UNITED STATES SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 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, 2019

or

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

For the transition period from _______________ to ______________

Commission File Number 000-31311

PDF SOLUTIONS, INC.
(Exact name of Registrant as Specified in its Charter)

Delaware (State or Other Jurisdiction of Incorporation or Organization)	**25-1701361** (I.R.S. Employer Identification No.)
2858 De La Cruz Blvd. **Santa Clara, California** (Address of Principal Executive Offices)	**95050** (Zip Code)

(408) 280-7900
(Registrant's Telephone Number, Including Area Code)

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

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, $0.00015 par value	PDFS	The Nasdaq Stock Market LLC

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 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, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company" and "emerging growth company" in Rule 12b-2 of the Exchange Act.

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

If an emerging growth company, indicated 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 ☑

There were 32,350,187 shares of the Registrant's Common Stock outstanding as of November 1, 2019.

TABLE OF CONTENTS

PART I — FINANCIAL INFORMATION

Item 1. Financial Statements

PDF SOLUTIONS, INC.
CONDENSED CONSOLIDATED BALANCE SHEETS
(unaudited)
(in thousands, except par value)

	September 30, 2019	December 31, 2018
ASSETS		
Current assets:		
Cash and cash equivalents	$ 100,259	$ 96,089
Accounts receivable, net of allowance for doubtful accounts of $339 in 2019 and $332 in 2018	34,556	51,570
Prepaid expenses and other current assets	8,026	9,562
Total current assets	142,841	157,221
Property and equipment, net	38,969	35,681
Operating lease right-of-use assets, net	7,581	—
Goodwill	2,293	1,923
Intangible assets, net	6,538	5,064
Deferred tax assets	23,100	19,044
Other non-current assets	8,025	6,972
Total assets	$ 229,347	$ 225,905
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 2,203	$ 2,454
Accrued compensation and related benefits	4,313	4,727
Accrued and other current liabilities	2,452	3,235
Operating lease liabilities – current portion	1,826	—
Deferred revenues – current portion	8,612	8,477
Billings in excess of recognized revenues	1,219	635
Total current liabilities	20,625	19,528
Long-term income taxes payable	3,565	3,751
Non-current operating lease liabilities	7,726	—
Other non-current liabilities	2,444	2,831
Total liabilities	34,360	26,110
Commitments and contingencies (Note 13)		
Stockholders' equity:		
Preferred stock, $0.00015 par value, 5,000 shares authorized, no shares issued and outstanding	—	—
Common stock, $0.00015 par value, 70,000 shares authorized: shares issued 41,596 and 40,677, respectively; shares outstanding 32,350 and 32,382, respectively	5	5
Additional paid-in-capital	322,183	310,660
Treasury stock at cost, 9,246 and 8,295 shares, respectively	(90,908)	(79,142)
Accumulated deficit	(34,540)	(30,452)
Accumulated other comprehensive loss	(1,753)	(1,276)
Total stockholders' equity	194,987	199,795
Total liabilities and stockholders' equity	$ 229,347	$ 225,905

See accompanying Notes to Condensed Consolidated Financial Statements (unaudited)

PDF SOLUTIONS, INC.
CONDENSED CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS
(unaudited)
(in thousands, except per share amounts)

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	**2018**	**2019**	**2018**
Revenues:				
Solutions	$ 16,208	$ 13,976	$ 46,298	$ 47,431
Gainshare performance incentives	5,706	6,237	16,725	18,638
Total revenues	21,914	20,213	63,023	66,069
Cost of Solutions				
Direct costs of solutions	8,571	10,539	23,984	32,651
Amortization of acquired technology	144	144	431	431
Total cost of solutions	8,715	10,683	24,415	33,082
Gross profit	13,199	9,530	38,608	32,987
Operating expenses:				
Research and development	8,435	6,755	23,993	21,100
Selling, general and administrative	5,990	5,507	19,940	17,801
Amortization of other acquired intangible assets	174	108	436	326
Restructuring charges	—	—	92	—
Total operating expenses	14,599	12,370	44,461	39,227
Loss from operations	(1,400)	(2,840)	(5,853)	(6,240)
Interest and other income (expense), net	202	223	307	283
Loss before income taxes	(1,198)	(2,617)	(5,546)	(5,957)
Income tax benefit	(511)	(535)	(1,458)	(1,355)
Net loss	$ (687)	$ (2,082)	$ (4,088)	$ (4,602)
Other comprehensive loss:				
Foreign currency translation adjustments, net of tax	(461)	(168)	(477)	(414)
Comprehensive loss	$ (1,148)	$ (2,250)	$ (4,565)	$ (5,016)
Net loss per share:				
Basic	$ (0.02)	$ (0.06)	$ (0.13)	$ (0.14)
Diluted	$ (0.02)	$ (0.06)	$ (0.13)	$ (0.14)
Weighted average common shares:				
Basic	32,392	32,184	32,405	32,105
Diluted	32,392	32,184	32,405	32,105

See accompanying Notes to Condensed Consolidated Financial Statements (unaudited)

PDF SOLUTIONS, INC.
CONDENDSED CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(unaudited)
(in thousands)

	Nine Months Ended September 30, 2019							
	Common Stock		Additional Paid-In Capital	Treasury Stock		Accumulated Deficit	Accumulated Other Comprehensive Loss	Total Stockholders' Equity
	Shares	Amount		Shares	Amount			
Balances, December 31, 2018	32,382	$ 5	$ 310,660	8,295	$ (79,142)	$ (30,452)	$ (1,276)	$ 199,795
Issuance of common stock in connection with employee stock purchase plan	87	-	782	-	-	-	-	782
Issuance of common stock in connection with exercise of options	87	-	518	-	-	-	-	518
Vesting of restricted stock units	104	-	-	-	-	-	-	-
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	-	-	-	54	(557)	-	-	(557)
Repurchases of common stock	(314)	-	-	314	(3,917)	-	-	(3,917)
Stock-based compensation	-	-	3,469	-	-	-	-	3,469
Comprehensive loss	-	-	-	-	-	(2,691)	(52)	(2,743)
Balances, March 31, 2019	32,346	5	315,429	8,663	(83,616)	(33,143)	(1,328)	197,347
Issuance of common stock in connection with exercise of options	69	-	326	-	-	-	-	326
Vesting of restricted stock units	176	-	-	-	-	-	-	-
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	-	-	-	72	(918)	-	-	(918)
Repurchases of common stock	(300)	-	-	300	(3,790)	-	-	(3,790)
Stock-based compensation	-	-	2,601	-	-	-	-	2,601
Comprehensive income (loss)	-	-	-	-	-	(710)	36	(674)
Balances, June 30, 2019	32,291	5	318,356	9,035	(88,324)	(33,853)	(1,292)	194,892
Issuance of common stock in connection with employee stock purchase plan	85	-	751	-	-	-	-	751
Issuance of common stock in connection with exercise of options	53	-	267	-	-	-	-	267
Vesting of restricted stock units	92	-	-	-	-	-	-	-
Purchases of treasury stock in connection with tax withholdings on restricted stock grants and exercise of options		-	-	40	(524)	-	-	(524)
Repurchases of common stock	(171)	-	-	171	(2,060)	-	-	(2,060)
Stock-based compensation	-	-	2,809	-	-	-	-	2,809
Comprehensive loss	-	-	-	-	-	(687)	(461)	(1,148)
Balances, September 30, 2019	32,350	$ 5	$ 322,183	9,246	$ (90,908)	$ (34,540)	$ (1,753)	$ 194,987

PDF SOLUTIONS, INC.
CONDENDSED CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY — Continued
(unaudited)
(in thousands)

	Nine Months Ended September 30, 2018							
	Common Stock		Additional Paid-In Capital	Treasury Stock		Accumulated Deficit	Accumulated Other Comprehensive Loss	Total Stockholders' Equity
	Shares	Amount		Shares	Amount			
Balances, December 31, 2017	32,112	$ 5	$ 297,950	7,688	$ (71,793)	$ (27,089)	$ (705)	$ 198,368
Cumulative-effect adjustment from adoption of ASU 2014-09	-	-	-	-	-	4,353	-	4,353
Issuance of common stock in connection with employee stock purchase plan	108	-	1,007	-	-	-	-	1,007
Issuance of common stock in connection with exercise of options	8	-	39	-	-	-	-	39
Vesting of restricted stock units	74	-	-	-	-	-	-	-
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	-	-	-	36	(557)	-	-	(557)
Repurchases of common stock	(338)	-	-	338	(4,123)	-	-	(4,123)
Stock-based compensation	-	-	2,871	-	-	-	-	2,871
Comprehensive income (loss)	-	-	-	-	-	(424)	525	101
Balances, March 31, 2018	31,964	5	301,867	8,062	(76,473)	(23,160)	(180)	202,059
Issuance of common stock in connection with exercise of options	51	-	377	-	-	-	-	377
Vesting of restricted stock units	159	-	-	-	-	-	-	-
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	-	-	-	63	(819)	-	-	(819)
Repurchases of common stock	(99)	-	-	99	(1,125)	-	-	(1,125)
Stock-based compensation	-	-	2,699	-	-	-	-	2,699
Comprehensive loss	-	-	-	-	-	(2,096)	(771)	(2,867)
Balances, June 30, 2018	32,075	5	304,943	8,224	(78,417)	(25,256)	(951)	200,324
Issuance of common stock in connection with employee stock purchase plan	92	-	824	-	-	-	-	824
Issuance of common stock in connection with exercise of options	9	-	53	-	-	-	-	53
Vesting of restricted stock units	81	-	-	-	-	-	-	-
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	-	-	-	28	(334)	-	-	(334)
Stock-based compensation	-	-	2,278	-	-	-	-	2,278
Comprehensive loss	-	-	-	-	-	(2,082)	(168)	(2,250)
Balances, September 30, 2018	32,257	$ 5	$ 308,098	8,252	$ (78,751)	$ (27,338)	$ (1,119)	$ 200,895

See accompanying Notes to Condensed Consolidated Financial Statements (unaudited)

PDF SOLUTIONS, INC.
CONDENSED CONSOLIDATED STATEMENTS OF CASH FLOWS
(unaudited)
(in thousands)

	Nine Months Ended September 30, 2019	Nine Months Ended September 30, 2018
Operating activities:		
Net loss	$ (4,088)	$ (4,602)
Adjustments to reconcile net loss to net cash provided by operating activities:		
Depreciation and amortization	4,306	3,689
Stock-based compensation expense	8,642	7,825
Amortization of acquired intangible assets	867	757
Amortization of costs capitalized to obtain revenue contracts	344	278
Adjustment to contingent consideration related to acquisition	36	—
Deferred taxes	(3,998)	(2,298)
Loss on disposal of property and equipment	130	4
Provision (reversal of allowance) for doubtful accounts and write-off of accounts receivable	67	(41)
Unrealized loss on foreign currency forward contract	—	59
Changes in operating assets and liabilities:		
Accounts receivable	16,946	5,653
Prepaid expenses and other current assets	(236)	(3,722)
Other non-current assets	(966)	2,367
Accounts payable	(191)	(598)
Accrued compensation and related benefits	(431)	(1,377)
Accrued and other liabilities	(483)	(252)
Deferred revenues	1,482	632
Billings in excess of recognized revenues	584	669
Net cash provided by operating activities	23,011	9,043
Investing activities:		
Proceeds from the sale of property and equipment	50	—
Purchases of property and equipment	(6,891)	(8,747)
Payment for business acquisition	(2,660)	—
Net cash used in investing activities	(9,501)	(8,747)
Financing activities:		
Proceeds from exercise of stock options	983	469
Proceeds from employee stock purchase plan	1,534	1,832
Repurchases of common stock	(9,639)	(5,248)
Payments for taxes related to net share settlement of equity awards	(1,898)	(1,711)
Payment of contingent consideration related to acquisition	(206)	—
Net cash used in financing activities	(9,226)	(4,658)
Effect of exchange rate changes on cash and cash equivalents	(114)	(117)
Net change in cash and cash equivalents	4,170	(4,479)
Cash and cash equivalents, beginning of period	96,089	101,267
Cash and cash equivalents, end of period	$ 100,259	$ 96,788
Supplemental disclosure of cash flow information:		
Cash paid during the period for taxes	$ 2,454	$ 1,616
Cash paid for amounts included in the measurement of operating lease liabilities	$ 1,268	$ —
Supplemental disclosure of noncash operating, investing, and financing activities:		
Stock-based compensation capitalized as software development costs	$ 244	$ —
Property and equipment received and accrued in accounts payable and accrued and other liabilities	$ 1,340	$ 3,398
Advances for purchase of fixed assets transferred from prepaid assets to property and equipment	$ 1,416	$ —
Tenant allowance paid by landlord for leasehold improvements	$ —	$ 1,536
Common shares repurchased from a cashless exercise of stock options	$ 128	$ —

See accompanying Notes to Condensed Consolidated Financial Statements (unaudited)

PDF SOLUTIONS, INC.
NOTES TO CONDENSED CONSOLIDATED FINANCIAL STATEMENTS (UNAUDITED)

1. BASIS OF PRESENTATION AND SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Basis of Presentation

The interim unaudited condensed consolidated financial statements included herein have been prepared by PDF Solutions, Inc. (the "Company") pursuant to the rules and regulations of the Securities and Exchange Commission ("SEC"), including the instructions to the Quarterly Report on Form 10-Q and Article 10 of Regulation S-X. Certain information and footnote disclosures normally included in annual financial statements prepared in accordance with accounting principles generally accepted in the United States of America ("U.S. GAAP") have been condensed or omitted. The interim unaudited condensed consolidated financial statements reflect, in the opinion of management, all adjustments necessary (consisting only of normal recurring adjustments), to present a fair statement of results for the interim periods presented. The operating results for any interim period are not necessarily indicative of the results that may be expected for other interim periods or the full fiscal year. The accompanying interim unaudited condensed consolidated financial statements should be read in conjunction with the audited consolidated financial statements and notes thereto in the Company's Annual Report on Form 10-K for the year ended December 31, 2018.

The condensed consolidated financial statements include the accounts of the Company and its wholly-owned subsidiaries after the elimination of all intercompany balances and transactions.

The condensed consolidated balance sheet at December 31, 2018, has been derived from the audited consolidated financial statements but does not include all disclosures required by accounting principles generally accepted in the United States of America.

Use of Estimates

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Significant estimates in these financial statements include revenue recognition, impairment of goodwill and long-lived assets, accounting for stock-based compensation expense, and income taxes. Actual results could differ from those estimates.

Reclassification of Prior Period Amount

Certain prior period amounts have been reclassified to conform to current year presentation of reporting amortization of costs capitalized to obtain revenue contracts on the Condensed Consolidated Statements of Cash Flows. This reclassification had no effect on the Company's reported net loss or net cash provided by operating activities.

Recently Adopted Accounting Standards

Leases

In February 2016, the Financial Accounting Standards Board (or FASB) issued Accounting Standards Update (ASU) 2016-02, Leases (Topic 842) and subsequent amendments to the initial guidance: ASU 2017-13, ASU 2018-10, ASU 2018-11, ASU 2018-20 and ASU 2019-01 (collectively, Topic 842). Topic 842 aims to increase transparency and comparability among organizations by requiring lessees to recognize leases with a term greater than 12 months as a right-of-use asset ("ROU") and corresponding lease liabilities on the balance sheet, regardless of lease classification, and requiring disclosure of key information about leasing arrangements. The lease liability should be initially measured at the present value of the remaining contractual lease payments. Subsequently, the ROU assets will be amortized generally on a straight-line basis over the lease term, and the lease liability will bear interest expense and be reduced for lease payments. Topic 842 became effective for public companies' financial statements issued for fiscal years beginning after December 15, 2018, including interim periods within those fiscal years. A modified retrospective application is required with an option to not restate comparative periods in the period of adoption. The Company adopted Topic 842 on January 1, 2019 using the modified retrospective approach, and financial information for the comparative period was not updated.

In addition, the Company elected the transition package of three practical expedients which allow companies not to reassess (i) whether agreements contain leases, (ii) the classification of leases, and (iii) the capitalization of initial direct costs. Further, the Company elected to not separate lease and non-lease components for all of its leases. The Company also made an accounting policy election to recognize lease expense for leases with a term of 12 months or less on a straight-line basis over the lease term and recognize no ROU or lease liability for those leases.

The Company's lease portfolio consists primarily of real estate assets, which include administrative and sales offices, and its research and development laboratory and clean room. Some of these leases also require the Company to pay maintenance, utilities, taxes, insurance, and other operating expenses associated with the leased space. Based upon the nature of the items leased and the structure of the leases, the Company's leases are classified as operating leases and continue to be classified as operating leases under the new accounting standard.

As a result of the adoption of the new lease accounting guidance, the Company recognized on January 1, 2019:

- operating lease liabilities of approximately $10.5 million, which represent the present value of the remaining lease payments, as of the date of adoption, discounted using the Company's incremental borrowing rate of 5.3%, and

- operating lease ROU assets of approximately $8.7 million which represent the operating lease liabilities of $10.5 million, adjusted for (1) deferred rent of approximately $0.3 million, and (2) lease incentives or tenant improvement allowance of $1.5 million.

The adoption of the new lease accounting standard did not have any other impact on the Company's condensed consolidated balance sheet, and did not impact the Company's operating results and cash flows. See Leases, in Note 5 for further information, including further discussion on the impact of adoption and changes in accounting policies relating to leases.

Income Statement – Reporting Comprehensive Income (Loss)

In February 2018, the FASB issued ASU No. 2018-02, Income Statement – Reporting Comprehensive Income (Topic 220): Reclassification of Certain Tax Effect from Accumulated Other Comprehensive Income. This update allows a reclassification from accumulated other comprehensive income to retained earnings for stranded tax effects resulting from the Tax Cuts and Job Act (TCJA) enacted in December 2017. This update became effective for the Company for fiscal years beginning after December 15, 2018 and interim periods within those fiscal years. The Company adopted this standard on January 1, 2019, and it did not have a material impact on its condensed consolidated financial statements and footnote disclosures.

Compensation - Stock Compensation

In June 2018, the FASB issued ASU 2018-07, Compensation – Stock Compensation (Topic 718), Improvements to Nonemployee Share-Based Payment Accounting. This ASU simplifies several aspects of the accounting for nonemployee share-based payment transactions resulting from expanding the scope of Topic 718, to include share-based payment transactions for acquiring goods and services from nonemployees and making guidance consistent with the accounting for employee share-based compensation. The Company adopted this standard on January 1, 2019, and it did not have a material impact on its condensed consolidated financial statements and footnote disclosures.

FASB Updates Certain SEC Guidance in the Codification

In July 2019, the FASB issued ASU No. 2019-07, Codification Updates to SEC Sections – Amendments to SEC Paragraphs Pursuant to SEC Final Rule Releases No. 33-10532, "Disclosure Update and Simplification," and Nos. 33-10231 and 33-10442, "Investment Company Reporting Modernization," and Miscellaneous Updates. This ASU codifies the SEC releases that clarify and improve the disclosure and presentation requirements of a variety of codification topics, thereby eliminating or amending certain disclosure requirements that have become redundant, duplicative, overlapping, outdated, or superseded, in light of other SEC disclosure requirement, U.S. GAAP, or changes in the information environment. The amendments and updates to the SEC Final Rule are effective upon issuance of this ASU in July 2019. The Company adopted this ASU in the third quarter of 2019, and did not have a material impact on its condensed consolidated financial statements and footnote disclosures. Included also in the aforementioned SEC Final Rule is extending the disclosure requirement of presenting changes in stockholders' equity for interim periods, which became effective to and adopted by the Company in the first quarter of 2019.

Management has reviewed other recently issued accounting pronouncements and has determined there are not any that would have a material impact on the condensed consolidated financial statements.

Accounting Standards Not Yet Effective

In June 2016, the FASB issued ASU 2016-13, Financial Instruments – Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments (ASU 2016-13) and also issued subsequent amendments to the initial guidance: ASU 2018-19, Codification Improvements to Topic 326, Financial Instruments – Credit Losses, ASU 2019-04, Codification Improvements to Topic 326, Financial Instruments – Credit Losses, Topic 815, Derivatives and Hedging, and Topic 825, Financial Instrument, and ASU 2019-05, Financial Instrument – Credit Losses (Topic 326): Targeted Transition Relief (collectively, Topic 326). Topic 326 requires measurement and recognition of expected credit losses for financial assets held at the reporting date based on external information, or a combination of both relating to past events, current conditions, and reasonable and supportable forecasts. The amendments affect loans, debt securities, trade receivables, net investments in leases, off-balance-sheet credit exposures, reinsurance receivables, and other financial assets that represent a right to receive cash. Topic 326 is effective for the Company beginning in the first quarter of 2020. Early adoption is permitted. The Company has not yet determined the impact of this standard on its condensed consolidated financial statements.

In January 2017, the FASB issued ASU No. 2017-04, Intangibles – Goodwill and Other (Topic 350). This standard eliminates step 2 from the annual goodwill impairment test. This update is effective for annual periods beginning after December 15, 2019, and interim periods within those fiscal years, with early adoption permitted, and is to be applied on a prospective basis. The Company does not anticipate that the adoption of this standard will have a significant impact on its condensed consolidated financial statements or the related disclosures.

In August 2018, the FASB issued ASU No. 2018-15, Intangibles – Goodwill and Other – Internal-Use Software (Subtopic 350-40): Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That Is a Service Contract. The new guidance clarifies the accounting for implementation costs incurred to develop or obtain internal-use software in cloud computing arrangements. Further, the standard also requires entities to expense the capitalized implementation costs of a hosting arrangement over the term of the hosting arrangement. This standard is effective for the Company beginning in the first quarter of 2020. Early adoption is permitted. ASU No. 2018-15 should be applied either retrospectively or prospectively to all implementation costs incurred after the date of adoption. The Company has not yet determined the impact of this standard on its condensed consolidated financial statements.

2. BUSINESS COMBINATION

On April 29, 2019 (the "Acquisition Date"), the Company acquired certain assets from StreamMosaic, Inc., a privately held provider of artificial intelligence and machine learning solutions, including the Stream.AI software product line and related assets. Pursuant to the terms of an asset purchase agreement, the Company acquired certain assets, including all intellectual property, from StreamMosaic and certain related liabilities for the purpose of enhancing the Company's position in advanced data analytics for semiconductors and electronics by broadening its product offering and expanding its customer reach. In connection with the acquisition, the Company paid a total consideration of approximately $2.7 million using cash on hand.

The Company accounted for this acquisition as a business combination. This method requires that assets acquired and liabilities assumed in a business combination be recognized at their fair values as of the Acquisition Date. The excess of purchase consideration over the fair value of net tangible and identifiable intangible assets acquired was recorded as goodwill. The goodwill recorded from this acquisition represents business benefits the Company anticipates from the acquired workforce and expectation for expanded sales opportunities in advanced data analytics for semiconductors and electronics. The amount of goodwill expected to be deductible for tax purposes is $370,000. Pro-forma results of operations have not been presented because the effect of the acquisition was not material to our financial results.

Intangible assets consist of developed technology and customer relationships. The value assigned to intangibles are based on estimates and judgments regarding expectations for success and life cycle of intangibles acquired. The following table summarizes the allocation of the fair values of the assets acquired and liabilities assumed and the related useful lives, where applicable:

	(in thousands)	Amortization period (years)
Finite-lived intangible assets:		
Developed technology	$ 1,640	9
Customer relationship	700	9
Deferred revenue	(50)	
Net asset acquired	**$ 2,290**	
Goodwill	370	
Purchase consideration	**$ 2,660**	

3. REVENUE FROM CONTRACTS WITH CUSTOMERS

The Company derives revenue from two sources: Solutions revenue and Gainshare performance incentives.

Revenue is recognized when control of products or services is transferred to customers, in an amount that reflects the consideration the Company expects to be entitled to in exchange for those promised products or services.

The Company determines revenue recognition through the following five steps:

- Identification of the contract, or contracts, with a customer
- Identification of the performance obligations in the contract
- Determination of the transaction price
- Allocation of the transaction price to the performance obligations in the contract
- Recognition of revenue when, or as, performance obligations are satisfied

The Company accounts for a contract when it has approval and commitment from both parties, the rights of the parties are identified, payment terms are identified, the contract has commercial substance, and collectability of consideration is probable.

The Company enters into contracts that can include various combinations of licenses, products and services, some of which are distinct and are accounted for as separate performance obligations. For contracts with multiple performance obligations, the Company allocates the transaction price of the contract to each performance obligation, generally on a relative basis using its standalone selling price. The Company does not adjust transaction price for the effects of a significant financing component when the period between the transfers of the promised good or service to the customer and payment for that good or service by the customer is expected to be one year or less. The Company assessed each of its revenue generating arrangements in order to determine whether a significant financing component exists, and determined its contracts did not include a significant financing component for the three and nine months ended September 30, 2019 and 2018.

Nature of Products and Services

Solutions revenue – The Company recognizes revenue for each element of solutions revenue as follows:

The Company licenses the majority of its software products separately from project-based solution implementation service contracts, in particular, its Exensio platform and related products. The majority of this software is delivered as on-premise software licenses, while others can be delivered entirely or partially through Software-as-a-Service (SaaS) or cloud delivery models. Revenue from perpetual (one-time charge) license software is recognized at a point in time at the inception of the arrangement when control transfers to the client, if the software license is distinct from the services offered by the Company. Revenue from post-contract support subscription is recognized over the contract term on a straight-line basis, because the Company is providing a service of standing ready to provide support, when-and-if needed, and is providing unspecified software upgrades on a when-and-if available basis over the contract term. Revenue from time-based license software is allocated to each performance obligation and is recognized either at a point in time or over time. The license component is recognized at a point in time, at the delivery of the software license, with the post-contract support subscription component being recognized ratably over for the committed term of the contract. Revenue from software hosting or SaaS arrangements that allow for the use of a hosted software product or service over a contractually determined period of time without taking possession of software is accounted for as subscriptions and recognized as revenue ratably, on a straight-line basis, over the coverage period beginning on the date the service is made available to customers.

The Company also licenses the Design-for-Inspection (“DFI”) system as a separate component of fixed-price service contracts that are not project-based solutions implementation services contracts. The Company allocates revenue to all deliverables under these DFI contracts based on their standalone selling prices, or SSP. In such instances, the Company applies judgment to estimate the range of SSPs for each performance obligation.

The Company generates a portion of its solutions revenue from fixed-price, project-based solution implementation service contracts that are associated with its classic yield ramp business, which services are delivered over a specific period of time. Revenue under these project–based contracts for solution implementation services is recognized as services are performed, using a percentage of completion method based on costs or labor-hours inputs, depending on whichever is the most appropriate measure of the progress towards completion of the contract. Due to the nature of the work performed in these arrangements, the estimation of costs or hours at completion is complex, subject to many variables and requires significant judgment. Key factors reviewed by the Company to estimate costs to complete each contract are future labor and product costs and expected productivity efficiencies. If circumstances arise that change the original estimates of revenues, costs, or extent of progress toward completion, revisions to the estimates are made. These revisions may result in increases or decreases in estimated revenues or costs. Losses on fixed-price solution implementation contracts are recognized in the period when they become probable. Revisions in profit estimates are reflected in the period in which the conditions that require the revisions become known and can be estimated (the cumulative catch-up method).

The Company typically includes some of its products and other technology as components of its fixed-price, project-based services contracts. In such instances, the Company determines whether the services performed and products/technology included, are distinct. In most cases, the arrangement is a single performance obligation and therefore follows the pattern of transfer as the service is provided. The Company applies a measure of progress (typically hours-to-hours or cost-to-cost) to any fixed consideration. As a result, revenue is generally recognized over the period the services are performed using percentage of completion method. This results in revenue recognition that corresponds with the value to the client for the services transferred to date relative to the remaining services promised.

Gainshare Performance Incentives — When the Company enters into a project-based solution implementation services contract, the contract usually includes two components: (1) a fixed fee for performance by the Company of services delivered over a specific period of time; and (2) a Gainshare performance incentive component where the customer pays a variable fee, usually after the fixed fee period has ended, related to continued usage of the Company's intellectual property. Revenue derived from Gainshare performance incentives is contingent upon the Company's customers reaching certain defined production yield levels. Gainshare performance incentive periods are usually subsequent to the delivery of all contractual services and performance obligations. The Company records Gainshare revenue as a usage-based royalty based on customers' usage of intellectual property and records it in the same period in which the usage occurs.

Disaggregation of revenue

The Company disaggregates revenue from contracts with customers into geographical regions, major contract performance obligations, and timing of transfer of goods and services. The Company determined that disaggregating revenue into these categories achieves the disclosure objective to depict how the nature, amount, timing, and uncertainty of revenue and cash flows are affected by economic factors.

The following table shows the revenues from contracts with customers by the nature of transactions (in thousands):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	**2018**	**2019**	**2018**
Licenses and Gainshare Performance Incentives	$ 6,454	$ 7,729	$ 20,360	$ 22,044
Support and Services	15,267	11,905	42,298	43,095
Other	193	579	365	930
Total	$ 21,914	$ 20,213	$ 63,023	$ 66,069

Licenses and Gainshare Performance Incentives revenue is comprised of (i) the software license fees for perpetual and time-based software license contracts where the standalone selling prices are estimable by the Company, or distinct and separate performance obligations; and (ii) the variable fee component of the Company's yield improvement service contracts, or Gainshare Performance Incentives, which is usually recognized as revenue subsequent to the delivery of all contractual services and performance obligations. The services component of such contracts, including recurring fees for unspecified software updates and technical support, is presented as support and services.

The Company's performance obligations are satisfied either over time or at a point-in-time. The following table represents a disaggregation of revenue by timing of revenue:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Over time	70%	59%	67%	66%
Point-in-time	30%	41%	33%	34%
Total	100%	100%	100%	100%

International revenues accounted for approximately 66% and 60% of the Company's total revenues for the three and nine months ended September 30, 2019, respectively, compared to 59% and 58% of the Company's total revenues for the three and nine months ended September 30, 2018, respectively. See Note 11. Customer and Geographic Information.

Significant Judgments

Judgments and estimates are required under ASU No. 2014-09, Revenue from Contracts with Customers (Topic 606). Due to the complexity of certain contracts, the actual revenue recognition treatment required under Topic 606 for the Company's arrangements may be dependent on contract-specific terms and may vary in some instances.

In services arrangements, the Company typically satisfies the performance obligation and recognizes revenue over time. In Design-to-silicon-yield service arrangements, the performance obligation is satisfied over time either because the client controls the asset as it is created (e.g., when the asset is built at the customer site) or because the Company's performance does not create an asset with an alternative use and the Company has an enforceable right to payment plus a reasonable profit for performance completed to date. In most other services arrangements, the performance obligation is satisfied over time because the client simultaneously receives and consumes the benefits provided as the Company performs the services.

For revenue under project-based contracts for fixed-price solution implementation services, revenue is recognized as services are performed using a percentage-of-completion method based on costs or labor-hours input method, whichever is the most appropriate measure of the progress towards completion of the contract. Due to the nature of the work performed in these arrangements, the estimation of percentage of completion method is complex, subject to many variables and requires significant judgment. Key factors reviewed by the Company to estimate costs to complete each contract are future labor and product costs and expected productivity efficiencies. If circumstances arise that change the original estimates of revenues, costs, or extent of progress toward completion, revisions to the estimates are made. These revisions may result in increases or decreases in estimated revenues or costs, and such revisions are reflected in revenue on a cumulative catch-up basis in the period in which the circumstances that gave rise to the revision become known.

The Company's contracts with customers often include promises to transfer products, licenses and services, including professional services, technical support services, and rights to unspecified updates to a customer. Determining whether products, licenses and services are distinct performance obligations that should be accounted for separately, or not distinct and thus accounted for together, requires significant judgment. The Company rarely licenses or sells products on a standalone basis, so the Company is required to estimate the range of SSPs for each performance obligation. In instances where SSP is not directly observable because the Company does not sell the license, product or service separately, the Company determines the SSP using information that may include market conditions and other observable inputs. The Company, in some cases, has more than one SSP for individual performance obligations. In these instances, the Company may use information such as the size of the customer and geographic region of the customer in determining the SSP.

The Company is required to record Gainshare royalty revenue in the same period in which the usage occurs. Because the Company generally does not receive the acknowledgment reports from its customers during a given quarter within the time frame necessary to adequately review the reports and include the actual amounts in quarterly results for such quarter, the Company accrues the related revenue based on estimates of customer's underlying sales achievement. The Company's estimation process can be based on historical data, trends, seasonality, changes in the contract rate, knowledge of the changes in the industry and changes in the customer's manufacturing environment learned through discussions with customers and sales personnel. As a result of accruing revenue for the quarter based on such estimates, adjustments will be required in the following quarter to true-up revenue to the actual amounts reported.

Contract Balances

The Company performs its obligations under a contract with a customer by transferring products or services in exchange for consideration from the customer. The timing of the Company's performance often differs from the timing of the customer's payment, which results in the recognition of a receivable, a contract asset or a contract liability.

The Company classifies the right to consideration in exchange for products or services transferred to a client as either a receivable or a contract asset. A receivable is a right to consideration that is unconditional as compared to a contract asset which is a right to consideration that is conditional upon factors other than the passage of time. The majority of the Company's contract assets represent unbilled amounts related to fixed-price solution implementation service contracts when the costs or labor-hours input method of revenue recognition is utilized and revenue recognized exceeds the amount billed to the client, and the right to consideration is subject to milestone completion or client acceptance. The contract assets are generally classified as current and are recorded on a net basis with deferred revenue (i.e., contract liabilities) at the contract level. At September 30, 2019 and December 31, 2018, contract assets of \$3.0 million and \$2.7 million, respectively, are included in prepaid expenses and other current assets in the condensed consolidated balance sheets. The change in the contract assets balance during the period relates to the recording of revenues for which the right to consideration is subject to milestone completion or client acceptance and movement of previously recorded contract assets to receivables as the right to consideration becomes unconditional.

Contract liabilities primarily consist of deferred revenues and billings in excess of recognized revenues. Deferred revenues consist substantially of amounts invoiced in advance of revenue recognition and is recognized as the revenue recognition criteria are met. Deferred revenues that will be recognized during the succeeding twelve-month period are recorded as current deferred revenues, and the remaining portion is recorded as non-current deferred revenues. This balance was recorded in the other non-current liabilities in the accompanying condensed consolidated balance sheets. The non-current portion of deferred revenue included in other non-current liabilities was \$2.4 million and \$1.0 million, respectively, as of September 30, 2019 and December 31, 2018. Billings in excess of recognized revenues included and presented separately in the condensed consolidated balance sheets are attributable to billings in excess of costs under the percentage of completion method representing the difference between contractually invoiced amounts (billings) and revenue recognized based on costs incurred to total estimated total costs at end of period. Billings in excess of recognized revenues are expected to be realized during the succeeding twelve-month period. Revenue recognized for each of the three months ended September 30, 2019 and 2018, that was included in the deferred revenues and billings in excess of recognized revenues balances at the beginning of each reporting period was \$4.4 million. Revenue recognized for the nine months ended September 30, 2019, and 2018, that was included in the deferred revenues and billings in excess of recognized revenues balances at the beginning of each reporting period was \$13.0 million and \$12.0 million, respectively.

At September 30, 2019, the aggregate amount of the transaction price allocated to the remaining performance obligations related to customer contracts that were unsatisfied or partially unsatisfied was approximately \$35.5 million. Given the applicable contract terms, the majority of this amount is expected to be recognized as revenue over the next two years, with the remainder in the following five years. This amount does not include contracts to which the customer is not committed, nor contracts with original expected lengths of one year or less, nor contracts for which we recognize revenue equal to the amount we have the right to invoice for services performed, or future sales-based or usage-based royalty payments in exchange for a license of intellectual property. This amount is subject to change due to future revaluations of variable consideration, terminations, other contract modifications, or currency adjustments. The estimated timing of the recognition of remaining unsatisfied performance obligations is subject to change and is affected by changes to the scope, change in timing of delivery of products and services, or contract modifications.

Payment terms and conditions vary by contract type, although terms generally include a requirement of payment within 30 to 90 days upon invoicing. Invoicing occurs generally upon delivery of license for perpetual software and equally over the expected time period for time-based software and/or service engagements. In instances where the timing of revenue recognition differs from the timing of invoicing, the Company has determined that its contracts generally do not include a significant financing component. The primary purpose of invoicing terms is to provide customers with simplified and predictable ways of purchasing the Company's products and services, and not to facilitate financing arrangements.

The adjustment to revenue recognized in the three months ended September 30, 2019 and 2018 from performance obligations satisfied (or partially satisfied) in previous periods was an increase of \$0.3 million and \$1.3 million, respectively. The adjustment to revenue recognized in the nine months ended September 30, 2019 and 2018 from performance obligations satisfied (or partially satisfied) in previous periods was an increase of \$0.1 million and \$1.6 million, respectively. These amounts primarily represent changes in estimated percentage-of-completion based contracts and changes in estimated Gainshare performance incentives for those customers that reported actual Gainshare revenue with some time lag.

Costs to obtain or fulfill a contract

The Company capitalizes the incremental costs to obtain or fulfill a contract with a customer, including direct sales commissions and related fees, when it expects to recover those costs. As a result, these costs will need to be capitalized and amortized over an appropriate period, which may exceed the initial contract term. The incremental costs of obtaining a contract are costs that would not have been incurred if the contract had not been obtained. The Company uses the portfolio method to recognize the amortization expense related to these capitalized costs related to initial contracts and renewals and such expense is recognized over the period associated with the revenue of the related portfolio. Total capitalized direct sales commission costs as of September 30, 2019 and December 31, 2018 were $0.7 million and $0.5 million, respectively. Amortization of these assets during each of the three months ended September 30, 2019 and 2018 was $0.1 million in each period. Amortization of these assets during each of the nine months ended September 30, 2019 and 2018 was $0.3 million in each period. There was no impairment loss in relation to the costs capitalized for the periods presented. Certain eligible initial project costs are capitalized when the costs relate directly to the contract, the costs generate or enhance resources of the Company that will be used in satisfying the performance obligation in the future, and the costs are expected to be recovered.

These costs primarily consist of transition and set-up costs related to the installation of systems and processes and other deferred fulfillment costs eligible for capitalization. Capitalized costs are amortized consistent with the transfer to the client of the services to which the asset relates and recorded as a component of cost of revenues. The Company also incurred certain direct costs to provide solution implementation services in relation to the specific anticipated contracts. The Company recognizes such costs as a component of cost of revenues, the timing of which is dependent upon identification of a contract arrangement. The Company also defers costs from arrangements that required it to defer the revenues, typically due to the pattern of transfer of the performance obligations in the contract. These costs are recognized in proportion to the related revenue. At the end of the reporting period, the Company evaluates its deferred costs for their probable recoverability. The Company recognizes impairment of deferred costs when it is determined that the costs no longer have future benefits and are no longer recoverable. Deferred costs balance was $0.2 million as of September 30, 2019 and December 31, 2018. The balance was included in prepaid expenses and other current assets and other non-current assets in the accompanying condensed consolidated balance sheets.

4. BALANCE SHEET COMPONENTS

Accounts receivable

Account receivable includes amounts that are unbilled at the end of the period that are expected to be billed and collected within 12-month period. Unbilled accounts receivable, included in accounts receivable, totaled $10.2 million and $22.2 million as of September 30, 2019, and December 31, 2018, respectively. Unbilled accounts receivable that are not expected to be billed and collected during the succeeding 12-month period are recorded in other non-current assets and totaled $6.2 million and $5.3 million as of September 30, 2019, and December 31, 2018, respectively.

Property and equipment

Property and equipment, net consists of (in thousands):

	September 30, 2019	December 31, 2018
Property and equipment, net:		
Computer equipment	$ 10,675	$ 10,536
Software	4,486	4,112
Furniture, fixtures and equipment	7,314	4,688
Leasehold improvements	6,045	5,474
Test equipment	22,250	14,697
Construction-in-progress	15,831	20,293
	66,601	59,800
Less: accumulated depreciation and amortization	(27,632)	(24,119)
Total	$ 38,969	$ 35,681

Test equipment includes assets at customer sites that are contributing to solution revenues. The construction-in-progress balance as of September 30, 2019 and December 31, 2018 was primarily related to construction of DFI assets. Depreciation and amortization expense for the three months ended September 30, 2019 and 2018 was $1.7 million and $1.2 million, respectively. Depreciation and amortization expense for the nine months ended September 30, 2019 and 2018 was $4.3 million and $3.7 million, respectively.

Goodwill and Intangible Assets

As of September 30, 2019, and December 31, 2018, the carrying amounts of goodwill were $2.3 million and $1.9 million, respectively.

Intangible assets balance was $6.5 million and $5.1 million as of September 30, 2019, and December 31, 2018, respectively. Intangible assets as of September 30, 2019, and December 31, 2018 consist of the following (in thousands):

		September 30, 2019			December 31, 2018		
	Amortization Period (Years)	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
Acquired identifiable intangibles:							
Customer relationships	1 – 9	$ 7,440	$ (4,823)	$ 2,617	$ 6,740	$ (4,514)	$ 2,226
Developed technology	4 – 9	17,460	(13,912)	3,548	15,820	(13,404)	2,416
Tradename	2 – 7	790	(667)	123	790	(648)	142
Patent	7 – 10	1,800	(1,550)	250	1,800	(1,520)	280
Total		$ 27,490	$ (20,952)	$ 6,538	$ 25,150	$ (20,086)	$ 5,064

The weighted average amortization period for acquired identifiable intangible assets was 6.4 years as of September 30, 2019. For each of the three months ended September 30, 2019 and 2018, intangible asset amortization expense was $0.3 million. For the nine months ended September 30, 2019 and 2018, total intangible asset amortization expense was $0.9 million and $0.8 million, respectively. The Company expects annual amortization of acquired identifiable intangible assets to be as follows (in thousands):

Year ending December 31,	Amount
2019 (remaining three months)	$ 317
2020	1,269
2021	1,093
2022	886
2023	886
2024 and thereafter	2,087
Total future amortization expense	$ 6,538

Intangible assets are amortized over their useful lives unless these lives are determined to be indefinite. Intangible assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset or asset group may not be recoverable. During the three and nine months ended September 30, 2019, there were no indicators of impairment related to the Company’s intangible assets.

5. LEASES

The Company leases administrative and sales offices and certain equipment under noncancelable operating leases, which contain various renewal options and, in some cases, require payment of common area costs, taxes, and utilities. These operating leases expire at various times through 2028. The Company had no leases that were classified as a financing lease as of September 30, 2019.

Leases with an initial term of 12 months or less are not recorded on the balance sheet and the Company recognizes lease expense for these leases on a straight-line basis over the lease term. Long-term operating leases are included in operating lease ROU assets and operating lease liabilities in the Company’s condensed consolidated balance sheet as of September 30, 2019.

ROU assets represent the Company’s right to use an underlying asset for the lease term and operating lease liabilities represent the Company’s obligation to make lease payments arising from the lease. Effective January 1, 2019, operating lease ROU assets and liabilities are recognized based on the present value of remaining lease payments over the lease term. In determining the present value of lease payments, implicit rate must be used when readily determinable. As the Company’s leases do not provide implicit rates, at the date of the Company’s adoption of the new lease standard, the discount rate is calculated using the Company’s incremental borrowing rate determined based on the information available. The operating lease ROU asset also includes any lease payments made and excludes lease incentives or tenant improvement allowance. The Company’s lease terms may include options to extend or terminate the lease when it is reasonably certain that the Company will exercise that option. Lease expense for lease payments is recognized on a straight-line basis over the lease term.

Operating lease expense was $0.6 million for each of the three months ended September 30, 2019 and 2018. Operating lease expense was $1.7 million and $1.9 million for the nine months ended September 30, 2019 and 2018, respectively. Operating lease cost includes short-term leases and variable lease costs, which are immaterial.

Maturity of operating lease liabilities as of September 30, 2019, are as follows (in thousands):

Year ending December 31,		**Amount**(1)
2019 (remaining three months)	$	388
2020		1,842
2021		1,693
2022		1,510
2023		1,393
2024 and thereafter		4,750
Total future minimum lease payments	$	11,576
Less: Interest(2)		(2,024)
Present value of operating lease liabilities(3)	$	9,552

(1) As of September 30, 2019, the total operating lease liability includes $1.0 million related to an option to extend a lease term that is reasonably certain to be exercised.
(2) Calculated using incremental borrowing interest rate for each lease.
(3) Includes the current portion of operating lease liabilities of $1.8 million as of September 30, 2019.

As of September 30, 2019, the weighted average remaining lease term under operating ROU leases was 7.5 years.

As of September 30, 2019, the weighted average discount rate for operating lease liabilities was approximately 5.3%.

No new operating lease ROU asset was obtained in exchange for operating lease liabilities during the three and nine months ended September 30, 2019.

6. STOCKHOLDERS' EQUITY

Stock Repurchase Program

On October 25, 2016, the Board of Directors adopted a program (the "2016 Program") that was effective immediately to repurchase up to $25.0 million of the Company's common stock both on the open market and in privately negotiated transactions over the next two years. On May 29, 2018, the Board of Directors terminated that 2016 stock repurchase program, and adopted a new program (the "2018 Program") to repurchase up to $25.0 million of the Company's common stock both on the open market and in privately negotiated transactions over the next two years. During the three and nine months ended September 30, 2019, the Company repurchased approximately 171,000 shares and 785,000 shares, respectively. As of September 30, 2019, approximately 785,000 shares had been repurchased at an average price of $12.43 per share, for a total price of $9.8 million under the 2018 Program. During the three and nine months ended September 30, 2018, the Company repurchased zero and approximately 437,000 shares, respectively, under the 2016 Program and no shares were repurchased under 2018 Program. As of May 29, 2018, the Company had repurchased approximately 1,279,000 shares at an average price of $14.59 per share, for a total price of $18.7 million, under the 2016 Program. Under the 2018 program, as of September 30, 2019, $15.2 million remained available for future repurchases of the Company's common stock.

7. EMPLOYEE BENEFIT PLANS

On September 30, 2019, the Company had the following stock-based compensation plans:

Employee Stock Purchase Plan

In July 2001, the Company adopted a ten-year Employee Stock Purchase Plan (as amended, the “Purchase Plan”) under which eligible employees can contribute up to 10% of their compensation, as defined in the Purchase Plan, towards the purchase of shares of PDF common stock at a price of 85% of the lower of the fair market value at the beginning of the offering period or the end of the purchase period. The Purchase Plan consists of twenty-four-month offering periods with four nine-month purchase periods in each offering period. Under the Purchase Plan, on January 1 of each year, starting with 2002, the number of shares reserved for issuance will automatically increase by the lesser of (1) 675,000 shares, (2) 2% of the Company’s outstanding common stock on the last day of the immediately preceding year, or (3) the number of shares determined by the board of directors. At the annual meeting of stockholders on May 18, 2010, the Company’s stockholders approved an amendment to the Purchase Plan to extend it through May 17, 2020.

The Company estimated the fair value of purchase rights granted under the Purchase Plan during the period using the Black-Scholes-Merton option-pricing model with the following weighted average assumptions, resulting in the following weighted average fair values:

	Nine Months Ended September 30,	
	2019	**2018**
Expected life (in years)	1.25	1.25
Volatility	42.45%	42.85%
Risk-free interest rate	2.24%	2.48%
Expected dividend	—	—
Weighted average fair value per share of options granted during the period	$ 4.08	$ 3.62

During the three months ended September 30, 2019 and 2018, a total of approximately 85,000 and 92,000 shares, respectively, were issued at a weighted-average purchase price of $8.90 and $8.93 per share, respectively. During the nine months ended September 30, 2019 and 2018, a total of approximately 172,000 and 200,000 shares, respectively, were issued at a weighted-average purchase price of $8.92 and $9.12 per share, respectively. As of September 30, 2019, there was $0.9 million of unrecognized compensation cost related to the Purchase Plan. That cost is expected to be recognized over a weighted average period of 1.4 years. As of September 30, 2019, 5.2 million shares were available for future issuance under the Purchase Plan.

Stock Incentive Plans

On November 16, 2011, the Company’s stockholders initially approved the 2011 Stock Incentive Plan, which has been amended and restated and approved by the Company’s stockholders a number of times since then (as amended, the “2011 Plan”). Under the 2011 Plan, the Company may award stock options, stock appreciation rights, stock grants or stock units covering shares of the Company’s common stock to employees, directors, non-employee directors and contractors. The aggregate number of shares reserved for awards under this plan is 10,300,000 shares, plus up to 3,500,000 shares previously issued under the 2001 Plan that are (i) forfeited or (ii) repurchased by the Company or shares subject to awards previously issued under the 2001 Plan that expire or that terminate without having been exercised or settled in full on or after November 16, 2011. In case of awards other than options or stock appreciation rights, the aggregate number of shares reserved under the 2011 Plan will be decreased at a rate of 1.33 shares issued pursuant to such awards. The exercise price for stock options must generally be at prices no less than the fair market value at the date of grant. Stock options generally expire ten years from the date of grant and become vested and exercisable over a four-year period.

In 2001, the Company adopted a 2001 Stock Plan (the “2001 Plan”). In 2003, in connection with its acquisition of IDS Systems Inc., the Company assumed IDS’ 2001 Stock Option / Stock Issuance Plan (the “IDS Plan”). Both of the 2001 and the IDS Plans expired in 2011. Stock options granted under the 2001 and IDS Plans generally expire ten years from the date of grant and become vested and exercisable over a four-year period. Although no new awards may be granted under the 2001 or IDS Plans, awards made under the 2001 and IDS Plans that are currently outstanding remain subject to the terms of each such plan.

As of September 30, 2019, 10.8 million shares of common stock were reserved to cover stock-based awards under the 2011 Plan, of which 3.5 million shares were available for future grant. The number of shares reserved and available under the 2011 Plan includes 0.5 million shares that were subject to awards previously made under the 2001 Plan and were forfeited, expired or repurchased by the Company after adoption of the 2011 Plan through September 30, 2019. As of September 30, 2019, there were no outstanding awards that had been granted outside of the 2011, 2001, or the IDS Plans (collectively, the "Stock Plans").

Stock-based compensation is estimated at the grant date based on the award's fair value and is recognized on a straight-line basis over the vesting periods, generally four years. Stock-based compensation expense before taxes related to the Company's stock plans and employee stock purchase plan was allocated as follows (in thousands):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Cost of solutions	$ 745	$ 787	$ 2,404	$ 2,768
Research and development	1,062	725	3,681	2,449
Selling, general and administrative	925	756	2,557	2,608
Stock-based compensation expenses	$ 2,732	$ 2,268	$ 8,642	$ 7,825

The stock-based compensation expense in the table above includes immaterial expense or credit adjustments related to cash-settled stock appreciation rights ("SARs") granted to certain employees. The Company accounted for these awards as liability awards and the amount was included in accrued compensation and related benefits. Stock-based compensation capitalized in the capitalized software development costs included in the Property and Equipment, net, was approximately $0.2 million at September 30, 2019.

Stock Options

The Company estimated the fair value of each stock option granted under the 2011 Stock Plan during the period using the Black-Scholes-Merton option-pricing model with the following weighted average assumptions, resulting in the following weighted average fair values:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Expected life (in years)	4.46	4.43	4.46	4.43
Volatility	39.93%	44.01%	42.61%	43.82%
Risk-free interest rate	1.40%	2.73%	1.99%	2.71%
Expected dividend	—	—	—	—
Weighted average fair value per share of options granted during the period	$ 4.70	$ 4.21	$ 4.61	$ 4.22

Additional information with respect to options under the Stock Plans during the nine months ended September 30, 2019, was as follows:

	Number of Options (in thousands)	Weighted Average Exercise Price per Share	Weighted Average Remaining Contractual Term (years)	Aggregate Intrinsic Value (in thousands)
Outstanding, January 1, 2019	1,027	$ 9.75		
Granted (weighted average fair value of $4.61 per share)	66	$ 12.35		
Exercised	(217)	$ 5.13		
Canceled	(75)	$ 14.53		
Expired	(55)	$ 16.09		
Outstanding, September 30, 2019	746	$ 9.79	4.54	$ 2,521
Vested and expected to vest, September 30, 2019	732	$ 10.33	4.45	$ 2,502
Exercisable, September 30, 2019	582	$ 9.79	3.33	$ 2,291

The aggregate intrinsic value in the table above represents the total intrinsic value based on the Company’s closing stock price of $13.07 per share as of September 30, 2019. The total intrinsic value of options exercised during the nine months ended September 30, 2019, was $1.5 million.

As of September 30, 2019, there was $0.7 million of total unrecognized compensation cost, net of forfeitures, related to unvested stock options. That cost is expected to be recognized over a weighted average period of 2.8 years. The total fair value of shares vested during the nine months ended September 30, 2019, was $0.1 million.

Restricted Stock Units

The fair value and compensation cost before estimated forfeitures for restricted stock units is calculated using the closing price of common stock on the date of grant.

Nonvested restricted stock units activity during the nine months ended September 30, 2019, was as follows:

	Shares (in thousands)	Weighted Average Grant Date Fair Value Per Share
Nonvested, January 1, 2019	1,835	$ 11.93
Granted	895	$ 13.33
Vested	(530)	$ 13.40
Forfeited	(164)	$ 12.03
Nonvested, September 30, 2019	2,036	$ 12.17

As of September 30, 2019, there was $19.4 million of total unrecognized compensation cost related to nonvested restricted stock units. That cost is expected to be recognized over a weighted average period of 2.8 years. Restricted stock units do not have rights to dividends prior to vesting.

8. RESTRUCTURING CHARGES

On September 27, 2018, the Board of Directors of the Company approved a reduction in its workforce to reduce expenses and align its operations with evolving business needs. Notifications to the affected employees began on October 24, 2018.

From inception of the restructuring plan to September 30, 2019, the Company has recorded restructuring charges of $0.7 million, primarily consisting of employee separation charges. The Company is in the process of implementing the restructuring plan, and the remaining charges expected to be incurred are not expected to be significant.

The following table summarizes the activities of restructuring liabilities under this plan (in thousands):

	Three Months Ended September 30, 2019	Nine Months Ended September 30, 2019
Beginning balance	$ —	$ 244
Restructuring charges	—	92
Cash payments	—	(336)
Ending balance	$ —	$ —

9. INCOME TAXES

Income tax benefit increased $0.1 million for the nine months ended September 30, 2019, to a $1.5 million income tax benefit as compared to an income tax benefit of $1.4 million for the nine months ended September 30, 2018. The Company’s effective tax rate benefit was 26.2% and 22.8% for the nine months ended September 30, 2019 and 2018, respectively. The Company’s effective tax rate benefit increased in the nine months ended September 30, 2019, as compared to the same period in 2018, primarily due to favorable reductions in excess tax benefits related to employee stock compensation and a change in the level of forecasted income/loss.

The Company's total amount of unrecognized tax benefits, excluding interest and penalties, as of September 30, 2019, was $13.5 million, of which $7.8 million, if recognized, would affect the Company's effective tax rate. The Company's total amount of unrecognized tax benefits, excluding interest and penalties, as of December 31, 2018, was $13.3 million, of which $7.8 million, if recognized, would affect the Company's effective tax rate. As of September 30, 2019, the Company has recorded unrecognized tax benefits of $2.8 million, including interest and penalties of $0.7 million, as long-term taxes payable in its condensed consolidated balance sheet. The remaining $11.4 million has been recorded net of our deferred tax assets, of which $5.7 million is subject to a full valuation allowance.

The valuation allowance was approximately $10.4 million and $9.8 million as of September 30, 2019, and December 31, 2018, respectively, which was related to California R&D tax credits and California net operating losses related to the Company's acquisition of Syntricity. The Company has recorded a valuation allowance against these deferred tax assets because it believes that it is more likely than not that these tax attributes will not be realized.

Effective January 1, 2018, the 2017 Tax Cuts and Jobs Acts (the Tax Act) creates a new requirement to include in U.S. income global intangible low-taxed income ("GILTI") earned by controlled foreign corporations ("CFCs"). The GILTI must be included currently in the gross income of the CFCs' U.S. shareholder. Under U.S. GAAP, the Company is allowed to make an accounting policy choice of either (1) treating taxes due on future U.S. inclusions related to GILTI as a current-period expense when incurred (the "period cost method") or (2) factoring such amounts into a company's measurement of its deferred taxes (the "deferred method"). During the first quarter of 2018, the Company selected the period cost method in recording the tax effects of GILTI in its condensed consolidated financial statements.

The Company conducts business globally and, as a result, files numerous consolidated and separate income tax returns in the U.S. federal, various state, and foreign jurisdictions. Because the Company used some of the tax attributes carried forward from previous years to tax years that are still open, statutes of limitation remain open for all tax years to the extent of the attributes carried forward into tax year 2002 for federal and California tax purposes. The Company is not subject to income tax examinations in any of its major foreign subsidiaries' jurisdictions.

10. NET LOSS PER SHARE

Basic net loss per share is computed by dividing net loss by weighted average number of common shares outstanding for the period (excluding outstanding stock options and shares subject to repurchase). Diluted net loss per share is computed using the weighted-average number of common shares outstanding for the period plus the potential effect of dilutive securities which are convertible into common shares (using the treasury stock method), except in cases in which the effect would be anti-dilutive. The following is a reconciliation of the numerators and denominators used in computing basic and diluted net loss per share (in thousands except per share amount):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	**2018**	**2019**	**2018**
Numerator:				
Net loss	$ (687)	$ (2,082)	$ (4,088)	$ (4,602)
Denominator:				
Basic weighted-average common shares outstanding	32,392	32,184	32,405	32,105
Effect of dilutive options and restricted stock	—	—	—	—
Diluted weighted average shares outstanding	32,392	32,184	32,405	32,105
Net loss per share – Basic	$ (0.02)	$ (0.06)	$ (0.13)	$ (0.14)
Net loss per share – Diluted	$ (0.02)	$ (0.06)	$ (0.13)	$ (0.14)

For the three and nine months ended September 30, 2019 and 2018, the Company was in a loss position, basic net loss per share is the same as diluted net loss per share as the inclusion of the potential common shares would have been anti-dilutive.

The following table sets forth potential shares of common stock that are not included in the diluted net loss per share calculation above because to do so would be anti-dilutive for the periods indicated (in thousands):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Outstanding options	525	598	584	625
Nonvested restricted stock units	1,394	1,093	985	1,054
Employee Stock Purchase Plan	53	465	150	165
Total	1,972	2,156	1,719	1,844

11. CUSTOMER AND GEOGRAPHIC INFORMATION

Operating segments are defined as components of an enterprise about which separate financial information is available that is evaluated regularly by the chief operating decision maker, or group, in deciding how to allocate resources and in assessing performance.

The Company's chief operating decision maker, the chief executive officer, reviews discrete financial information presented on a consolidated basis for purposes of regularly making operating decisions and assessing financial performance. Accordingly, the Company considers itself to be in one operating segment, specifically the licensing and implementation of yield improvement solutions for companies designing and/or manufacturing integrated circuits.

The Company had revenues from individual customers in excess of 10% of total revenues as follows:

	Three Months Ended September 30,		Nine Months Ended September 30,	
Customer	2019	2018	2019	2018
A	22%	38%	30%	39%
B	16%	*%	*%	*%

* represents less than 10%

The Company had gross accounts receivable from individual customers in excess of 10% of gross accounts receivable as follows:

Customer	September 30, 2019	December 31, 2018
A	30%	35%
B	14%	21%
C	11%	*%

* represents less than 10%

Revenues from customers by geographic area based on the location of the customers' work sites are as follows (in thousands):

	Three Months Ended September 30,			
	2019		2018	
	Revenues	Percentage of Revenues	Revenues	Percentage of Revenues
United States	$ 7,341	34%	$ 8,366	41%
China	5,118	23	4,644	23
Japan	2,423	11	1,652	8
Taiwan	1,945	9	936	5
Rest of the world	5,087	23	4,615	23
Total revenue	$ 21,914	100%	$ 20,213	100%

	Nine Months Ended September 30,			
	2019		2018	
	Revenues	Percentage of Revenues	Revenues	Percentage of Revenues
United States	$ 25,203	40%	$ 27,430	42%
China	11,369	18	14,186	21
Taiwan	6,041	10	4,109	6
Japan	4,761	7	4,193	7
Rest of the world	15,649	25	16,151	24
Total revenue	$ 63,023	100%	$ 66,069	100%

Long-lived assets, net by geographic area are as follows (in thousands):

	September 30, 2019(1)	December 31, 2018(2)
United States	$ 44,370	$ 35,173
Rest of the world	2,180	508
Total long-lived assets, net	$ 46,550	$ 35,681

(1) Amounts consist of property and equipment, net, and operating lease right-of-use assets, net

(2) Amounts consist of property and equipment, net

12. FAIR VALUE MEASUREMENTS

Fair value is the exit price, or the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants as of the measurement date. The multiple assumptions used to value financial instruments are referred to as inputs, and a hierarchy for inputs used in measuring fair value is established, that maximizes the use of observable inputs and minimizes the use of unobservable inputs by requiring that the most observable inputs be used when available. Observable inputs reflect assumptions market participants would use in pricing an asset or liability based on market data obtained from independent sources while unobservable inputs reflect a reporting entity's pricing based upon its own market assumptions. These inputs are ranked according to a fair value hierarchy that prioritizes the inputs to valuation techniques used to measure fair value into three broad levels.

Level 1 - Inputs are quoted prices in active markets for identical assets or liabilities.

Level 2 - Inputs are quoted prices for similar assets or liabilities in an active market, quoted prices for identical or similar assets or liabilities in markets that are not active, inputs other than quoted prices that are observable and market-corroborated inputs which are derived principally from or corroborated by observable market data.

Level 3 - Inputs are derived from valuation techniques in which one or more significant inputs or value drivers are unobservable.

The following table represents the Company's assets measured at fair value on a recurring basis as of September 30, 2019, and the basis for that measurement (in thousands):

Assets	Total	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Money market mutual funds	$ 27,524	$ 27,524	$ —	$ —

The following table represents the Company's assets measured at fair value on a recurring basis as of December 31, 2018, and the basis for that measurement (in thousands):

Assets	Total	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Money market mutual funds	$ 27,068	$ 27,068	$ —	$ —

The Company enters into foreign currency forward contracts from time to time to reduce the exposure to foreign currency exchange rate fluctuations on certain foreign currency denominated monetary assets and liabilities, primarily on third-party accounts payables and intercompany balances. The primary objective of the Company's hedging program is to reduce volatility of earnings related to foreign currency exchange rate fluctuations. The counterparty to these foreign currency forward contracts is a financial institution that the Company believes is creditworthy, and therefore, the Company believes the credit risk of counterparty nonperformance is not significant. These foreign currency forward contracts are not designated for hedge accounting treatment.

Therefore, the change in fair value of these contracts is recorded into earnings as a component of other income (expense), net, and offsets the change in fair value of the foreign currency denominated assets and liabilities, which is also recorded in other income (expense), net. For the three months ended September 30, 2019 and 2018, the Company recognized a realized loss of $0.4 million and a realized loss of $0.1 million on the contracts, respectively, which was recorded in other income (expense), net in the Company's Condensed Consolidated Statements of Comprehensive Loss. For the nine months ended September 30, 2019 and 2018, the Company recognized a realized loss of $0.7 million and a realized loss of $0.5 million on the contracts, respectively, which was recorded in other income (expense), net in the Company's Condensed Consolidated Statements of Comprehensive Loss.

The Company carries these derivatives financial instruments on its condensed consolidated balance sheets at their fair values. The Company's foreign currency forward contracts are classified as Level 2 because they are not actively traded and the valuation inputs are based on quoted prices and market observable data of similar instruments. As of September 30, 2019, the Company had no outstanding forward contract. As of December 31, 2018, the Company had one outstanding forward contract with a notional amount of $8.2 million and recorded $55,000 other current liability associated with the outstanding forward contract.

13. COMMITMENTS AND CONTINGENCIES

Indemnifications — The Company generally provides a warranty to its customers that its software will perform substantially in accordance with documented specifications typically for a period of 90 days following initial delivery of its products. The Company also indemnifies certain customers from third-party claims of intellectual property infringement relating to the use of its products. Historically, costs related to these guarantees have not been significant. The Company is unable to estimate the maximum potential impact of these guarantees on its future results of operations.

Purchase obligations — The Company has purchase obligations with certain suppliers for the purchase of goods and services entered in the ordinary course of business. As of September 30, 2019, total outstanding purchase obligations were $14.9 million, which are primarily due within the next 12 months.

Indemnification of Officers and Directors — As permitted by the Delaware general corporation law, the Company has included a provision in its certificate of incorporation to eliminate the personal liability of its officers and directors for monetary damages for breach or alleged breach of their fiduciary duties as officers or directors, other than in cases of fraud or other willful misconduct.

In addition, the Bylaws of the Company provide that the Company is required to indemnify its officers and directors even when indemnification would otherwise be discretionary, and the Company is required to advance expenses to its officers and directors as incurred in connection with proceedings against them for which they may be indemnified. The Company has entered into indemnification agreements with its officers and directors containing provisions that are in some respects broader than the specific indemnification provisions contained in the Delaware general corporation law. The indemnification agreements require the Company to indemnify its officers and directors against liabilities that may arise by reason of their status or service as officers and directors other than for liabilities arising from willful misconduct of a culpable nature, to advance their expenses incurred as a result of any proceeding against them as to which they could be indemnified, and to obtain directors' and officers' insurance if available on reasonable terms. The Company has obtained directors' and officers' liability insurance in amounts comparable to other companies of the Company's size and in the Company's industry. Since a maximum obligation of the Company is not explicitly stated in the Company's Bylaws or in its indemnification agreements and will depend on the facts and circumstances that arise out of any future claims, the overall maximum amount of the obligations cannot be reasonably estimated.

Litigation — From time to time, the Company is subject to various claims and legal proceedings that arise in the ordinary course of business. The Company accrues for losses related to litigation when a potential loss is probable and the loss can be reasonably estimated in accordance with FASB requirements. As of September 30, 2019, the Company was not party to any material legal proceedings, thus no loss was probable and no amount was accrued.

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

Forward-Looking Statements

The following discussion of our financial condition and results of operations contains 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. All statements other than statements of historical fact may be forward-looking statements. In some cases, you can identify forward-looking statements by terminology such as "may," "could," "should," "expect," "plan," "anticipate," "believe," "estimate," "predict," "potential", "target" or "continue," the negative effect of terms like these or other similar expressions. Any statement concerning future financial performance (including future revenues, earnings or growth rates), ongoing business strategies or prospects, and possible actions taken by us or our subsidiaries, which may be provided by us are also forward-looking statements. These forward-looking statements are only predictions. Forward-looking statements are based on current expectations and projections about future events and are inherently subject to a variety of risks and uncertainties, many of which are beyond our control, which could cause actual results to differ materially from those anticipated or projected. All forward-looking statements included in this document are based on information available to us on the date of filing and we further caution investors that our business and financial performance are subject to substantial risks and uncertainties. We assume no obligation to update any such forward-looking statements. In evaluating these statements, you should specifically consider various factors, including the risk factors set forth in Item 1. "Business" and Item 7. "Management's Discussion and Analysis of Financial Condition and Results of Operations" in our Annual Report on Form 10-K for the year ended December 31, 2018, filed with the Securities and Exchange Commission on March 8, 2019. All references to "we", "us", "our", "PDF", "PDF Solutions" or "the Company" refer to PDF Solutions, Inc.

Overview

We offer products and services designed to empower engineers and data scientists across the semiconductor ecosystem to improve the yield, quality, and profitability of their products. Our solutions combine proprietary software, physical intellectual property (or IP) for integrated circuit (or IC) designs, electrical measurement hardware tools, proven methodologies, and professional services. We primarily monetize our solutions through time-based license fees and contract revenue for professional services. In some cases, especially on our historical yield ramp engagements, we also receive a value-based royalty that we call a Gainshare performance incentive. Our products and services have been sold to integrated device manufacturers (or IDMs), fabless semiconductor companies, foundries, out-sourced semiconductor assembly and test (or OSATs), and system houses.

Industry Trend

Certain trends may affect our analytics opportunities. In particular, the confluence of Industry 4.0 (i.e. the fourth industrial revolution, or the automation and data exchange in manufacturing technologies and processes) and cloud computing (i.e. the on-demand availability of computing resources and data storage without direct active management by the user) is driving increased innovation in semiconductor and electronics manufacturing and analytics, as well as in the organization of IT networks and computing at those same companies. First, the ubiquity of wireless connectivity and sensor technology enables any manufacturing company to augment its factories and visualize its entire production line. In parallel, the cost per terabyte of data storage has continually increased year to year. The combination of these two trends means that more data is collected and stored than ever before. Semiconductor companies are striving to analyze these very large data sets in real-time to make rapid decisions that measurably improve manufacturing efficiency and quality. In parallel, the traditional practice of on-site data storage, even for highly sensitive data, is changing. The ability to cost-effectively and securely store, analyze, and retrieve massive quantities of data from the cloud versus on-premise enables data to be utilized across a much broader population of users, frequently resulting in greater demands on the analytics programs. The combination of these two trends means that cloud-based, analytic programs that effectively manage identity management, physical security and data protection are increasingly demanded for insights and efficiencies across the organizations of these companies. We believe that all these trends will continue for the next few years, and the challenges involved in adopting Industry 4.0 and secure cloud computing will create opportunities for companies that have a combination of advanced analytics capabilities, proven and established data infrastructures, and professional services to optimize their environment to customers' specialized needs.

Other trends may continue to affect our integrated yield ramp opportunities. The logic foundry market at the leading edge nodes, such as 10nm and 7nm has undergone significant change over the past few years. The leading foundry continues to increase market share as other foundries have either suspended 7nm development, forecasted a later start of mass production, or started later than originally forecast in some cases. This trend will likely continue to negatively impact our yield ramp solutions business on these nodes. Further, for many foundries, utilization rates for 28nm fabs remain suppressed. We expect most logic foundries to invest in derivatives of older process nodes, such as 28nm and 20nm, to extract additional value as many of their customers will not move to advanced nodes due to either technological barriers or restrictive economics. Foundries that participate at leading edge nodes are expected to continue to invest in new technologies such as memory, packaging, and multi-patterned and EUV lithography, as well as new innovations in process control and variability management. We expect China's investment in semiconductors to continue for at least the next few years. In order for these trends to provide opportunities for us to increase our business in process control and electrical characterization, Chinese semiconductors manufacturers will need to increase their production volumes on advanced technology nodes and continue to engage foreign suppliers.

There are other trends that may affect our business opportunities in general. For instance, the demand for consumer electronics, communications devices, and high performance computing continues to drive technological innovation in the semiconductor industry as the need for products with greater performance, lower power consumption, reduced costs and smaller size continues to grow with each new product generation. In addition, advances in computing systems and mobile devices have fueled demand for higher capacity memory chips. To meet these demands, IC manufacturers and designers are constantly challenged to improve the overall performance of their ICs by designing and manufacturing ICs with more embedded applications to create greater functionality while lowering power and cost per transistor. As this trend continues, companies will continually be challenged to improve process capabilities to optimally produce ICs with minimal random and systematic yield loss, which is driven by the lack of compatibility between the design and its respective manufacturing process. We believe that these difficulties will continue to create a need for all types of products and services that address yield loss across the IC product life cycle.

Financial Highlights

Financial highlights for the three months ended September 30, 2019, were as follows:

- Total revenues were $21.9 million, which was an increase of $1.7 million, or 8%, compared to the year-ago period. Solutions revenue was $16.2 million, which was an increase of $2.2 million, or 16%, compared to the year-ago period. The increase in Solutions revenue was primarily due to the increases in our Exensio platform revenues that were driven by higher business activity. Gainshare performance incentives revenue was $5.7 million, a decrease of $0.5 million, or 9%, compared to the year-ago period. The decrease was primarily due to lower wafer volumes at the 14nm and 28nm technology nodes covered by contracts with Gainshare performance incentives revenue.

- Gross margin was 60%, compared to 47% for the year-ago period. Gross profit was significantly higher than the prior period due primarily to higher Solutions revenue and a reduction in headcount primarily related to our yield ramp business, which is a cost of revenues. Cost of solutions decreased for the three months ended September 30, 2019, compared to the year-ago period, primarily due to a $2.5 million decrease in personnel-related cost driven by lower headcount, and a $0.2 million decrease in travel expenses resulting from our cost management effort. These decreases in cost of solutions were partially offset by (i) a $0.5 million decrease in Gainshare performance incentives, (ii) a $0.7 million increase in hardware and equipment expense, (iii) a $0.2 million increase in cloud-delivered solutions-related costs, and (iv) a $0.3 million increase in depreciation expense.

- Net loss was $0.7 million, compared to a net loss of $2.1 million for the year-ago period. The decrease in net loss was primarily attributable to a $1.7 million increase in total revenues, and a $2.0 million decrease in cost of solutions, partially offset by a $2.2 million increase in operating expenses as we continued to make investments in research and development and sales and marketing activities.

- Net loss per basic and diluted share was $(0.02), compared to net loss per basic and diluted share of $(0.06) for the year-ago period, a decrease of $0.04 per basic and diluted share.

- Cash and cash equivalents increased $4.2 million to $100.3 million at September 30, 2019, from $96.1 million at December 31, 2018, primarily due to collection of significant past due accounts receivables during the third quarter of fiscal 2019, partially offset by cash used in investing activities related to the property and equipment purchased for the development our DFI solution, expansion of our research and development laboratory and clean room, and a payment for the acquisition of certain assets of StreamMosaic, Inc., a provider of artificial intelligence and machine learning solutions, and cash used in financing activities primarily due to repurchases of our common stock.

Financial highlights for the nine months ended September 30, 2019, were as follows:

- Total revenues were $63.0 million, which was a decrease of $3.0 million, or 5%, compared to the compared to the year-ago period. Solutions revenues were $46.3 million, which was a decrease of $1.1 million, or 2%, compared to the year-ago period. The decrease in Solutions revenue was primarily related to a decrease in the revenue from our yield ramp solutions resulting from lower hours worked across multiple contracts and customers, which was partially offset by increases in Exensio platform revenues. Gainshare performance incentives revenue was $16.7 million, a decrease of $1.9 million, or 10%, compared to the year-ago period. The decrease in Gainshare performance incentives revenue was primarily due to lower incentives revenue from the 28nm technology node.

- Gross margin was 61%, compared to 50% for the year-ago period. Gross profit was significantly higher than the prior period due primarily to (i) recognition of Solutions revenue of $3.3 million from a customer contract amendment during the first quarter of fiscal year 2019, without which our gross margin would have been approximately 2% lower, and (ii) a reduction in headcount primarily related to our yield ramp business, which is a cost of revenues. Cost of solutions decreased compared to the year-ago period, primarily due to (i) a $7.6 million decrease in personnel-related cost driven by lower headcount and lower chargeable hours incurred across multiple contracts and customers, and a decrease in stock-based compensation expense, partially offset by an increase in salary expenses related to our worldwide merit increases, (ii) a $0.2 million decrease in hardware and equipment expense due to lower Solutions revenue, and (iii) a $0.7 million decrease in travel expenses resulting from our cost management efforts. These decreases in cost of solutions were partially offset by (i) a $1.9 million decrease in Gainshare performance incentives, (ii) a $0.2 million increase in cloud-delivered solutions related costs, and (iii) $0.3 million increase in depreciation expense.

- Net loss was $4.1 million, compared to a net loss of $4.6 million for the year-ago period. The decrease in net loss was primarily attributable to (i) a $3.4 million decrease in cost of solutions and operating expenses related to a decrease in personnel-related costs driven by lower headcount, hardware and equipment costs, travel, operating lease and subcontractor expenses and accounting and audit fees, partially offset by increase in employee stock compensation expense, recruiting and legal fees, facilities and depreciation and amortization expenses, and (ii) a $3.0 million decrease in total revenues.

- Net loss per basic and diluted share was $(0.13), compared to net loss per basic and diluted share of $(0.14) for the year-ago period, a decrease of $0.01 per basic and diluted share.

Critical Accounting Policies and Estimates

See Note 1 of "Notes to Condensed Consolidated Financial Statements (Unaudited)" of this Quarterly Report on Form 10-Q for a description of recent accounting pronouncements and accounting changes, including the expected dates of adoption and expected effects, if any, on our condensed consolidated financial statements, and to Management's Discussion and Analysis of Financial Condition and Results of Operations contained in Part II, Item 7 of our Annual Report on Form 10-K for the year ended December 31, 2018.

With the exception of the changes made to our accounting for leases as a result of the adoption of ASC 842, there have been no material changes during the nine months ended September 30, 2019, to the items that we disclosed as our critical accounting policies and estimates in Management's Discussion and Analysis of Financial Condition and Results of Operations in our Annual Report on Form 10-K for the fiscal year ended December 31, 2018.

The following is a brief discussion of the more significant accounting policies and methods that we use.

General

Our discussion and analysis of our financial conditions, results of operations and cash flows are based on our condensed consolidated financial statements, which have been prepared in conformity with accounting principles generally accepted in the United States of America. Our preparation of these consolidated financial statements requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the dates of the financial statements and the reported amounts of revenues and expenses during the reporting periods. We base our estimates on historical experience and on various other assumptions that we believe to be reasonable under the circumstances. The most significant estimates and assumptions relate to revenue recognition, stock-based compensation and the realization of deferred tax assets. Actual amounts may differ from such estimates under different assumptions or conditions.

Revenue Recognition

We derive revenues from two sources: Solutions revenue and Gainshare performance incentives.

Solutions revenue — We recognize revenue for each element of solutions revenue as follows:

We license the majority of our software products separately from project-based solution implementation service contracts, in particular, our Exensio platform and related products. The majority of this software is delivered as on-premise software licenses, while others can be delivered entirely or partially through Software-as-a-Service (SaaS) or cloud delivery models. Revenue from perpetual (one-time charge) license software is recognized at a point in time at the inception of the arrangement when control transfers to the client, if the software license is distinct from the services offered by us. Revenue from post-contract support subscription is recognized over the contract term on a straight-line basis, because we are providing a service of standing ready to provide support, when-and-if needed, and is providing unspecified software upgrades on a when-and-if available basis over the contract term. Revenue from time-based license software is allocated to each performance obligation and is recognized either at a point in time or over time. The license component is recognized at a point in time, at the delivery of the software license, with the post-contract support subscription component being recognized ratably over for the committed term of the contract. Revenue from software hosting or SaaS arrangements that allow for the use of a hosted software product or service over a contractually determined period of time without taking possession of software are accounted for as subscriptions and recognized as revenue ratably, on a straight-line basis, over the coverage period beginning on the date the service is made available to customers.

We also license our DFI system as a separate component of fixed-price service contracts that are not project-based solutions implementation services contracts. We allocate revenue to all deliverables under these DFI contracts based on their standalone selling prices, or SSP. In such instances, we apply judgment to estimate the range of SSPs for each performance obligation.

We generate a portion of our Solutions revenue from fixed-price, project-based solution implementation service contracts that are associated with our classic yield ramp business, which services are delivered over a specific period of time. Revenue under these project–based contracts for solution implementation services is recognized as services are performed using a percentage of completion method based on costs or labor-hours inputs, depending on whichever is the most appropriate measure of the progress towards completion of the contract. Due to the nature of the work performed in these arrangements, the estimation of costs or hours at completion is complex, subject to many variables and requires significant judgment. Key factors reviewed by us to estimate costs to complete each contract are future labor and product costs and expected productivity efficiencies. If circumstances arise that change the original estimates of revenues, costs, or extent of progress toward completion, revisions to the estimates are made. These revisions may result in increases or decreases in estimated revenues or costs. Losses on fixed-price solution implementation contracts are recognized in the period when they become probable. Revisions in profit estimates are reflected in the period in which the conditions that require the revisions become known and can be estimated (the cumulative catch-up method).

We typically include some of our products and other technology as components of our fixed-price, project-based services contracts. In such instances, we determine whether the services performed and products/technology included, are distinct. In most cases, the arrangement is a single performance obligation, and therefore, follows the pattern of transfer as the service is provided. We apply a measure of progress (typically hours-to-hours or cost-to-cost) to any fixed consideration. As a result, revenue is generally recognized over the period the services are performed using the percentage of completion method. This results in revenue recognition that corresponds with the value to the client of the services transferred to date relative to the remaining services promised.

Gainshare Performance Incentives — When we enter into a project-based solution implementation services contract, the contract usually includes two components: (1) a fixed fee for performance by the Company of services delivered over a specific period of time; and (2) a Gainshare performance incentive component where the customer pays a variable fee, usually after the fixed fee period has ended, related to continued usage of the Company's intellectual property. Revenue derived from Gainshare performance incentives is contingent upon our customers reaching certain defined production yield levels. Gainshare performance incentive periods are usually subsequent to the delivery of all contractual services and performance obligations. We recorded Gainshare revenue as a usage-based royalty based on customers' usage of intellectual property and recorded in the same period in which the usage occurs.

Income Taxes

The Company's provision for income tax comprises its current tax liability and change in deferred tax assets and liabilities. Deferred tax assets and liabilities are recognized for the expected tax consequences of temporary differences between the tax bases of assets and liabilities. The measurement of current and deferred tax assets and liabilities is based on provisions of enacted tax laws; the effect of future changes in tax laws or rates is not factored in. Valuation allowances are provided to reduce deferred tax assets to an amount that in management's judgment is more likely than not to be recoverable against future taxable income. No U.S. taxes are provided on earnings of non-U.S. subsidiaries, to the extent such earnings are deemed to be permanently invested. The Company's income tax calculations are based on application of the respective U.S. federal, state or foreign tax laws. The Company's tax filings, however, are subject to audit by the respective tax authorities. Accordingly, the Company recognizes tax liabilities based upon its estimate of whether, and the extent to which, additional taxes will be due when such estimates are more-likely-than-not to be sustained. An uncertain income tax position will not be recognized if it has less than a 50% likelihood of being sustained. To the extent the final tax liabilities are different from the amounts originally accrued, the increases or decreases are recorded as income tax expense or benefit in the condensed consolidated statements of comprehensive loss.

Recent Accounting Pronouncements and Accounting Changes

See Note 1 of "Notes to Condensed Consolidated Financial Statements (Unaudited)" of this Quarterly Report on Form 10-Q for a description of recent accounting pronouncements and accounting changes, including the expected dates of adoption and estimated effects, if any, on our condensed consolidated financial statements.

Results of Operations

Discussion of Financial Data for the Three and Nine Months Ended September 30, 2019 and 2018

Revenues

	Three Months Ended September 30,		Change		Nine Months Ended September 30,		Change	
	2019	2018	$	%	2019	2018	$	%
(Dollars in thousands)								
Solutions	$ 16,208	$ 13,976	$ 2,232	16%	$ 46,298	$ 47,431	$ (1,133)	(2)%
Gainshare performance incentives	5,706	6,237	(531)	(9)%	16,725	18,638	(1,913)	(10)%
Total revenues	$ 21,914	$ 20,213	$ 1,701	8%	$ 63,023	$ 66,069	$ (3,046)	(5)%
Solutions revenue as a percentage of total revenues	74%	69%			73%	72%		
Gainshare performance incentives as a percentage of total revenues	26%	31%			27%	28%		

Solutions revenue is derived from services (including solution implementations, software support and maintenance, consulting, and training), software licenses, and hardware. Solutions revenue increased $2.2 million for three months ended September 30, 2019, compared to the year-ago period, due primarily to the increase in our Exensio platform revenues that were driven by higher business activity. Solutions revenue decreased by $1.1 million for the nine months ended September 30, 2019, compared to the year-ago period, due primarily to the decrease in the revenue from our yield ramp solutions resulting from lower hours worked across multiple contracts and customers, which was partially offset by increases in Exensio platform revenues. Our Solutions revenue may fluctuate in the future and is dependent on a number of factors, including the semiconductor industry's continued acceptance of our solutions, the timing of purchases by existing and new customers, cancellations by existing customers, and our ability to attract new customers, penetrate new markets, and further penetrate of our current customer base. Fluctuations in future results may also occur if any of our significant customers renegotiate pre-existing contractual commitments, including due to adverse changes in their own business.

Gainshare performance incentives revenues represent royalties and performance incentives earned contingent upon our customers reaching certain defined operational levels. Revenue derived from Gainshare performance incentives decreased by $0.5 million for the three months ended September 30, 2019, compared to the year-ago period, due primarily to lower wafer volumes at the 14nm and 28nm technology nodes covered by contracts with Gainshare performance incentives revenue. Revenue derived from Gainshare performance incentives decreased by $1.9 million for the nine months ended September 30, 2019, compared to the year-ago period, due primarily to lower wafer volumes at the 28nm technology node covered by contracts with Gainshare performance incentives revenue. Our Gainshare performance incentives revenue may continue to fluctuate from period to period. Gainshare performance incentives revenue is dependent on many factors that are outside our control, including among others, continued production of ICs by our customers at facilities at which we generate Gainshare, sustained yield improvements by our customers, and our ability to enter into new solutions contracts containing Gainshare performance incentives.

Gross Margin

	Three Months Ended September 30,		Change		Nine Months Ended September 30,		Change	
	2019	2018	$	%	2019	2018	$	%
(Dollars in thousands)								
Solutions	$ 7,493	$ 3,293	$ 4,200	128%	$ 21,883	$ 14,349	$ 7,534	53%
Gainshare performance incentives	5,706	6,237	(531)	(9)%	16,725	18,638	(1,913)	(10)%
Gross profit	$ 13,199	$ 9,530	$ 3,669	38%	$ 38,608	$ 32,987	$ 5,621	17%
Gross margin – Solutions revenue	46%	24%			47%	30%		
Gross margin – Gainshare performance incentives	100%	100%			100%	100%		
Gross margin – Total Company	60%	47%			61%	50%		

Gross margin increased for the three months ended September 30, 2019 compared to the year-ago period, due primarily to higher Solutions revenue and a reduction in headcount related to our yield ramp business, which is a cost of revenues. Cost of solutions decreased for the three months ended September 30, 2019, compared to the year-ago period, primarily due to a $2.5 million decrease in personnel-related cost driven by lower headcount, and a $0.2 million decrease in travel expenses resulting from our cost management effort. These decreases in cost of solutions were partially offset by (i) a $0.5 million decrease in Gainshare performance incentives, (ii) a $0.7 million increase in hardware and equipment expense due to higher solutions revenue, (iii) a $0.2 million increase in cloud-delivered solutions-related costs, and (iv) a $0.3 million increase in depreciation expense.

Gross margin increased for the nine months ended September 30, 2019 compared to the year-ago period, due primarily to (i) recognition of Solutions revenue of $3.3 million from a customer contract amendment during the first quarter of fiscal year 2019, without which our gross margin would be approximately 2% lower, and (ii) a reduction in headcount primarily related to our yield ramp business, which is a cost of revenues. Cost of solutions decreased for the nine months ended September 30, 2019, compared to the year-ago period, primarily due to (i) a $7.6 million decrease in personnel-related cost driven by lower headcount and lower chargeable hours incurred across multiple contracts and customers, and decrease in stock-based compensation expense, partially offset by increase in salary expenses related to our worldwide merit increases, (ii) a $0.2 million decrease in hardware and equipment expense due to lower solutions revenue, and (iii) a $0.7 million decrease in travel expenses resulting from our cost management efforts. These decreases in costs of solutions partially offset by (i) a $1.9 million decrease in Gainshare performance incentives, (ii) a $0.2 million increase in cloud-delivered solutions-related costs, and (iii) $0.3 million increase in depreciation expense.

Research and Development

	Three Months Ended September 30,		Change		Nine Months Ended September 30,		Change	
	2019	2018	$	%	2019	2018	$	%
(Dollars in thousands)								
Research and development	$ 8,435	$ 6,755	$ 1,680	25%	$ 23,993	$ 21,100	$ 2,893	14%
Research and development as a percentage of total revenues	38%	33%			38%	32%		

Research and development expenses consist primarily of personnel-related costs to support product development activities, including compensation and benefits, outside development services, travel, facilities cost allocations, and stock-based compensation charges.

Research and development expenses increased for the three months ended September 30, 2019, compared to the year-ago period, primarily due to (i) a $1.2 million increase in personnel-related cost, driven primarily by salary expenses related to our annual merit performance program, higher payroll expenses due to the shifting of more resources from our yield ramp business to research and development activities, additional headcount, and an increase in stock based compensation expense, and (ii) a $0.5 million increase in facilities and information technology related-costs driven primarily by increased in development costs for our cloud-based delivery for our Exensio platform and higher depreciation expense.

Research and development expenses increased for the nine months ended September 30, 2019, compared to the year-ago period due primarily to (i) a $2.6 million increase in personnel-related expense, driven by an increase in stock based compensation expense of $1.2 million, higher payroll expenses due to the shifting of more resources from our yield ramp business to research and development activities, additional headcount, and an increase in salary expenses related to our worldwide merit increases, and (ii) a $1.0 million increase in facilities and information technology (IT) related-costs, driven primarily by higher costs allocation for certain facilities and IT related-expenses which are calculated using a proportional allocation based on headcount, an increase in development costs for our cloud-based delivery for our Exensio platform, and higher depreciation expense for our laboratory equipment and higher amortization expense of leasehold improvements related to the expansion of our research and development laboratory and clean room. These increases in research and development expense were partially offset by a $0.7 million decrease in subcontractor expenses that is primarily related to our DFI and Exensio solutions.

We anticipate our expenses in research and development will fluctuate in absolute dollars from period to period as a result of cost control initiatives and the timing of product development projects and revenue generating activity requirements.

Selling, General and Administrative

	Three Months Ended September 30,		Change		Nine Months Ended September 30,		Change	
	2019	2018	$	%	2019	2018	$	%
(Dollars in thousands)								
Selling, general and administrative	$ 5,990	$ 5,507	$ 483	9%	$ 19,940	$ 17,801	$ 2,139	12%
Selling, general and administrative as a percentage of total revenues	27%	27%			32%	27%		

Selling, general and administrative expenses consist primarily of compensation and benefits for sales, marketing and general and administrative personnel, legal and accounting services, marketing communications, travel and facilities cost allocations, and stock-based compensation charges.

Selling, general and administrative expenses increased for the three months ended September 30, 2019, compared to the year-ago period, primarily due to (i) a $0.5 million increase in personnel-related expenses driven by higher payroll expenses allocated to selling and marketing activities as a result of shifting of resources from our yield ramp business, salary expenses related to our worldwide merit increases, and increase in stock-based compensation, and (ii) a $0.1 million increase in professional fees due mainly from timing of professional audit fees causing variance between the two periods. These increases in selling, general and administrative expenses were partially offset by a $0.1 million decrease in travel expenses resulting from our cost management effort, and a $0.1 million decrease in legal expense.

Selling, general and administrative expenses increased for the nine months ended September 30, 2019, compared to the year-ago period, primarily due to (i) a $2.2 million increase in personnel-related expenses driven by higher payroll expenses allocated to selling and marketing activities as a result of the shifting of resources from our yield ramp business, salary expenses related to our worldwide merit increases, an increase in accrued vacation benefits, and increase in recruiting expense, (ii) a $0.3 million increase in other facilities and IT related-expenses, and (iii) a $0.2 million increase in legal expense primarily related to a business acquisition in the second quarter of fiscal 2019. These increases in selling, general and administrative expenses were partially offset by (i) a $0.3 million decrease in professional fees due primarily to lower audit fees, (ii) a $0.3 million decrease in travel expenses resulting from our cost management effort, and (iii) a $0.2 million decrease in operating lease expense.

Amortization of Other Acquired Intangible Assets

	Three Months Ended September 30,		Change		Nine Months Ended September 30,		Change	
	2019	**2018**	**$**	**%**	**2019**	**2018**	**$**	**%**
(Dollars in thousands)								
Amortization of other acquired intangible assets	$ 174	$ 108	$ 66	61%	$ 436	$ 326	$ 110	34%

Amortization of other acquired intangible assets consists of amortization of intangibles acquired as a result of certain business combinations. The increase in amortization of other acquired intangible assets for the three and nine months ended September 30, 2019, compared to the year-ago periods, was primarily related to amortization of other acquired intangible assets related to acquisition of certain assets from StreamMosaic, Inc.

Interest and Other Income (Expense), Net

	Three Months Ended September 30,		Change		Nine Months Ended September 30,		Change	
	2019	**2018**	**$**	**%**	**2019**	**2018**	**$**	**%**
(Dollars in thousands)								
Interest and other income (expense), net	$ 202	$ 223	$ (21)	(9)%	$ 307	$ 283	$ 24	8%

Interest and other income (expense), net, primarily consists of interest income and foreign currency transaction exchange gain (loss). Interest and other income (expense), net, slightly decreased for the three months ended September 30, 2019, compared to the year-ago period primarily due to a decrease in other miscellaneous income and an increase in loss related to foreign currency forward contracts, partially offset by higher interest income and net favorable fluctuations in foreign exchange rates. Interest and other income (expense), net, slightly increased for the nine months ended September 30, 2019, compared to the year-ago period, primarily due to an increase in interest income and net favorable fluctuations in foreign exchange rates, partially offset by loss related to foreign currency forward contracts.

Income Tax Benefit

	Three Months Ended September 30,		Change		Nine Months Ended September 30,		Change	
	2019	2018	$	%	2019	2018	$	%
(Dollars in thousands)								
Income tax benefit	$ (511)	$ (535)	$ (24)	(4)%	$ (1,458)	$ (1,355)	$ 103	8%

Income tax benefit is relatively flat for the three months ended September 30, 2019, compared to the year-ago period. Income tax benefit increased for the nine months ended September 30, 2019, compared to the year-ago period, primarily due to the changes in forecasted income/loss between fiscal year 2019 and 2018, and higher excess tax benefit for employee stock compensation compared to the year-ago period.

Liquidity and Capital Resources

As of September 30, 2019, our working capital, defined as total current assets less total current liabilities, was $122.2 million, compared to $137.7 million as of December 31, 2018. Cash and cash equivalents were $100.3 million as of September 30, 2019, compared to $96.1 million as of December 31, 2018. As of September 30, 2019, and December 31, 2018, cash and cash equivalents held by our foreign subsidiaries were $4.6 million and $4.1 million, respectively. We believe that our existing cash resources and anticipated funds from operations will satisfy our cash requirements to fund our operating activities, capital expenditures and other obligations for the next twelve months.

	Nine Months Ended September 30,		
	2019	2018	$ Change
(In thousands)			
Net cash flows provided by (used in):			
Operating activities	$ 23,011	$ 9,043	$ 13,968
Investing activities	(9,501)	(8,747)	(754)
Financing activities	(9,226)	(4,658)	(4,568)
Effect of exchange rate changes on cash and cash equivalents	(114)	(117)	3
Net increase (decrease) in cash and cash equivalents	$ 4,170	$ (4,479)	$ 8,649

Net Cash Flows Provided by Operating Activities

Cash flow from operating activities during the nine months ended September 30, 2019 mostly consisted of net loss, adjusted for certain non-cash items which primarily consisted of depreciation and amortization, share-based compensation expense and deferred taxes. The $14.0 million increase in cash flows from operating activities for the nine months ended September 30, 2019, compared to the year-ago period, was driven primarily by (i) a $0.5 million decrease in net loss, (ii) an increase in non-cash adjustments to net loss by $0.1 million primarily due to an increase in stock-based compensation expense of $0.8 million, an increase in depreciation and amortization expense of $0.6 million, partially offset by an increase in deferred tax assets of $1.7 million, and (iii) a $13.3 million increase in net change from operating assets and liabilities. The major contributors to the net change in operating assets and liabilities for the nine months ended September 30, 2019 were as follows:

- Accounts receivable decreased by $16.9 million for the nine months ended September 30, 2019 primarily due to collection of significant past due accounts receivables from three customers in Asia.

- Other noncurrent assets increased by $1.0 million primarily due to an increase in unbilled receivables resulting from increase in solutions revenue recognized during the third quarter of fiscal 2019.

- Deferred revenue increased by $1.5 million primarily due to the timing of billing and revenue recognition.

Net Cash Flows Used in Investing Activities

Net cash used in investing activities increased by $0.8 million for the nine months ended September 30, 2019 compared to the year-ago period. For the nine months ended September 30, 2019, cash flows used in investing activities related to (i) $6.9 million of property and equipment purchased primarily related to the construction of our DFI assets and expansion of our research and development laboratory and clean room, and (ii) a $2.7 million payment for a business acquisition. For the nine months ended September 30, 2018, cash flows used in investing activities related to property and equipment purchased for the development of our DFI solution, furniture and fixture and leasehold improvements for the office headquarters.

Net Cash Flows Used in Financing Activities

Net cash used in financing activities increased by $4.6 million for the nine months ended September 30, 2019, compared to the year-ago period. For the nine months ended September 30, 2019, net cash used in financing activities primarily consisted of $9.6 million in cash used to repurchase shares of our common stock, and $1.9 million in cash payments for taxes related to net share settlement of equity awards, partially offset by $2.5 million of proceeds from our Employee Stock Purchase Plan and exercise of stock options. For the nine months ended September 30, 2018, net cash used in financing activities consisted of $5.2 million in cash used to repurchase shares of our common stock, $1.7 million of cash payments for taxes related to net share settlement of equity awards, partially offset by $2.3 million of proceeds from our Employee Stock Purchase Plan and exercise of stock options.

Contractual Obligations

The following table summarizes our known contractual obligations (in thousands) as of September 30, 2019:

	Payments Due by Period						
Contractual Obligations	**2019 (remaining three months)**	**2020**	**2021**	**2022**	**2023**	**2024 and thereafter**	**Total**
Operating lease obligations(1)	$ 388	$ 1,842	$ 1,693	$ 1,510	$ 1,152	$ 3,673	$ 10,258
Purchase obligations(2)	6,612	7,259	1,005	62	3	–	14,941
Total(3)	$ 7,000	$ 9,101	$ 2,698	$ 1,572	$ 1,155	$ 3,673	$ 25,199

(1) Refer to Note 5 of "Notes to Condensed Consolidated Financial Statements (Unaudited)" (Item 1 of Part I of this Report) for further discussion.

(2) Purchase obligations consist of agreements to purchase goods and services entered in the ordinary course of business.

(3) The contractual obligation table above excludes liabilities for uncertain tax positions of $2.8 million, which are not practicable to assign to any particular years, due to the inherent uncertainty of the tax positions. See Note 9 of "Notes to Condensed Consolidated Financial Statements (Unaudited)" (Item 1 of Part I of this Report) for further discussion.

Item 3. Quantitative and Qualitative Disclosures about Market Risk

We are exposed to three primary types of market risks: credit risk and counterparty risk, foreign currency exchange rate risk and interest rate risk. The following discusses our exposure to market risk related to changes in interest rates and foreign currency exchange rates. We do not currently own any equity investments, nor do we expect to own any in the foreseeable future. This discussion contains forward-looking statements that are subject to risks and uncertainties. Actual results could vary materially as a result of a number of factors.

Interest Rate Risk. As of September 30, 2019, we had cash and cash equivalents of $100.3 million. Cash and cash equivalents consisted of cash and highly liquid money market instruments. We would not expect our operating results or cash flows to be affected to any significant degree by the effect of a sudden change in market interest on our portfolio. A hypothetical increase in market interest rates of 100 basis points from the market rates in effect at September 30, 2019, would cause the fair value of these investments to decrease by an immaterial amount, which would not have significantly impacted our financial position or results of operations.

Foreign Currency and Exchange Risk. Certain of our payables for our international offices are denominated in the local currency, including the Euro, Yen and RMB. Therefore, a portion of our operating expenditures is subject to foreign currency risks. We enter into foreign currency forward contracts to reduce the exposure to foreign currency exchange rate fluctuations on certain foreign currency denominated monetary assets and liabilities. We do not use foreign currency forward contracts for speculative or trading purposes. We record these forward contracts at fair value. The counterparty to these foreign currency forward contracts is a financial institution that we believe is creditworthy, and therefore, we believe the credit risk of counterparty non-performance is not significant. The change in fair value of these contracts is recorded into earnings as a component of other income (expense), net and offsets the change in fair value of foreign currency denominated monetary assets and liabilities, which is also recorded in other income (expense), net. As of September 30, 2019, we had no outstanding forward contracts. Subsequent to the end of third quarter of 2019, we entered into one outstanding forward contract with a notional amount of $8.0 million. The foreign currency exchange rate movement of plus-or-minus 10% will result in the change in fair value of this contract of plus-or-minus $0.8 million.

Off-Balance Sheet Arrangements

We do not have any off-balance sheet arrangements, investments in special purpose entities or undisclosed borrowings or debt.

Item 4. Controls and Procedures

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our principal executive officer and principal financial and accounting officer, evaluated the effectiveness of our “disclosure controls and procedures” as defined in Exchange Act Rules 13a-15(e) and 15d-15(e) as of September 30, 2019, in connection with the filing of this Quarterly Report on Form 10-Q. Based on that evaluation as of September 30, 2019, our principal executive officer and principal financial and accounting officer concluded that our disclosure controls and procedures were effective to ensure that information we are required to disclose in reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in rules and forms of the SEC and accumulated and communicated to our management as appropriate to allow timely decisions regarding required disclosure.

Changes in Internal Control over Financial Reporting

There were no changes in the Company's internal control over financial reporting during the three months ended September 30, 2019, that have materially affected, or are reasonably likely to materially affect, the Company’s internal control over financial reporting.

PART II — OTHER INFORMATION

Item 1. Legal Proceedings

From time to time, we are subject to various claims and legal proceedings that arise in the ordinary course of business. We accrue for losses related to litigation when a potential loss is probable and the loss can be reasonably estimated in accordance with FASB requirements. During the reported period, we were not a party to any material legal proceedings, thus no loss was probable and no amount was accrued at September 30, 2019.

Item 1A. Risk Factors

Item 1A, “Risk Factors,” on pages 13 through 19 of the Company’s Annual Report on Form 10-K for the year ended December 31, 2018, and Item 1A, “Risk Factors,” on page 36 of the Company’s Quarterly Report on Form 10-Q for the second quarter ended June 30, 2019, provide information on the significant risks associated with our business.

Item 2. Unregistered Sales of Equity Securities and Use of Proceeds

The table below sets forth the information with respect to purchases made by or on behalf of the Company or any “affiliated purchaser” (as the term is defined in Rule 10b-18(a)(3) under the Exchange Act) of our common stock during the three months ended September 30, 2019 (in thousands except per share amounts):

ISSUER PURCHASES OF EQUITY SECURITIES

Period	Total Number of Shares Purchased (in thousands) (1)	Average Price Paid Per Share	Total Number of Shares Purchased as Part of Publicly Announced Programs (in thousands) (1)	Approximate Dollar Value of Shares that May Yet Be Purchased Under Programs (in thousands) (1)
July 1, 2019 through July 31, 2019	—	$ —	—	$ 17,293
August 1, 2019 through August 31, 2019	76	$ 11.62	76	$ 16,410
September 1, 2019 through September 30, 2019	95**(2)**	$ 12.37	95 **(2)**	$ 15,233
Total	171	$ 12.04	171	

(1) On May 29, 2018, the Board of Directors adopted a new 2018 program to repurchase up to $25.0 million of common stock both on the open market and in privately negotiated transactions, from time to time, over the next two years. See Note 6 of “Notes to Condensed Consolidated Financial Statements (Unaudited)” (Item 1 of Part I of this Report) for further information regarding our stock repurchase program.

(2) This includes approximately 10,000 shares which were previously owned by an employee that were tendered to the Company to pay the exercise price of the stock options in lieu of paying cash or fully utilizing the Company’s cashless exercise alternative. The shares were effectively repurchased by the Company at a market price of $12.63 a share.

Item 3. Defaults Upon Senior Securities

None.

Item 4. Mine Safety Disclosures

None.

Item 5. Other Information

None.

Item 6. Exhibits

Exhibit Number	Description
31.01	Certification of the principal executive officer pursuant to Exchange Act Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.†
31.02	Certification of the principal financial and accounting officer pursuant to Exchange Act Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.†
32.01	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.*
32.02	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.*
101.INS	XBRL Instance Document.†
101.SCH	XBRL Taxonomy Extension Schema Document.†
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document.†
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document.†
101.LAB	XBRL Taxonomy Extension Label Linkbase Document.†
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document.†

† Filed herewith.
* Furnished, and not filed.

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 the undersigned thereunto duly authorized.

PDF SOLUTIONS, INC.

Date: November 6, 2019	By: /s/ JOHN K. KIBARIAN John K. Kibarian President and Chief Executive Officer (principal executive officer)
Date: November 6, 2019	By: /s/ CHRISTINE A. RUSSELL Christine A. Russell Executive Vice President, Finance and Chief Financial Officer (principal financial and accounting officer)

Exhibit 31.01

CERTIFICATIONS

I, John K. Kibarian, certify that:

1. I have reviewed this quarterly report on Form 10-Q of PDF Solutions, 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 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.

By: */s/* John K. Kibarian
John K. Kibarian
President and Chief Executive Officer
(principal executive officer)

Date: August 6, 2019

Exhibit 31.02

CERTIFICATIONS

I, Christine A. Russell, certify that:

1. I have reviewed this quarterly report on Form 10-Q of PDF Solutions, 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 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.

By: /s/ Christine A. Russell
Christine A. Russell
Executive Vice President, Finance and Chief Financial Officer
(principal financial and accounting officer)

Date: August 6, 2019

Exhibit 32.01

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Quarterly Report of PDF Solutions, Inc. (the “Company”) on Form 10-Q for the quarter ended September 30, 2019, as filed with the Securities and Exchange Commission on August 6, 2019 (the “Report”), I, John K. Kibarian, President and Chief Executive Officer of the Company, certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to my knowledge:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

By: */s/* John K. Kibarian
John K. Kibarian
President and Chief Executive Officer
(principal executive officer)

Date: August 6, 2019

Exhibit 32.02

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Quarterly Report of PDF Solutions, Inc. (the “Company”) on Form 10-Q for the quarter ended September 30, 2019 as filed with the Securities and Exchange Commission on August 6, 2019 (the “Report”), I, Christine A. Russell, Executive Vice President, Finance and Chief Financial Officer of the Company, certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to my knowledge:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

By: /s/ Christine A. Russell
Christine A. Russell
Executive Vice President, Finance and Chief Financial Officer
(principal financial and accounting officer)

Date: August 6, 2019