5.03(a) of the Financing Agreement have been furnished.

(b) Pursuant to Section 5.03(a)(ii) of the Financing Agreement, the Loan Parties were required to furnish to the Collateral Agent, within 90 days after the Effective Date (or such later date as determined by the Agents in their sole discretion), Processor Letters from each Credit Card Processor set forth on Schedule 6.01(jj) as of the Effective Date. Notwithstanding anything contained in the Financing Agreement, the Agents and the Lenders acknowledge and agree that the Loan Parties have used commercially reasonable efforts to obtain such letters.

4. Representations and Warranties. Each Loan Party hereby represents and warrants to the Agents and the Lenders as follows:

(a) Organization, Good Standing, Etc. Each Loan Party and each of its Subsidiaries (i) is a corporation, limited company, limited liability company or limited partnership, as applicable, duly organized, validly existing and in good standing under the laws of the state or jurisdiction of its incorporation or organization, as applicable, (ii) has all requisite power and authority to conduct its business as now conducted and as presently contemplated and to execute and deliver this Amendment, and to consummate the transactions contemplated hereby and by the Financing Agreement, as amended hereby, and (iii) is duly qualified to do business and is in good standing in each jurisdiction in which the character of the properties owned or leased by it or in which the transaction of its business makes such qualification necessary, except (solely for the purposes of this subclause (iii)) where the failure to be so qualified or in good standing, individually or in the aggregate, could not reasonably be expected to result in a Material Adverse Effect.

(b) Authorization, Etc. The execution, delivery and performance by each Loan Party of this Amendment and the Financing Agreement, as amended hereby, (i) have been duly authorized by all necessary corporate or other organizational action, (ii) do not and will not contravene any of its Governing Documents or, in any material respect, any applicable Requirement of Law, (iii) do not and will not conflict with, result in a breach of, or constitute (with due notice or lapse of time or both) a default under any Material Contract, (iv) do not and will not result in or require the creation of any Lien (other than pursuant to any Loan Document) upon or with respect to any of its properties, and (v) do not and will not result in any default, noncompliance, suspension, revocation, impairment, forfeiture or nonrenewal of any material permit, license, authorization or approval applicable to its operations or any of its properties.

(c) Governmental Approvals. No authorization or approval or other action by, and no notice to or filing with, any Governmental Authority is required in connection with the due execution, delivery and performance by any Loan Party of this Amendment and the Financing Agreement, as amended hereby, other than (x) authorizations, approvals, notices, filings or other actions that have been obtained and that are still in force and effect and (y) filing of this Amendment with the SEC following the execution hereof.

(d) Enforceability of Amendment. Each of this Amendment and the Financing Agreement, as amended hereby, is and each other Loan Document to which any Loan Party is or will be a party, when delivered hereunder, will be a legal, valid and binding obligation of such Person which is a party thereto, enforceable against such Person in accordance with its terms, except as enforceability may be limited by applicable equitable principles or by bankruptcy, insolvency, reorganization, moratorium or other similar laws affecting the enforcement of creditors' rights generally.

5. Conditions to Effectiveness. This Amendment shall become effective only upon satisfaction in full, in a manner satisfactory to the Collateral Agent, of the following conditions precedent (the first date upon which all such conditions shall have been satisfied being herein called the "First Amendment Effective Date"):

(a) Delivery of Documents. The Collateral Agent shall have received this Amendment duly executed and delivered by the Loan Parties, the Agents and the Lenders.

(b) Representations and Warranties. The representations and warranties contained in ARTICLE VI of the Financing Agreement (as amended hereby) and in each other Loan Document, certificate or other writing delivered to any Secured Party pursuant hereto or thereto on or prior to the First Amendment Effective Date shall be true and correct in all material respects (except that such materiality qualifier shall not be applicable any representations or warranties that already are qualified or modified as to "materiality" or "Material Adverse Effect" in the text thereof, which representations and warranties shall be true and correct in all respects subject to such qualification) on and as of the First Amendment Effective Date as though made on and as of the First Amendment Effective Date, except to the extent that any such representation or warranty expressly relates solely to an earlier date (in which case such representation or warranty shall be true and correct in all material respects (except that such materiality qualifier shall not be applicable to any representations or warranties that already are qualified or modified as to "materiality" or "Material Adverse Effect" in the text thereof, which representations and warranties shall be true and correct in all respects subject to such qualification) on and as of such earlier date).

(c) No Default or Event of Default. After giving effect to this Amendment, no Default or Event of Default shall have occurred and be continuing on the First Amendment Effective Date or would result from this Amendment becoming effective in accordance with its terms.

(d) Payment of Fees, Etc. The Loan Parties shall have paid all fees, costs and expenses then due and payable by the Loan Parties pursuant to the Loan Documents, including, without limitation, the Fee Letter and Sections 2.06 and 12.04 of the Financing Agreement, so long as with respect to third party items they have been invoiced to the Loan Parties at least thirty (30) days prior to the First Amendment Effective Date.

6. Continued Effectiveness of the Financing Agreement and Other Loan Documents. Each Loan Party hereby (i) acknowledges and consents to this Amendment, (ii) confirms and agrees that the Financing Agreement and each other Loan Document to which it is a party is, and shall continue to be, in full force and effect and is hereby ratified and confirmed in all respects except that on and after the First Amendment Effective Date all references in any such Loan Document to "the Financing Agreement", the "Agreement", "thereto", "thereof", "thereunder" or words of like import referring to the Financing Agreement shall mean the Financing Agreement as amended by this Amendment, and (iii) confirms and agrees that to the extent that any such Loan Document purports to assign or pledge to the Collateral Agent for the benefit of the Agents and the Lenders, or to grant to the Collateral Agent for the benefit of the Agents and the Lenders a security interest in or Lien on, any Collateral as security for the Obligations from time to time existing in respect of the Financing Agreement (as amended hereby) and the other Loan Documents, such pledge, assignment and/or grant of the security interest or Lien is hereby ratified and confirmed in all respects. This Amendment does not and shall not affect any of the obligations of the Loan Parties, other than as expressly provided herein, including, without limitation, the Loan Parties' obligations to repay the Loans in accordance with the terms of Financing Agreement, or the obligations of the Loan Parties under any Loan Document to which they are a party, all of which obligations shall remain in full force and effect, and nothing herein contained shall be construed as a substitution or novation of the obligations outstanding under the Financing Agreement or instruments securing the same. Nothing expressed or implied in this Amendment shall be construed as a release or other discharge of any Loan Party under the Financing Agreement, or the other Loan Documents, as amended hereby, from any of its obligations and liabilities as a "Borrower", "Guarantor" or "Loan Party" thereunder. Except as expressly provided herein, the execution, delivery and effectiveness of this Amendment shall not operate as a waiver of any right, power or remedy of the Agents or any Lender under the Financing Agreement or any other Loan Document, nor constitute a waiver of any provision of the Financing Agreement or any other Loan Document.

7. Miscellaneous.

(a) This Amendment may be executed in any number of counterparts and by different parties hereto in separate counterparts, each of which shall be deemed to be an original but all of which taken together shall constitute one and the same agreement. Delivery of an executed counterpart of this Amendment by facsimile or electronic mail shall be equally effective as delivery of an original executed counterpart of this Amendment.

(b) Section and paragraph headings herein are included for convenience of reference only and shall not constitute a part of this Amendment for any other purpose.

(c) This Amendment shall be governed by, and construed in accordance with, the laws of the State of New York.

(d) Each Loan Party hereby acknowledges and agrees that this Amendment constitutes a "Loan Document" under the Financing Agreement. Accordingly, it shall be an Event of Default under the Financing Agreement if (i) any representation or warranty made by a Loan Party under or in connection with this Amendment shall have been incorrect in any material respect when made, or (ii) any Loan Party shall fail to perform or comply with any covenant or agreement contained in this Amendment.

(e) Any provision of this Amendment that is prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining portions hereof or affecting the validity or enforceability of such provision in any other jurisdiction.

[remainder of page intentionally left blank]

IN WITNESS WHEREOF, the parties hereto have caused this Amendment to be executed and delivered as of the date set forth on the first page hereof.

BORROWERS:

HARVARD BIOSCIENCE, INC.

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

DATA SCIENCES INTERNATIONAL, INC.

By: Harvard Bioscience, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

GUARANTORS:

HOEFER, INC.

By: Harvard Bioscience, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

WARNER INSTRUMENTS LLC

By: Harvard Bioscience, Inc., its sole member

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

TRIANGLE BIOSYSTEMS, INC.

By: Harvard Bioscience, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

DENVILLE SCIENTIFIC, INC.

By: Harvard Bioscience, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

COULBOURN INSTRUMENTS, LLC

By: Denville Scientific, Inc., its sole member
By: Harvard Bioscience, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

BIOCHROM US, INC.

By: Harvard Bioscience, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

BIOCHROM LIMITED

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Director

EALING SCIENTIFIC LIMITED /
LA COMPAGNIE SCIENTIFIQUE EALING LIMITÉE
By: Harvard Bioscience, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Chief Financial Officer

DATA SCIENCES UK (MN) LIMITED
By: Data Sciences International, Inc., its sole shareholder

By: /s/ Robert E. Gagnon
Name: Robert E. Gagnon
Title: Director

COLLATERAL AGENT:

CERBERUS BUSINESS FINANCE, LLC

By: /s/ Authorized Signatory
Name: Authorized Signatory
Title: Authorized Signatory

[First Amendment to Financing Agreement]

ADMINISTRATIVE AGENT AND A LENDER:

PNC BANK, NATIONAL ASSOCIATION

By: /s/ Matthew Leighton
Name: Matthew Leighton
Title: Vice President

LENDERS:

CERBERUS ASRS FUNDING LLC

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Vice President

CERBERUS CAVALIERS LEVERED LOAN OPPORTUNITIES FUND, LLC

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Vice President

CERBERUS ICQ OFFSHORE LEVERED LP
By: Cerberus ICQ Offshore GP LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

CERBERUS LOAN FUNDING XX L.P.
By: Cerberus LFGP XX, LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

CERBERUS LOAN FUNDING XXII L.P.
By: Cerberus LFGP XXII, LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

CERBERUS LOAN FUNDING XXIII L.P.
By: Cerberus LFGP XXIII, LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

CERBERUS LOAN FUNDING XXIV L.P.
By: Cerberus LFGP XXIV, LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

CERBERUS N-1 FUNDING LLC

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Vice President

CERBERUS ND LEVERED LLC

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Vice President

CERBERUS OFSHORE LEVERED LOAN OPPORTUNITIES MASTER FUND III, L.P.
By: Cerberus Offshore Levered Opportunities III GP, LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

CERBERUS PSERS LEVERED LLC

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Vice President

CERBERUS REDWOOD LEVERED A LLC

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Vice President

CERBERUS REDWOOD LEVERED LOAN OPPORTUNITIES FUND B, L.P.
By: Cerberus Redwood Levered Opportunities GP B, LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

CERBERUS SWC LEVERED HOLDINGS II LP
By: CSL Holdings II GP LLC
Its: General Partner

By: /s/ Daniel E. Wolf
Name: Daniel E. Wolf
Title: Senior Managing Director

ANNEX A

SCHEDULE 1.01(F)

INELIGIBLE CATEGORIES

	Total	HAI US	DSI
Sales Clearing	$47,700.00	$47,700.00	$0.00
Trade Clearing	$74,100.00	$74,100.00	$0.00
Deferred Revenue	$424,500.00	$14,500.00	$410,000.00
Warranties Contra	$246,300.00	$65,600.00	$180,700.00
FOB Destination	$197,000.00	$0.00	$197,000.00
Customer Replacement Unit Liab	$429,000.00	$0.00	$429,000.00
Debit Memos	$0.00	$0.00	$0.00
Tooling Bills	$0.00	$0.00	$0.00
Other	$0.00	$0.00	$0.00

EXHIBIT 31.1

Certification

I, Corey W. Manchester, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of Harvard Bioscience, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)), and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

a. Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

c. Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

b. Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: November 1, 2018

/s/ COREY W. MANCHESTER

Corey W. Manchester
Vice President, Corporate Controller
(Principal Financial Officer)

EXHIBIT 31.2

Certification

I, Jeffrey A. Duchemin, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of Harvard Bioscience, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)), and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

a. Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

c. Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

b. Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: November 1, 2018

/s/ JEFFREY A. DUCHEMIN

Jeffrey A. Duchemin
Chief Executive Officer

EXHIBIT 32.1

CERTIFICATION OF PERIODIC FINANCIAL REPORT

PURSUANT TO 18 U.S.C. SECTION 1350

The undersigned officer of Harvard Bioscience, Inc. (the Company) hereby certifies to his knowledge that the Company’s Quarterly Report on Form 10-Q for the quarterly period ended September 30, 2018 (the Report) to which this certification is being furnished as an exhibit, as filed with the Securities and Exchange Commission on the date hereof, fully complies with the requirements of Section 13(a) or 15(d), as applicable, of the Securities Exchange Act of 1934, as amended (the Exchange Act), and that the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company. This certification is provided solely pursuant to 18 U.S.C. Section 1350 and Item 601(b)(32) of Regulation S-K (Item 601(b)(32)) promulgated under the Securities Act of 1933, as amended (the Securities Act), and the Exchange Act. In accordance with clause (ii) of Item 601(b)(32), this certification (A) shall not be deemed “filed” for purposes of Section 18 of the Exchange Act, or otherwise subject to the liability of that section, and (B) shall not be deemed to be incorporated by reference into any filing under the Securities Act or the Exchange Act, except to the extent that the Company specifically incorporates it by reference.

Date: November 1, 2018

/s/ COREY W. MANCHESTER

Name: Corey W. Manchester
Title: Vice President, Corporate Controller
(Principal Financial Officer)

EXHIBIT 32.2

CERTIFICATION OF PERIODIC FINANCIAL REPORT

PURSUANT TO 18 U.S.C. SECTION 1350

The undersigned officer of Harvard Bioscience, Inc. (the Company) hereby certifies to his knowledge that the Company's Quarterly Report on Form 10-Q for the quarterly period ended September 30, 2018 (the Report) to which this certification is being furnished as an exhibit, as filed with the Securities and Exchange Commission on the date hereof, fully complies with the requirements of Section 13(a) or 15(d), as applicable, of the Securities Exchange Act of 1934, as amended (the Exchange Act), and that the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company. This certification is provided solely pursuant to 18 U.S.C. Section 1350 and Item 601(b)(32) of Regulation S-K (Item 601(b)(32)) promulgated under the Securities Act of 1933, as amended (the Securities Act), and the Exchange Act. In accordance with clause (ii) of Item 601(b)(32), this certification (A) shall not be deemed "filed" for purposes of Section 18 of the Exchange Act, or otherwise subject to the liability of that section, and (B) shall not be deemed to be incorporated by reference into any filing under the Securities Act or the Exchange Act, except to the extent that the Company specifically incorporates it by reference.

Date: November 1, 2018

/s/ JEFFREY A. DUCHEMIN

Name: Jeffrey A. Duchemin
Title: Chief Executive Officer