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 June 30, 2022

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	**25-1701361**
(State or Other Jurisdiction of Incorporation or Organization)	(I.R.S. Employer Identification No.)
2858 De La Cruz Blvd. **Santa Clara, California**	**95050**
(Address of Principal Executive Offices)	(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, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

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

There were 37,276,873 shares of the Registrant's Common Stock outstanding as of August 5, 2022.

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PART I — FINANCIAL INFORMATION

Item 1. Financial Statements

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

	June 30, 2022	December 31, 2021
ASSETS		
Current assets:		
Cash and cash equivalents	$ 81,343	$ 27,684
Short-term investments	35,907	112,542
Accounts receivable, net of allowance for doubtful accounts of $890 as of June 30, 2022 and December 31, 2021	36,117	40,087
Prepaid expenses and other current assets	10,408	8,194
Total current assets	163,775	188,507
Property and equipment, net	38,390	35,295
Operating lease right-of-use assets, net	5,240	5,408
Goodwill	14,123	14,123
Intangible assets, net	19,505	21,239
Deferred tax assets, net	46	75
Other non-current assets	8,088	9,121
Total assets	$ 249,167	$ 273,768
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 3,382	$ 5,554
Accrued compensation and related benefits	10,634	9,495
Accrued and other current liabilities	6,237	3,328
Operating lease liabilities – current portion	1,493	1,758
Deferred revenues – current portion	19,568	23,691
Billings in excess of recognized revenues	480	—
Total current liabilities	41,794	43,826
Long-term income taxes payable	2,475	2,656
Non-current portion of operating lease liabilities	5,275	5,258
Non-current portion of deferred revenues	1,748	2,443
Total liabilities	51,292	54,183
Commitments and contingencies (Note 12)		
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 48,058 and 47,414, respectively; shares outstanding 36,975 and 37,411, respectively	6	6
Additional paid-in-capital	434,784	423,069
Treasury stock at cost, 11,083 and 10,003 shares, respectively	(131,365)	(104,705)
Accumulated deficit	(103,018)	(97,721)
Accumulated other comprehensive loss	(2,532)	(1,064)
Total stockholders' equity	197,875	219,585
Total liabilities and stockholders' equity	$ 249,167	$ 273,768

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 June 30,		Six Months Ended June 30,	
	2022	**2021**	**2022**	**2021**
Revenues:				
Analytics	$ 31,117	$ 19,578	$ 61,543	$ 38,971
Integrated Yield Ramp	3,551	7,841	6,623	12,648
Total revenues	34,668	27,419	68,166	51,619
Costs and Expenses:				
Costs of revenues	12,042	10,785	23,571	21,448
Research and development	13,374	11,064	27,463	21,905
Selling, general and administrative	9,770	9,410	20,609	18,874
Amortization of acquired intangible assets	314	313	628	627
Interest and other expense (income), net	(991)	243	(1,301)	(198)
Income (loss) before income taxes	159	(4,396)	(2,804)	(11,037)
Income tax expense	1,306	88	2,493	1,044
Net loss	$ (1,147)	$ (4,484)	$ (5,297)	$ (12,081)
Other comprehensive loss:				
Foreign currency translation adjustments, net of tax	(1,037)	216	(1,434)	(314)
Change in unrealized losses related to available-for-sale debt securities, net of tax	—	(6)	(34)	(4)
Total other comprehensive income (loss)	(1,037)	210	(1,468)	(318)
Comprehensive loss	$ (2,184)	$ (4,274)	$ (6,765)	$ (12,399)
Net loss per share, basic and diluted	$ (0.03)	$ (0.12)	$ (0.14)	$ (0.33)
Weighted average common shares used to calculate net loss per share, basic and diluted	37,028	37,004	37,316	36,989

See accompanying Notes to Condensed Consolidated Financial Statements (unaudited)

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

	Three and Six Months Ended June 30, 2022							
	Common Stock		Additional Paid-In	Treasury Stock		Accumulated	Accumulated Other Comprehensive	Total Stockholders'
	Shares	Amount	Capital	Shares	Amount	Deficit	Loss	Equity
Balances, December 31, 2021	37,411	$ 6	$ 423,069	10,003	$ (104,705)	$ (97,721)	$ (1,064)	$ 219,585
Issuance of common stock in connection with employee stock purchase plan	95	—	1,502	—	—	—	—	1,502
Issuance of common stock in connection with exercise of options	75	—	675	—	—	—	—	675
Vesting of restricted stock units	232	—	—	—	—	—	—	—
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	—	—	—	113	(3,389)	—	—	(3,389)
Repurchase of common stock	(219)	—	—	219	(5,778)	—	—	(5,778)
Stock-based compensation expense	—	—	5,553	—	—	—	—	5,553
Comprehensive loss	—	—	—	—	—	(4,150)	(431)	(4,581)
Balances, March 31, 2022	37,594	$ 6	$ 430,799	10,335	$ (113,872)	$ (101,871)	$ (1,495)	$ 213,567
Issuance of common stock in connection with exercise of options	12	—	113	—	—	—	—	113
Vesting of restricted stock units	84	—	—	—	—	—	—	—
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	—	—	—	33	(800)	—	—	(800)
Repurchase of common stock	(715)	—	—	715	(16,693)	—	—	(16,693)
Stock-based compensation expense	—	—	3,872	—	—	—	—	3,872
Comprehensive loss	—	—	—	—	—	(1,147)	(1,037)	(2,184)
Balances, June 30, 2022	36,975	$ 6	$ 434,784	11,083	$ (131,365)	$ (103,018)	$ (2,532)	$ 197,875

	Three and Six Months Ended June 30, 2021							
	Common Stock		Additional Paid-In	Treasury Stock		Accumulated	Accumulated Other Comprehensive	Total Stockholders'
	Shares	Amount	Capital	Shares	Amount	Deficit	Loss	Equity
Balances, December 31, 2020	36,850	$ 6	$ 407,173	9,550	$ (96,215)	$ (76,233)	$ (225)	$ 234,506
Issuance of common stock in connection with employee stock purchase plan	100	—	921	—	—	—	—	921
Issuance of common stock in connection with exercise of options	81	—	568	—	—	—	—	568
Vesting of restricted stock units	149	—	—	—	—	—	—	—
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	—	—	—	73	(1,463)	—	—	(1,463)
Repurchase of common stock	(251)	—	—	251	(4,523)	—	—	(4,523)
Stock-based compensation expense	—	—	3,369	—	—	—	—	3,369
Comprehensive loss	—	—	—	—	—	(7,597)	(528)	(8,125)
Balances, March 31, 2021	36,929	$ 6	$ 412,031	9,874	$ (102,201)	$ (83,830)	$ (753)	$ 225,253
Issuance of common stock in connection with exercise of options	39	—	290	—	—	—	—	290
Vesting of restricted stock units	118	—	—	—	—	—	—	—
Purchases of treasury stock in connection with tax withholdings on restricted stock grants	—	—	—	51	(887)	—	—	(887)
Stock-based compensation expense	—	—	2,742	—	—	—	—	2,742
Comprehensive income (loss)	—	—	—	—	—	(4,484)	210	(4,274)
Balances, June 30, 2021	37,086	$ 6	$ 415,063	9,925	$ (103,088)	$ (88,314)	$ (543)	$ 223,124

See accompanying Notes to Condensed Consolidated Financial Statements (unaudited)

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

	Six Months Ended June 30,	
	2022	**2021**
Cash flows from operating activities:		
Net loss	$ (5,297)	$ (12,081)
Adjustments to reconcile net loss to net cash provided by (used in) operating activities:		
Depreciation and amortization	2,773	3,345
Stock-based compensation expense	9,425	6,111
Amortization of acquired intangible assets	1,734	1,698
Amortization of costs capitalized to obtain revenue contracts	755	327
Deferred taxes	17	84
Other	20	133
Changes in operating assets and liabilities:		
Accounts receivable	3,910	3,989
Prepaid expenses and other current assets	(3,208)	1,235
Operating lease right-of-use assets	1,238	740
Other non-current assets	1,002	362
Accounts payable	(3,633)	(1,723)
Accrued compensation and related benefits	1,362	(1,028)
Accrued and other liabilities	2,147	116
Deferred revenues	(4,789)	(3,514)
Billings in excess of recognized revenues	480	848
Operating lease liabilities	(1,316)	(837)
Net cash provided by (used in) operating activities	6,620	(195)
Cash flows from investing activities:		
Proceeds from maturities and sales of short-term investments	112,500	109,000
Purchases of short-term investments	(35,920)	(45,992)
Purchases of property and equipment	(4,454)	(1,121)
Prepayment for the purchase of property and equipment	(133)	—
Net cash provided by investing activities	71,993	61,887
Cash flows from financing activities:		
Proceeds from exercise of stock options	788	793
Proceeds from employee stock purchase plan	1,502	921
Payments for taxes related to net share settlement of equity awards	(4,189)	(2,350)
Repurchases of common stock	(22,471)	(4,523)
Net cash used in financing activities	(24,370)	(5,159)
Effect of exchange rate changes on cash and cash equivalents	(584)	(128)
Net change in cash, cash equivalents, and restricted cash	53,659	56,405
Cash, cash equivalents, and restricted cash at beginning of period	27,684	33,815
Cash, cash equivalents, and restricted cash at end of period	$ 81,343	$ 90,220
Reconciliation of cash, cash equivalents, and restricted cash to the condensed consolidated balance sheet:		
Cash and cash equivalents	$ 81,343	$ 87,201
Restricted cash	—	3,019
Total cash, cash equivalents, and restricted cash	$ 81,343	$ 90,220

Continued on next page.

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

	Six Months Ended June 30,	
	2022	2021
Supplemental disclosure of cash flow information:		
Cash paid during the period for taxes	$ 1,690	$ 1,275
Cash paid for amounts included in the measurement of operating lease liabilities	$ 795	$ 1,076
Supplemental disclosure of noncash information:		
Property and equipment received and accrued in accounts payable and accrued and other liabilities	$ 2,466	$ 530
Advances for purchase of fixed assets transferred from prepaid assets to property and equipment	$ 333	$ 963
Operating lease liabilities arising from obtaining right-of-use assets	$ 1,137	$ —
Release of restricted cash reducing goodwill due to the acquisition purchase price adjustment	$ —	$ 469

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 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, 2021, filed with the Securities and Exchange Commission on March 1, 2022.

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, 2021, 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 generally accepted accounting principles in the United States 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, the estimated useful lives of property and equipment and intangible assets, assumptions made in analysis of allowance for doubtful accounts, impairment of goodwill and long-lived assets, valuation for deferred tax assets, and accounting for lease obligations, stock-based compensation expense, and income tax uncertainties and contingencies. Actual results could differ from those estimates and may result in material effects on the Company's operating results and financial position.

The global COVID-19 pandemic ("COVID-19") has impacted the operations and purchasing decisions of companies worldwide. As of the date of issuance of the condensed consolidated financial statements, the Company is not aware of any specific event or circumstance relating to COVID-19 that would require updates to the Company's estimates and judgments or revisions to the carrying value of its assets or liabilities. These estimates may change, as new events occur and additional information is obtained, and are recognized in the condensed consolidated financial statements as soon as they become known. Actual results could differ from those estimates and any such differences may be material to the financial statements.

Recent Accounting Standards

Accounting Standards Not Yet Adopted

In June 2016, the FASB issued ASU No. 2016-13, Financial Instruments – Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments (ASU 2016-13), which requires measurement and recognition of expected credit losses for financial assets held at the reporting date based on internal information, external information, or a combination of both relating to past events, current conditions, and reasonable and supportable forecasts. ASU No. 2016-13 replaces the existing incurred loss impairment model with a forward-looking expected credit loss model, which will result in earlier recognition of credit losses. Subsequent to the issuance of ASU No. 2016-13, the FASB issued ASU No. 2018-19, Codification

Improvements to Topic 326, Financial Instruments – Credit Losses, ASU No. 2019-04, Codification Improvements to Topic 326, Financial Instruments – Credit Losses, Topic 815, Derivatives and Hedging, and Topic 825, Financial Instrument, ASU No. 2019-05, Financial Instruments – Credit Losses (Topic 326) Targeted Transition Relief, ASU No. 2016-13, ASU No. 2019-10 Financial Instruments-Credit Losses (Topic 326), Derivatives and Hedging (Topic 815), and Leases (Topic 842), and ASU No. 2019-11 Codification Improvements to Topic 326, Financial Instruments-Credit Losses. The subsequent ASUs do not change the core principle of the guidance in ASU No. 2016-13. Instead, these amendments are intended to clarify and improve operability of certain topics included within ASU No. 2016-13.

Additionally, ASU No. 2019-10 defers the effective date for the adoption of the new standard on credit losses for public filers that are considered small reporting companies ("SRC") as defined by the SEC to fiscal years beginning after December 15, 2022, including interim periods within those fiscal years, which will be fiscal 2023 for the Company if it continues to be classified as an SRC. In February 2020, the FASB issued ASU 2020-02, which provides guidance regarding methodologies, documentation, and internal controls related to expected credit losses. The subsequent amendments will have the same effective date and transition requirements as ASU No. 2016-13. Early adoption is permitted. Topic 326 requires a modified retrospective approach by recording a cumulative-effect adjustment to retained earnings as of the beginning of the period of adoption. While the Company is currently evaluating the impact of Topic 326, the Company does not expect the adoption of this ASU to have a material impact on its condensed consolidated financial statements or the related disclosure.

In August 2020, the FASB issued ASU No. 2020-06, Debt – Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging – Contracts in Entity's Own Equity (Subtopic 815-20): Accounting for Convertible Instruments and Contracts in an Entity's Own Equity, which is intended to simplify the accounting for certain financial instruments with characteristics of liabilities and equity, including convertible instruments and contracts on an entity's own equity. The guidance allows for either full retrospective adoption or modified retrospective adoption. Additionally, the ASU will require entities to use the "if-converted" method when calculating diluted earnings per share for convertible instruments. The ASU will be effective for annual reporting periods beginning after December 15, 2023 for SRCs and interim periods within those annual periods. Early adoption is permitted. The Company does not anticipate that the adoption of this ASU will have a significant impact on its condensed consolidated financial statements or the related disclosures.

Management has reviewed other recently issued accounting pronouncements issued or proposed by the FASB, and does not believe any of these accounting pronouncements has had or will have a material impact on the condensed consolidated financial statements.

2. REVENUE FROM CONTRACTS WITH CUSTOMERS

The Company derives revenue from two sources: Analytics revenue and Integrated Yield Ramp revenue.

The Company recognizes revenue in accordance with FASB ASC Topic 606, *Revenue from Contracts with Customers*, and its related amendments (collectively known as "ASC 606"). ASC 606 outlines a single comprehensive model to use in accounting for revenue arising from contracts with customers. 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.

Contracts with multiple performance obligations

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 on a relative basis using the standalone selling price (“SSP”).

Analytics Revenue

Analytics revenue is derived from the following primary offerings: licenses and services for standalone software (which is primarily Exensio® and Cimetrix® products), software-as-a-service (“SaaS”) (which is primarily Exensio® products), and DFI™ systems and CV® systems that do not include performance incentives based on customers’ yield achievement.

Revenue from standalone software is recognized depending on whether the license is perpetual or time-based. Perpetual (one-time charge) license software is recognized at the time of the inception of the arrangement when control transfers to the customers, if the software license is considered as a separate performance obligation from the services offered by the Company. Revenue from post-contract support is recognized over the contract term on a straight-line basis, because we are providing (i) support and (ii) unspecified software updates on a when-and-if available basis over the contract term. Revenue from time-based-licensed software is allocated to each performance obligation and is recognized either at a point in time or over time as follows. The license component is recognized at the time when control transfers to customers, with the post-contract support component recognized ratably over the committed term of the contract. For contracts with any combination of licenses, support, and other services, distinct performance obligations are accounted for separately. For contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using the SSP attributed to each performance obligation.

Revenue from SaaS arrangements, which allow for the use of a cloud-based software product or service over a contractually determined period of time without the customer having to take possession of software, is accounted for as a subscription and is recognized as revenue ratably, on a straight-line basis, over the subscription period beginning on the date the service is first made available to customers. For contracts with any combination of SaaS and related services, distinct performance obligations are accounted for separately. For contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using the SSP attributed to each performance obligation.

Revenue from DFI systems and CV systems that do not include performance incentives based on customers’ yield achievement is recognized primarily as services are performed. Where there are distinct performance obligations, the Company allocates revenue to all deliverables based on their SSPs. For those contracts with multiple performance obligations, the Company allocates the transaction price of the contract to each performance obligation on a relative basis using the SSP attributed to each performance obligation. Where there are not discrete performance obligations, historically, revenue is primarily recognized as services are performed using a percentage of completion method based on costs or labor-hours inputs, whichever is the most appropriate measure of the progress towards completion of the contract. The estimation of percentage of completion method is complex and subject to many variables that require significant judgement. Please refer to the “Significant Judgments” section of this Note for further discussion.

Integrated Yield Ramp Revenue

Integrated Yield Ramp revenue is derived from the Company’s fixed-fee engagements that include performance incentives based on customers’ yield achievement (which consists primarily of Gainshare royalties) typically based on customer’s wafer shipments, pertaining to these fixed-price contracts, which royalties are variable.

Revenue under these project–based contracts, which are delivered over a specific period of time, typically for a fixed fee component paid on a set schedule, is recognized as services are performed using a percentage of completion method based on costs or labor-inputs, whichever is the most appropriate measure of the progress towards completion of the contract. Where there are distinct performance obligations, the Company allocates revenue to all deliverables based on their SSPs and allocates the transaction price of the contract to each performance obligation on a relative basis using SSP. Similar to the services provided in connection with DFI systems and CV systems that are contributing to Analytics revenue, due to the nature of the work performed in these arrangements, the estimation of percentage of completion method is complex and subject to many variables that require significant judgment. Please refer to the “Significant Judgments” section of this Note for further discussion.

The Gainshare royalty contained in Integrated Yield Ramp contracts is a variable fee related to continued usage of the Company’s intellectual property after the fixed-fee service period ends, based on a customer’s yield achievement. Revenue derived from Gainshare is contingent upon the Company’s customers reaching certain defined production yield levels. Gainshare royalty periods are generally subsequent to the delivery of all contractual services and performance obligations. The Company records Gainshare as a usage-based royalty derived from 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 the timing of the transfer of goods and services and the geographical regions. 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 Company’s performance obligations are satisfied either over time or at a point-in-time. The following table represents a disaggregation of revenue percentage by timing of revenue:

	Three Months Ended June 30,		Six Months Ended June 30,	
	2022	**2021**	**2022**	**2021**
Over time	74	57 %	72 %	54 %
Point-in-time	26	43 %	28 %	46 %
Total	100 %	100 %	100 %	100 %

International revenues accounted for approximately 51% and 49% of our total revenues during the three and six months ended June 30, 2022, respectively, compared to 56% and 60% of our total revenues during the three and six months ended June 30, 2021, respectively. See Note 10, *Customer and Geographic Information*.

Significant Judgments

Judgments and estimates are required under ASC 606. Due to the complexity of certain contracts, the actual revenue recognition treatment required under ASC 606 for the Company’s arrangements may be dependent on contract-specific terms and may vary in some instances.

For revenue under project-based contracts for fixed-price 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 software and provide services, including professional services, technical support services, and rights to unspecified updates to a customer. Determining whether 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 software 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 license the software or sell the service separately, the Company determines the SSP using information that may include market conditions and other observable inputs.

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 customers 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 licensing software or providing 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 software or services transferred to a customer 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 service contracts when the revenue recognized exceeds the amount billed to the customer. 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 June 30, 2022 and December 31, 2021, the total contract assets included in prepaid expenses and other current assets in the Condensed Consolidated Balance Sheets were $2.8 million and $0.4 million, respectively. The Company did not record any asset impairment charges related to contract assets for the periods presented.

Deferred revenues and billings in excess of recognized revenues consist substantially of amounts invoiced in advance of revenue recognition and are 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 in the Condensed Consolidated Balance Sheets. Revenue recognized that was included in the deferred revenues and billings in excess of recognized revenues balances at the beginning of each reporting period was $7.2 million and $6.5 million during the three months ended June 30, 2022 and 2021, respectively, and $11.8 million and $10.5 million during the six months ended June 30, 2022 and 2021, respectively.

At June 30, 2022, 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 $184.4 million. Given the applicable contract terms with customers, the majority of this amount is expected to be recognized as revenue over the next two years, with the remainder in the following three years. This amount does not include insignificant contracts to which the customer is not committed, nor significant 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.

The adjustment to revenue recognized from performance obligations satisfied (or partially satisfied) in previous periods was an increase of $0.5 million and a decrease $0.4 million during the three months ended June 30, 2022 and 2021, respectively, and an increase of $0.5 million and an increase of $0.1 million during the six months ended June 30, 2022 and 2021, respectively. These amounts primarily represent changes in estimated percentage-of-completion based contracts and changes in actual versus estimated Gainshare royalty.

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. Amortization expense related to these capitalized costs is recognized over the period associated with the revenue from which the cost was incurred. Total capitalized direct sales commission costs included in prepaid expenses and other current assets in the accompanying Condensed Consolidated Balance Sheets as of June 30, 2022, and December 31, 2021, were $1.1 million and $0.6 million, respectively. Total capitalized direct sales commission costs included in other non-current assets in the accompanying Condensed Consolidated Balance Sheets as of June 30, 2022, and December 31, 2021, were $1.8 million and $2.1 million, respectively. Amortization of these assets were $0.6 million and $0.2 million during the three months ended June 30, 2022 and 2021, respectively, and $0.8 million and $0.3 million during the six months ended June 30, 2022 and 2021, respectively. There was no impairment loss in relation to the costs capitalized for the periods presented.

Practical expedient

The Company does not adjust the 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 during the three and six months ended June 30, 2022 and 2021.

3. STRATEGIC PARTNERSHIP AGREEMENT WITH ADVANTEST AND RELATED PARTY TRANSACTIONS

On July 29, 2020, the Company entered into a long-term strategic partnership with Advantest Corporation through its wholly-owned subsidiary, Advantest America, Inc. (collectively referred to herein as "Advantest") that included the following agreements.

- A Securities Purchase Agreement for the purchase by Advantest of an aggregate of 3,306,924 shares of the Company's common stock for aggregate gross proceeds of $65.2 million and a related Stockholder Agreement.

- An Amendment #1 to that certain Software License and Related Services Agreement, dated as of March 25, 2020, for an exclusive commercial arrangement in which the Company and Advantest collaborate on, and the Company initially hosts, develops and maintains, an Advantest-specific cloud layer on the Exensio platform.

- An Amended and Restated Master Development Agreement with Advantest, pursuant to which the Company and Advantest agreed to collaborate on extensions to or combinations of both of their existing technology and new technology to address mutual customers' needs through one or more development phases subject to certain conditions as set forth therein. Costs and expenses incurred related to this agreement have not been significant for the three and six months ended June 30, 2022 and 2021.

- A Master Commercial Terms and Support Services Agreement for the commercialization and support of integrated products of the Company and Advantest that are the outcome of the above development agreement. No material costs and expenses were incurred related to the Commercial Agreement with Advantest during the three and six months ended June 30, 2022 and 2021.

Analytics revenue recognized from Advantest was $2.6 million and $5.3 million during the three and six months ended June 30, 2022, respectively, compared to $2.6 million and $5.2 million during the three and six months ended June 30, 2021, respectively. There were no outstanding accounts receivable from Advantest as of June 30, 2022, and December 31, 2021, and deferred revenue amounted to $1.6 million and $6.8 million as of June 30, 2022 and December 31, 2021, respectively. There was no occurrence of any termination events under these agreements as of the issuance of these condensed consolidated financial statements.

The Company carries out transactions with Advantest on arm's length commercial customary terms.

4. BALANCE SHEET COMPONENTS

Accounts receivable

Accounts receivable include amounts that are unbilled at the end of the period that are expected to be billed and collected within a 12-month period. Unbilled accounts receivable, included in accounts receivable, totaled $8.9 million and $11.8 million as of June 30, 2022, and December 31, 2021, respectively. Unbilled accounts receivable that are not expected to be billed and collected during the succeeding 12-month period is recorded in other non-current assets and totaled $1.1 million and $1.3 million as of June 30, 2022, and December 31, 2021, respectively.

The Company performs ongoing credit evaluations of its customers' financial condition. An allowance for doubtful accounts is maintained for probable credit losses based upon the Company's assessment of the expected collectability of the accounts receivable. The allowance for doubtful accounts is reviewed on a quarterly basis to assess the adequacy of the allowance.

Property and equipment

Property and equipment, net consist of the following (in thousands):

	June 30, 2022	December 31, 2021
Computer equipment	$ 11,640	$ 11,924
Software	5,391	5,419
Furniture, fixtures and equipment	2,491	2,506
Leasehold improvements	6,294	6,272
Laboratory and other equipment	4,249	3,981
Test equipment	28,204	24,452
Construction-in-progress	23,690	22,158
	81,959	76,712
Less: accumulated depreciation and amortization	(43,569)	(41,417)
Total	$ 38,390	$ 35,295

Test equipment mainly includes DFI™ systems and CV® systems assets at customer sites that are contributing to revenue. Among assets under construction, the construction-in-progress balance related to construction of DFI™ systems assets amounted to $19.8 million and $20.0 million as of June 30, 2022, and December 31, 2021, respectively. Depreciation and amortization expense was $1.4 million and $1.6 million during the three months ended June 30, 2022 and 2021, respectively, and $2.8 million and $3.3 million during the six months ended June 30, 2022 and 2021, respectively.

In the fourth quarter of 2021, the Company wrote down the value of its property and equipment by $3.2 million related to its first-generation of e-beam tools for DFI™ systems wherein carrying values may not be fully recoverable due to lack of market demand and future needs of our customers for these tools.

Goodwill and Intangible Assets, Net

As of June 30, 2022, and December 31, 2021, the carrying amount of goodwill was $14.1 million.

Intangible assets, net, consisted of the following (in thousands):

		June 30, 2022			December 31, 2021		
	Amortization Period (Years)	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
Acquired identifiable intangibles:							
Customer relationships	1-10	$ 9,407	$ (6,363)	$ 3,044	$ 9,407	$ (6,041)	$ 3,366
Developed technology	4-9	33,635	(18,447)	15,188	33,635	(17,250)	16,385
Tradename and trademarks	2-10	1,598	(865)	733	1,598	(812)	786
Patent	7-10	1,800	(1,660)	140	1,800	(1,640)	160
Noncompetition agreements	3	848	(448)	400	848	(306)	542
Total		$ 47,288	$ (27,783)	$ 19,505	$ 47,288	$ (26,049)	$ 21,239

The weighted average amortization period for acquired identifiable intangible assets was 6.4 years as of June 30, 2022. The following table summarizes intangible assets amortization expense in the Condensed Consolidated Statements of Comprehensive Loss (in thousands):

	Three Months Ended June 30,		Six Months Ended June 30,	
	2022	2021	2022	2021
Amortization of acquired technology included under Costs of Revenues	$ 553	$ 536	$ 1,106	$ 1,071
Amortization of acquired intangible assets presented separately under Costs and Expenses	314	313	628	627
Total amortization of acquired intangible assets	$ 867	$ 849	$ 1,734	$ 1,698

The Company expects annual amortization of acquired identifiable intangible assets to be as follows (in thousands):

Year Ending December 31,	Amount
2022 (remaining six months)	$ 1,734
2023	3,444
2024	3,046
2025	2,882
2026	2,712
2027 and thereafter	5,687
Total future amortization expense	$ 19,505

There were no impairment charges for goodwill and intangible assets during the three and six months ended June 30, 2022 and 2021.

5. LEASES

The Company leases administrative and sales offices and certain equipment under non-cancellable 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 dates through 2028. The Company had no leases that were classified as a financing lease as of June 30, 2022, and December 31, 2021.

In the first quarter of 2022, the Company early terminated an office lease contract. The termination of this lease reduced the Company's operating lease right-of-use assets and lease liabilities by approximately $0.5 million and $0.6 million, respectively. The gain from the lease termination of approximately $0.1 million was recorded under selling, general and administrative expense in the Condensed Consolidated Statement of Comprehensive Loss for the six months ended June 30, 2022.

Lease expense was comprised of the following (in thousands):

	Three Months Ended June 30,		Six Months Ended June 30,	
	2022	2021	2022	2021
Operating lease expense (1)	$ 353	$ 484	$ 698	$ 969
Short-term lease and variable lease expense (2)	274	233	557	407
Total lease expense	$ 627	$ 717	$ 1,255	$ 1,376

(1) Net of gain recognized upon lease termination of $0.1 million in the six months ended June 30, 2022.

(2) Leases with an initial term of 12 months or less are not recorded on the Condensed Consolidated Balance Sheets, and the Company recognizes lease expense for these leases on a straight-line basis over the lease term. Variable lease expense for the periods presented primarily included common area maintenance charges.

Supplemental balance sheets information related to operating leases was as follows:

	June 30, 2022	December 31, 2021
Weighted average remaining lease term under operating ROU leases (in years)	5.5	5.7
Weighted average discount rate for operating lease liabilities	4.96 %	5.25 %

Maturities of operating lease liabilities as of June 30, 2022, were as follows (in thousands):

Year Ending December 31,	Amount (1)
2022 (remaining six months)	$ 798
2023	1,488
2024	1,366
2025	1,258
2026	1,154
2027 and thereafter	1,701
Total future minimum lease payments	$ 7,765
Less: Interest (2)	(997)
Present value of future minimum lease payments under operating lease liabilities (3)	$ 6,768

(1) As of June 30, 2022, the total operating lease liability includes approximately $1.1 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 $1.5 million as of June 30, 2022.

6. STOCKHOLDERS' EQUITY

Stock Repurchase Program

On June 4, 2020, the Company's Board of Directors adopted a stock repurchase program (the "2020 Program") to repurchase up to $25.0 million of the Company's common stock both on the open market and in privately negotiated transactions, including through Rule 10b5-1 plans, over the next two years. During the six months ended June 30, 2022, 218,858 shares were repurchased under the 2020 Program at an average price of $26.40 per share for an aggregate total price of $5.8 million. During the six months ended June 30, 2021, 251,212 shares were repurchased under the 2020 Program at an average price of $18.01 per share for an aggregate total price of $4.5 million. Through April 10, 2022, 470,070 shares had been repurchased under the 2020 Program at an average price of $21.91 per share, for an aggregate total price of $10.3 million.

On April 11, 2022, the Board of Directors terminated the 2020 Program, and adopted a new program (the “2022 Program”) to repurchase up to $35.0 million of the Company’s common stock both on the open market and in privately negotiated transactions, from time to time, over the next two years. During the three and six months ended June 30, 2022, 714,600 shares were repurchased under the 2022 Program at an average price of $23.36 per share for an aggregate total price of $16.7 million.

7. EMPLOYEE BENEFIT PLANS

On June 30, 2022, the Company had the following stock-based compensation plans:

Employee Stock Purchase Plan

In July 2001, the Company’s stockholders initially approved the 2001 Employee Stock Purchase Plan, which was subsequently amended and restated in 2010 (as amended, the “2010 Purchase Plan”) to extend the term of the plan through May 17, 2020. Under the 2010 Purchase Plan, eligible employees could contribute up to 10% of their compensation, as defined in the 2010 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 2010 Purchase Plan provided for twenty-four-month offering periods with four six-month purchase periods in each offering period. The 2010 Purchase Plan expired on May 17, 2020. Existing offering periods under the 2010 Plan continued through the applicable expiration date and the final offering period expired on January 31, 2022. On June 15, 2021, the Company’s stockholders approved the 2021 Employee Stock Purchase Plan, which has a ten-year term (the “2021 Purchase Plan” and, together with the 2010 Purchase Plan, the “Employee Purchase Plans”). The terms of 2021 Purchase Plan are substantially similar to those of the 2010 Purchase Plan. A twenty-four-month offering period under the 2021 Purchase Plan commenced on August 1, 2021.

The Company estimated the fair value of purchase rights granted under the 2010 and the 2021 Purchase Plans 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:

	2021 Purchase Plan	2010 Purchase Plan
	Six Months Ended June 30,	Six Months Ended June 30,
	2022	2021
Expected life (in years)	1.25	1.25
Volatility	48.90 %	34.25 %
Risk-free interest rate	0.86 %	1.43 %
Expected dividend	—	—
Weighted average fair value of purchase rights granted during the period	$ 10.76	$ 4.83

During the three months ended June 30, 2022 and 2021, no shares were issued under the Employee Purchase Plans. During the six months ended June 30, 2022, a total of 90,040 shares were issued under the 2021 Purchase Plan, at a weighted-average purchase price of $15.90 per share. During the six months ended June 30, 2022 and 2021, a total of 5,203 and 99,674 shares, respectively, were issued under the 2010 Purchase Plan, at a weighted-average purchase price of $13.40 per share and $9.24 per share, respectively. As of June 30, 2022, unrecognized compensation cost related to the 2021 Purchase Plan was $1.5 million. These costs are expected to be recognized over a weighted average period of 1.2 years. No unrecognized compensation cost related to the 2010 Purchase Plan as of June 30, 2022.

As of June 30, 2022, 909,960 shares were available for future issuance under the 2021 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 ("SARs"), 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 the 2011 Plan is 12,800,000 shares, plus up to 3,500,000 shares previously issued under the 2001 Stock Plan adopted by the Company in 2001, which expired in 2011 (the "2001 Plan") that are either (i) forfeited or (ii) repurchased by the Company or are 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 SARs, 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.

As of June 30, 2022, 13.3 million shares of common stock were reserved to cover stock-based awards under the 2011 Plan, of which 4.5 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 the adoption of the 2011 Plan through June 30, 2022. As of June 30, 2022, there were no outstanding awards that had been granted outside of the 2011 or 2001 Plans (collectively, the "Stock Plans").

The Company estimated the fair value of share-based awards granted under the 2011 Stock Plan during the period using the Black-Scholes-Merton option-pricing model. There were no stock options granted during the three and six months ended June 30, 2022 and 2021.

Stock-Based Compensation

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 plans was allocated as follows (in thousands):

	Three Months Ended June 30,		Six Months Ended June 30,	
	2022	**2021**	**2022**	**2021**
Costs of revenues	$ 655	$ 538	$ 1,383	$ 1,190
Research and development	1,810	1,126	4,978	2,714
Selling, general and administrative	1,407	1,078	3,064	2,207
Stock-based compensation expenses	$ 3,872	$ 2,742	$ 9,425	$ 6,111

Additional information with respect to options under the Stock Plans during the six months ended June 30, 2022, is 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, 2022	226	$	12.78			
Granted	—		—			
Exercised	(87)		9.10			
Canceled	(4)		13.30			
Expired	(2)		8.79			
Outstanding, June 30, 2022	133	$	15.19	3.80	$	848
Vested and expected to vest, June 30, 2022	133	$	15.18	3.78	$	843
Exercisable, June 30, 2022	112	$	15.16	3.22	$	714

The aggregate intrinsic value in the table above represents the total intrinsic value based on the Company's closing stock price of $21.51 per share as of June 30, 2022. The total intrinsic value of options exercised was $1.5 million during the six months ended June 30, 2022.

As of June 30, 2022, there was $0.1 million of total unrecognized compensation cost, net of forfeiture, related to unvested stock options, which is expected to be recognized over a weighted average period of 1.3 years. The total fair value of shares vested was immaterial during the six months ended June 30, 2022.

Nonvested restricted stock unit activity during the six months ended June 30, 2022, was as follows:

	Shares (in thousands)		Weighted Average Grant Date Fair Value Per Share
Nonvested, January 1, 2022	1,872	$	18.24
Granted	331	$	27.24
Vested	(462)	$	17.94
Forfeited	(56)	$	19.38
Nonvested, June 30, 2022	1,685	$	20.05

As of June 30, 2022, there was $24.8 million of total unrecognized compensation cost related to restricted stock units. That cost is expected to be recognized over a weighted average period of 2.3 years. Restricted stock units do not have rights to dividends prior to vesting.

8. INCOME TAXES

Income tax expense increased $1.5 million for the six months ended June 30, 2022, to a $2.5 million income tax expense as compared to an income tax expense of $1.0 million for the six months ended June 30, 2021. The Company's effective tax rate expense was (88.9%) and (9.5%) for the six months ended June 30, 2022 and 2021, respectively. The Company's effective tax rate expense increased in the six months ended June 30, 2022, as compared to the same period in 2021, primarily due to increases in foreign withholding taxes and changes in the geographic mix of worldwide income, which is subject to taxation at different statutory tax rates.

The Company's total amount of unrecognized tax benefits, excluding interest and penalties, as of June 30, 2022, was $15.2 million, of which $1.9 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, 2021, was $14.7 million, of which $1.9 million, if recognized, would affect the Company's effective tax rate. As of June 30, 2022, the Company has recorded unrecognized tax benefits of $2.4 million, including interest and penalties of $0.6 million, as long-term taxes payable in its Condensed Consolidated Balance Sheet. The remaining $13.4 million has been recorded net of the Company's deferred tax assets ("DTAs"), which is subject to a full valuation allowance.

The valuation allowance was approximately $51.6 million as of June 30, 2022, and December 31, 2021, which was related to U.S. net federal and state DTAs. The worldwide net deferred tax assets balance as of June 30, 2022, and December 31, 2021 were not significant.

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. For U.S. federal and California income tax purposes, the statute of limitations currently remains open for the tax years ending 2018 to present and 2017 to present, respectively. In addition, due to net operating loss carryback claims, the tax years 2013 through 2015 may be subject to federal examination and all of the net operating loss and research and development credit carryforwards that may be utilized in future years may be subject to federal and state examination. The Company is not subject to income tax examinations in any other of its major foreign subsidiaries' jurisdictions.

9. 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 June 30,		Six Months Ended June 30,	
	2022	2021	2022	2021
Numerator:				
Net loss	$ (1,147)	$ (4,484)	$ (5,297)	$ (12,081)
Denominator:				
Basic weighted-average shares outstanding	37,028	37,004	37,316	36,989
Effect of dilutive options and restricted stock units	—	—	—	—
Diluted weighted-average shares outstanding	37,028	37,004	37,316	36,989
Net loss per share, basic and diluted	$ (0.03)	$ (0.12)	$ (0.14)	$ (0.33)

For the three and six months ended June 30, 2022 and 2021, because 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 were 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 June 30,		Six Months Ended June 30,	
	2022	2021	2022	2021
Outstanding options	45	194	73	209
Nonvested restricted stock units	684	970	795	1,038
Employee Stock Purchase Plan	45	1	69	6
Total	774	1,165	937	1,253

10. 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, allocation of resources, and assessing financial performance. Accordingly, the Company considers itself to be in one operating and reporting segment, specifically the provision of services for differentiated data and analytics solutions to the semiconductor and electronics industries.

The Company had revenues from individual customers that are approximately 10% or more of the Company's consolidated total revenues as follows:

	Three Months Ended June 30,		Six Months Ended June 30,	
Customer	**2022**	**2021**	**2022**	**2021**
A	* %	15 %	* %	14 %
D	29 %	* %	31 %	10 %

* represents less than 10%

Gross accounts receivable balances (including amounts that are unbilled) from individual customers that are approximately 10% or more of the Company's gross accounts receivable balance as follows:

Customer	**June 30, 2022**	**December 31, 2021**
C	* %	15 %
D	43 %	29 %

* represents less than 10%

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

	Three Months Ended June 30,			
	2022		2021	
	Revenues	**Percentage of Revenues**	**Revenues**	**Percentage of Revenues**
United States	$ 17,086	49 %	$ 12,095	44 %
China	4,539	13	4,289	16
Japan	2,794	8	2,450	9
Rest of the world	10,249	30	8,585	31
Total revenue	$ 34,668	100 %	$ 27,419	100 %

	Six Months Ended June 30,			
	2022		2021	
	Revenues	Percentage of Revenues	Revenues	Percentage of Revenues
United States	$ 34,577	51 %	$ 20,651	40 %
China	8,659	13	6,028	12
Japan	5,401	8	6,028	12
Rest of the world	19,529	28	18,912	36
Total revenue	$ 68,166	100 %	$ 51,619	100 %

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

	June 30, 2022	December 31, 2021
United States (1)	$ 42,288	$ 39,158
Rest of the world	1,342	1,545
Total long-lived assets, net	$ 43,630	$ 40,703

(1) Includes assets deployed at customer sites which could be outside the U.S.

11. 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 June 30, 2022, and December 31, 2021, and the basis for those measurements (in thousands):

		Fair Value Measurements Using		
Assets	**June 30, 2022**	**Quoted Prices in Active Markets for Identical Assets (Level 1)**	**Significant Other Observable Inputs (Level 2)**	**Significant Unobservable Inputs (Level 3)**
Cash equivalents				
Money market mutual funds	$ 65,020	$ 65,020	$ —	$ —
Short-term investments (available-for-sale debt securities)				
U.S. Government securities (1)	35,907	35,907	—	—
Total	$ 100,927	$ 100,927	$ —	$ —

		Fair Value Measurements Using		
Assets	**December 31, 2021**	**Quoted Prices in Active Markets for Identical Assets (Level 1)**	**Significant Other Observable Inputs (Level 2)**	**Significant Unobservable Inputs (Level 3)**
Cash equivalents				
Money market mutual funds	$ 12,474	$ 12,474	$ —	$ —
Short-term investments (available-for-sale debt securities)				
U.S. Government securities (1)	112,542	112,542	—	—
Total	$ 125,016	$ 125,016	$ —	$ —

(1) As of June 30, 2022, and December 31, 2021, the amortized cost of the Company's investments in U.S Government Securities approximated their fair value due to their short-term maturities, and there have been no events or changes in circumstances that would have had a significant effect on the fair value of these securities in the periods presented. There was no material realized or unrealized gains or losses, either individually or in the aggregate.

12. COMMITMENTS AND CONTINGENCIES

Strategic Partnership with Advantest — See Note 3, *Strategic Partnership Agreement with Advantest And Related Party Transactions*, for the discussion about the Company's commitments under the strategic partnership with Advantest.

Operating Leases — Refer to Note 5, *Leases*, for the discussion about the Company's lease commitments.

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 June 30, 2022, total outstanding purchase obligations were $14.0 million, the majority of which is 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.

Legal Proceedings — 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 June 30, 2022, except as disclosed below, the Company was not party to any material legal proceedings, thus no loss was probable and no amount was accrued.

On May 6, 2020, the Company initiated an arbitration proceeding with the Hong Kong International Arbitration Center against SMIC New Technology Research & Development (Shanghai) Corporation ("SMIC") due to SMIC's failure to pay fees due to PDF under a series of contracts. The Company seeks to recover the unpaid fees, a declaration requiring SMIC to pay fees under the contracts in the future, and costs associated with bringing the arbitration proceeding. SMIC denies liability and the arbitration is on-going.

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," "projected," "should," "expect," "plan," "anticipate," "believe," "estimate," "predict," "potential", "target" or "continue," the negative effect of terms like these or other similar expressions. These statements include, but are not limited to, statements concerning: expectations about the effectiveness of our business and technology strategies; expectations regarding global economic trends; the impact of rising inflation, expectations regarding recent and future acquisitions; current semiconductor industry trends; expectations of the success and market acceptance of our intellectual property and our solutions; the continuing impact of COVID-19 on the semiconductor industry and our business and our ability to obtain additional financing if needed. 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, 2021, filed with the Securities and Exchange Commission ("SEC") on March 1, 2022. All references to "we", "us", "our", "PDF", "PDF Solutions" or "the Company" refer to PDF Solutions, Inc.

Cimetrix, CV, DFI, Exensio, PDF Solutions and the PDF Solutions logo are trademarks or registered trademarks of PDF Solutions, Inc. or its subsidiaries.

Overview

We provide comprehensive data solutions designed to empower organizations across the semiconductor ecosystem to improve the yield and quality of their products and operational efficiency for increased profitability. Our offerings include proprietary software, professional services based on proven methodologies and using third-party cloud-hosting platforms for software-as-a-service ("SaaS"), electrical measurement hardware tools, and physical intellectual property ("IP") for integrated circuit ("IC") designs. We derive revenues from two sources, Analytics and Integrated Yield Ramp, by monetizing our offerings through contract fees for on-premise licenses, SaaS, and other professional services and a value-based, variable fee or royalty, which we call Gainshare, on some Characterization services engagements. Our products and services have been sold to integrated device manufacturers ("IDMs"), fabless semiconductor companies, foundries, equipment manufacturers, electronics manufacturing suppliers ("EMS"), original device manufacturers ("ODMs"), out-sourced semiconductor assembly and test ("OSATs"), and system houses. We are headquartered in Santa Clara, California and also operate worldwide with offices in Canada, China, France, Germany, Italy, Japan, Korea, and Taiwan.

Industry Trends

The ongoing COVID-19 pandemic has significantly affected how we and our customers operate our businesses. For example, most U.S. states and countries worldwide imposed in 2020, and may continue to impose from time-to-time for the foreseeable future, restrictions on the physical movement of people to limit the spread of COVID-19 and its variants, including travel restrictions and stay-at-home orders. We continue to closely monitor the COVID-19 situation and expect to ask employees who were working in-office prior to COVID-19 and have not yet returned to working in their offices at least a minimum number of days a week, subject to local restrictions, in each case, with a focus on our employees' safety. In addition, our personnel worldwide continue to be subject to various country-to-country travel restrictions, which limits the ability of some employees to travel to other offices or customer sites. We believe the lack of an ability to meet in person during most of 2021 and to some degree the first half of 2022 made it harder for us to sell complex or new technologies to some customers during these periods. Once we can again begin to meet with these customers in person, we believe we may improve traction with them. To date, we have been able to provide uninterrupted access to our products and services due to our globally distributed workforce, many of whom were working remotely prior to the pandemic, and our pre-existing infrastructure, which supports secure access to our internal systems. The total duration and full extent of the impact from the COVID-19 pandemic depends on future developments that cannot be accurately predicted at this time, such as the ultimate severity and transmission rate of the virus and its variants, the extent and effectiveness of containment actions and vaccinations, and the impact of these and other factors on our employees, customers, partners, and suppliers. To date, one effect of the COVID-19 pandemic is a global shortage in semiconductors due primarily to supply chain disruptions and many companies, including in the automotive industry, have announced shortages in production. Although this shortage has not materially affected our business, this trend may affect our future business opportunities, particularly future Gainshare and Cimetrix run-time licenses, if our customers' production volumes decrease.

Certain other trends may affect our Analytics revenue specifically. 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 semiconductor and electronics companies across the ecosystem. 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 decreased year to year. The combination of these two trends means that more data is collected and stored than ever before. Further, 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 analytics programs. The combination of these latter two trends means that cloud-based, analytic programs that effectively manage identity management, physical security, and data protection are increasingly in demand 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 our combination of advanced analytics capabilities, proven and established supporting infrastructure, and professional services to configure our products to meet customers' specialized needs.

Other trends may continue to affect our characterization services business and Integrated Yield Ramp revenue specifically. The logic foundry market at the leading-edge nodes, such as 10nm, 7nm, and smaller, underwent significant change over the past few years. The leading foundry continues to dominate market share as other foundries started later than originally forecast in some cases. This trend will likely continue to impact our characterization services business on these nodes. We expect most logic foundries to invest in derivatives of older process nodes, such as 28nm and 14nm, 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 extreme ultraviolet lithography, as well as new innovations in process control and variability management. We expect China's investment in semiconductors to continue. In order for these trends to provide opportunities for us to increase our business leveraging electrical characterization, Chinese semiconductors manufacturers will need to increase their production volumes on advanced technology nodes and continue to engage foreign suppliers, subject to compliance with changing U.S. export restrictions. As a result of these market developments, we have chosen to focus our resources and investments in products, services, and solutions for analytics.

There are other business trends that may affect our business opportunities generally. 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 continue to fuel 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 our products and services that address yield loss across the

IC product life cycle. For further instance, the ongoing Russo-Ukrainian war is negatively impacting the global supply chain generally, e.g., reducing the production of millions of new cars and trucks, which indirectly impacts the global semiconductor market, and also affecting global energy markets and causing shortages and rising prices of semiconductors directly. Ukraine and Russia are both top suppliers of neon gas that is used in lasers and chip manufacturing, and Russia is a major producer of palladium, a rare metal used in computer components, sensors, and fuel cells. Limitations on the supply of these two elements can severely affect the global supply chain, which is already scarce in semiconductors. Russia also supplies much of the world's premium nickel, which is used by electronics manufacturers to make batteries. If these trends continue or worsen, we may face a shortage of critical components for our own tools and our business may suffer if the business of our customers decreases. Rising prices of semiconductors may mean increased royalties to us and increased Integrated Yield Ramp revenue.

The U.S. government continues to expand and intensify export controls and sanctions, including the addition of many People's Republic of China ("P.R.C.") and Russian companies to the U.S. Export Administration Regulations ("EAR") Entity List. These listings restrict supply to designees of items that are subject to the EAR. After an internal evaluation, we determined that a large percentage of our software products are not of U.S. origin and are, thus, not subject to the EAR. Our standard operations include development, distribution processes, software download sites, and professional service centers and processes located in various geographies around the world to better serve our customers. Some customers in the P.R.C., in particular, have nonetheless expressed concerns to us that continued action by the U.S. government could potentially interrupt their ability to make use of our products or services. The continuing tension between the U.S. and P.R.C. and/or Russian governments in trade and security matters or the perception of that tension could lead to disruptions or reductions in international trade, deter or prevent purchasing activity of customers, and negatively impact our China sales (with respect to U.S.-P.R.C. tensions) and financial results in general (with respect to global tensions).

Financial Highlights

Financial highlights for the three months ended June 30, 2022, are as follows:

- Total revenues were $34.7 million, an increase of $7.2 million, or 26%, compared to the three months ended June 30, 2021. Analytics revenue was $31.1 million, an increase of $11.5 million, or 59%, compared to the three months ended June 30, 2021. The increase in Analytics revenue was driven by increases in revenue from CV systems and DFI systems across multiple contracts and customers, and increases in revenue from Cimetrix and Exensio software licenses. Integrated Yield Ramp revenue decreased $4.3 million, or 55%, compared to the three months ended June 30, 2021, primarily due to the end of Gainshare periods, partially offset by an increase in hours worked on fixed fees engagements.

- Costs of revenues increased $1.3 million, compared to the three months ended June 30, 2021, primarily due to increases in personnel-related costs, subcontractor costs, and cloud-delivery costs. These increases were partially offset by decreases in software royalty and licenses expenses, facilities and information technology-related costs including depreciation expenses.

- Net loss was $1.1 million, compared to $4.5 million for the three months ended June 30, 2021. The decrease in net loss was primarily attributable to an increase in total revenues and other income from net foreign currency exchange gain, partially offset by increases in costs of revenues and operating expenses related primarily to our research and development, sales and marketing activities, and general and administrative expenses, all of which were primarily related to increases in personnel-related costs, subcontractor costs, and cloud-services related costs, and an increase in income tax expense.

Financial highlights for the six months ended June 30, 2022, are as follows:

- Total revenues were $68.2 million, an increase of $16.5 million, or 32%, compared to the six months ended June 30, 2021. Analytics revenue was $61.5 million, an increase of $22.6 million, or 58%, compared to the six months ended June 30, 2021. The increase in Analytics revenue was driven by increases in revenue from CV systems and DFI systems across multiple contracts and customers, and increases in revenues from Cimetrix and Exensio software licenses. Integrated Yield Ramp revenue decreased $6.0 million, or 48%, compared to the six months ended June 30, 2021 primarily due to the end of Gainshare periods, partially offset by an increase in hours worked on fixed fees engagements.

- Costs of revenues increased $2.1 million, compared to the six months ended June 30, 2021, primarily due to increases in personnel-related costs, cloud-delivery costs, and subcontractor costs. These increases were partially offset by decreases in facilities and information technology-related costs, including depreciation expenses, software royalty, and licenses expense.

- Net loss was $5.3 million, compared to $12.1 million for the six months ended June 30, 2021. The decrease in net loss was primarily attributable to an increase in total revenues and other income from net foreign currency exchange gain, partially offset by increases in costs of revenues and operating expenses related primarily to our research and development, sales and marketing activities, and general and administrative expenses, which were primarily related to increases in personnel-related costs, subcontractor costs, and cloud-services related costs, and an increase in income tax expense.

- Cash, cash equivalents and short-term investments decreased $23.0 million to $117.2 million at June 30, 2022, from $140.2 million at December 31, 2021, primarily due to cash used to repurchase shares of common stock and payment for taxes related to net share settlement of equity awards, and purchase of property and equipment, partially offset by proceeds from the exercise of stock options, proceeds from purchases under our employee stock purchase plans and cash provided by operating activities.

Critical Accounting Policies and Estimates

See Note 1, *Basis of Presentation And Summary of Significant Accounting Policies*, to our condensed consolidated financial statements in 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, 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, 2021, filed with the SEC on March 1, 2022.

There were no material changes during the six months ended June 30, 2022, 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 Part II, Item 7 of our Annual Report on Form 10-K for the year ended December 31, 2021.

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 condensed 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, valuation of long-lived assets including goodwill and intangible assets, and the realization of deferred tax assets. Actual amounts may differ from such estimates under different assumptions or conditions.

Revenue Recognition

We derive revenue from two sources: Analytics and Integrated Yield Ramp.

Analytics Revenue

Analytics revenue is derived from the following primary offerings: licenses and services for standalone Software (which consists primarily of Exensio and Cimetrix products), SaaS (which consists primarily of Exensio products), and DFI and CV systems (including Characterization services) that do not include performance incentives based on customers' yield achievement.

Revenue from standalone software is recognized depending on whether the license is perpetual or time-based. Perpetual (one-time charge) license software is recognized at the time of the inception of the arrangement when control transfers to the customers, if the software license is distinct from the services offered by us. Revenue from post-contract support is recognized over the contract term on a straight-line basis because we are providing (i) support and (ii) unspecified software updates on a when-and-if available basis over the contract term. Revenue from time-based-licensed software is allocated to each performance obligation and is recognized either at a point in time or over time as follows. The license component is recognized at the time when control transfers to customers, with the post-contract support component recognized ratably over the committed term of the contract. For contracts with any combination of licenses, support, and other services, distinct performance obligations are accounted for separately. For contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using the standalone selling price ("SSP") attributed to each performance obligation.

Revenue from SaaS arrangements, which allow for the use of a cloud-based software product or service over a contractually determined period of time without taking possession of software, is accounted for as subscriptions and is recognized as revenue ratably, on a straight-line basis, over the subscription period beginning on the date the service is first made available to customers.

Revenue from DFI systems and CV systems (including Characterization services) that do not include performance incentives based on customers' yield achievement is recognized primarily as services are performed. Where there are distinct performance obligations, we allocate revenue to all deliverables based on their SSPs. For these contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using SSP attributed to each performance obligation. Where there are not discrete performance obligations, historically, revenue is primarily recognized as services are performed using a percentage of completion method based on costs or labor-hours inputs, whichever is the most appropriate measure of the progress towards completion of the contract. The estimation of percentage of completion method is complex and subject to many variables that require significant judgment.

Integrated Yield Ramp Revenue

Integrated Yield Ramp revenue is derived from our Integrated Yield Ramp engagements that include Gainshare royalties or other performance incentives based on customers' yield achievement.

Revenue under these project–based contracts, which are delivered over a specific period of time typically for a fixed fee component paid on a set schedule, is recognized as services are performed using a percentage of completion method based on costs or labor-inputs, whichever is the most appropriate measure of the progress towards completion of the contract. Where there are distinct performance obligations, we allocate revenue to all deliverables based on their SSPs and allocate the transaction price of the contract to each performance obligation on a relative basis using SSP. Similar to the services provided in connection with DFI systems and CV systems that are contributing to Analytics revenue, due to the nature of the work performed in these arrangements, the estimation of percentage of completion method is complex and subject to many variables that require significant judgment.

The Gainshare royalty contained in the Integrated Yield Ramp contracts is a variable fee related to continued usage of our IP after the fixed-fee service period ends, based on the customers' yield achievement. Revenue derived from Gainshare is contingent upon our customers reaching certain defined production yield levels. Gainshare royalty periods are generally subsequent to the delivery of all contractual services and performance obligations. We record Gainshare as a usage-based royalty derived from customers' usage of intellectual property and record it in the same period in which the usage occurs.

Income Taxes

We are required to assess whether it is “more-likely-than-not” that we will realize our deferred tax assets. If we believe that they are not likely to be fully realizable before the expiration dates applicable to such assets, then to the extent we believe that recovery is not likely, we must establish a valuation allowance. Based on all available evidence, both positive and negative, we determined a full valuation allowance was still appropriate for our U.S. federal and state net deferred tax assets (“DTAs”), primarily driven by a cumulative loss incurred over the 12-quarter period ended June 30, 2022, and the likelihood that we may not utilize tax attributes before they expire. The valuation allowance was approximately $51.6 million as of June 30, 2022, and December 31, 2021. We will continue to evaluate the need for a valuation allowance and may change our conclusion in a future period based on changes in facts (e.g., 12-quarter cumulative profit, significant new revenue, etc.). If we conclude that we are more likely than not to utilize some or all of our U.S. DTAs, we will release some or all of our valuation allowance and our tax provision will decrease in the period in which we make such determination.

We evaluate our DTAs for realizability considering both positive and negative evidence, including our historical financial performance, projections of future taxable income, future reversals of existing taxable temporary differences, tax planning strategies and any carryback availability. In evaluating the need for a valuation allowance, we estimate future taxable income based on management approved business plans. This process involves significant management judgment about assumptions that are subject to change from period to period based on changes in tax laws or variances between future projected operating performance and actual results. Changes in the net DTAs, less offsetting valuation allowance, in a period are recorded through the income tax provision and could have a material impact on the Condensed Consolidated Statements of Comprehensive Loss.

Our income tax calculations are based on application of applicable U.S. federal, state, or foreign tax law. Our tax filings, however, are subject to audit by the respective tax authorities. Accordingly, we recognize tax liabilities based upon our 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 than the amounts originally accrued, the increases or decreases are recorded as income tax expense or benefit in the Condensed Consolidated Statements of Comprehensive Loss. At June 30, 2022, no deferred taxes have been provided on undistributed earnings from our international subsidiaries. We intend to reinvest the earnings of our non-U.S. subsidiaries in those operations indefinitely. As such, we have not provided for any foreign withholding taxes on the earnings of foreign subsidiaries as of June 30, 2022. The earnings of our foreign subsidiaries are taxable in the U.S. in the year earned under the Global Intangible Low-Taxed Income rules implemented under 2017 Tax Cuts and Jobs Act.

Valuation of Long-lived Assets including Goodwill and Intangible Assets

We record goodwill when the purchase consideration of an acquisition exceeds the fair value of the net tangible and identified intangible assets as of the date of acquisition. We have one operating segment and one operating unit. We perform an annual impairment assessment of goodwill during the fourth quarter of each calendar year or more frequently, if required to determine if any events or circumstances exist, such as an adverse change in business climate or a decline in the overall industry demand, that would indicate that it would more likely than not reduce the fair value of a reporting unit below its carrying amount, including goodwill. If events or circumstances do not indicate that the fair value of a reporting unit is below its carrying amount, then goodwill is not considered to be impaired and no further testing is required. If the carrying amount exceeds its fair value, an impairment loss would be recognized equal to the amount of excess, limited to the amount of total goodwill. There was no impairment of goodwill for the three and six months ended June 30, 2022.

Our long-lived assets, excluding goodwill, consist of property, equipment, and intangible assets. We periodically review our long-lived assets for impairment. For assets to be held and used, we initiate our review whenever events or changes in circumstances indicate that the carrying amount of a long-lived asset group may not be recoverable. Recoverability of an asset group is measured by comparison of its carrying amount to the expected future undiscounted cash flows that the asset group is expected to generate. If it is determined that an asset group is not recoverable, an impairment loss is recorded in the amount by which the carrying amount of the asset group exceeds its fair value. There was no impairment of long-lived assets for the three and six months ended June 30, 2022.

Recent Accounting Pronouncements and Accounting Changes

See Note 1, *Basis of Presentation and Summary of Significant Accounting Policies*, to our condensed consolidated financial statements in 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 Six Months ended June 30, 2022

Revenues, Costs of Revenues, and Gross Margin

	Three Months Ended June 30,		Change		Six Months Ended June 30,		Change	
(Dollars in thousands)	**2022**	**2021**	**$**	**%**	**2022**	**2021**	**$**	**%**
Revenues:								
Analytics	$ 31,117	$ 19,578	$ 11,539	59 %	$ 61,543	$ 38,971	$ 22,572	58 %
Integrated Yield Ramp	3,551	7,841	(4,290)	(55)%	6,623	12,648	(6,025)	(48)%
Total revenues	34,668	27,419	7,249	26 %	68,166	51,619	16,547	32 %
Costs of revenues	12,042	10,785	1,257	12 %	23,571	21,448	2,123	10 %
Gross profit	$ 22,626	$ 16,634	$ 5,992	36 %	$ 44,595	$ 30,171	$ 14,424	48 %
Gross margin	65 %	61 %			65 %	58 %		
Analytics revenue as a percentage of total revenues	90 %	71 %			90 %	75 %		
Integrated Yield Ramp revenue as a percentage of total revenues	10 %	29 %			10 %	25 %		

Analytics Revenue

Analytics revenue increased $11.5 million for the three months ended June 30, 2022, compared to the three months ended June 30, 2021. The increase in Analytics revenue was primarily driven by increases in revenue from CV systems and DFI systems across multiple contracts and customers, and increases in revenues from Cimetrix and Exensio software licenses.

Analytics revenue increased $22.6 million for the six months ended June 30, 2022, compared to the six months ended June 30, 2021. The increase in Analytics revenue was primarily driven by increases in revenue from CV systems and DFI systems across multiple contracts and customers, and increases in revenues from Cimetrix and Exensio software licenses.

Integrated Yield Ramp Revenue

Integrated Yield Ramp revenue decreased $4.3 million for the three months ended June 30, 2022, compared to the prior year period, due to the end of Gainshare periods, partially offset by an increase in hours worked on fixed fees engagements. Integrated Yield Ramp revenue decreased $6.0 million for the six months ended June 30, 2022, compared to the prior year period, due to the end of Gainshare periods, partially offset by an increase in hours worked on fixed fees engagements.

Our Integrated Yield Ramp revenue may continue to fluctuate from period to period primarily due to the contribution of Gainshare royalty, which 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 contracts containing Gainshare.

Our Analytics and Integrated Yield Ramp revenues may fluctuate in the future and are dependent on a number of factors, including the semiconductor industry's continued acceptance of our products, services and solutions, the timing of purchases by existing and new customers, cancellations by existing customers, and our ability to attract new customers and penetrate new markets, and further penetration 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.

Costs of Revenues

Costs of revenues consist primarily of costs incurred to provide and support our services, costs recognized in connection with licensing our software, and amortization of acquired technology. Service costs include material, employee compensation and related benefits including stock-based compensation expense, subcontractor costs, overhead costs, travel and allocated facilities-related costs. Software license costs consist of costs associated with cloud-delivery related expenses and licensing third-party software used by us in providing services to our customers in solution engagements or sold in conjunction with our software products.

The increase in costs of revenues of $1.3 million for the three months ended June 30, 2022, compared to the three months ended June 30, 2021, was primarily due to (i) a $1.2 million increase in personnel-related costs due to worldwide merit increases, increases in benefit costs, stock-based compensation expense, and bonus expense, (ii) a $0.3 million increase in subcontractor costs, and (iii) a $0.3 million increase in cloud-delivery costs. These were partially offset by a $0.3 million decrease in software royalty and licenses expense, and a $0.3 million decrease in facilities and information technology-related costs including depreciation expense.

The increase in costs of revenues of $2.1 million for the six months ended June 30, 2022, compared to the six months ended June 30, 2021, was primarily due to (i) a $1.7 million increase in personnel-related costs due to worldwide merit increases, increases in benefit costs, stock-based compensation expense, and bonus expense, (ii) a $0.8 million increase in cloud-delivery costs, and (iii) a $0.4 million increase in subcontractor costs. These were partially offset by a $0.5 million decrease in facilities and information technology-related costs including depreciation expense and a $0.2 million decrease in software royalty and licenses expense.

Gross Margin

Gross margin increased 4 percentage points for the three months ended June 30, 2022, to 65%, compared to 61% for the three months ended June 30, 2021. The higher gross margin during the three months ended June 30, 2022 was primarily due to higher total revenue and decreases in certain costs of revenues, as discussed above, which decreased the costs of revenues as a percentage of total revenues, when compared to the year-ago period.

Gross margin increased 7 percentage points for the six months ended June 30, 2022, to 65%, compared to 58% for the six months ended June 30, 2021. The higher gross margin during the six months ended June 30, 2022 was primarily due to higher total revenue and decreases in certain costs of revenues, as discussed above, which decreased the costs of revenues as a percentage of total revenues, when compared to the year-ago period.

Operating Expenses:

Research and Development

	Three Months Ended June 30,		Change		Six Months Ended June 30,		Change	
(Dollars in thousands)	**2022**	**2021**	**$**	**%**	**2022**	**2021**	**$**	**%**
Research and development	$ 13,374	$ 11,064	$ 2,310	21 %	$ 27,463	$ 21,905	$ 5,558	25 %
As a percentage of total revenues	39 %	40 %			40 %	42 %		

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

Research and development expenses increased for the three months ended June 30, 2022, compared to the three months ended June 30, 2021, primarily due to (i) a $1.9 million increase in personnel-related costs primarily resulting from increases in stock-based compensation expense, headcount, bonus expense, benefit costs, and worldwide merit increases, (ii) a $0.2 million increase in subcontractor expenses primarily related to DFI systems and Cimetrix software, and (iii) a $0.2 million increase in facilities and information technology-related costs.

Research and development expenses increased for the six months ended June 30, 2022, compared to the six months ended June 30, 2021, primarily due to (i) a $4.6 million increase in personnel-related costs primarily resulting from increases in stock-based compensation expense, headcount, bonus expense, benefit costs, and worldwide merit increases, (ii) a $0.5 million increase in subcontractor expenses primarily related to CV systems and Exensio and Cimetrix software, and (iii) a $0.5 million increase in facilities and information technology-related costs, and a $0.2 million increase in travel expense.

We anticipate our expenses in research and development will fluctuate in absolute dollars from period to period as a result of the size and the timing of product development projects.

Selling, General, and Administrative

	Three Months Ended June 30,		Change		Six Months Ended June 30,		Change	
(Dollars in thousands)	**2022**	**2021**	**$**	**%**	**2022**	**2021**	**$**	**%**
Selling, general and administrative	$ 9,770	$ 9,410	$ 360	4 %	$ 20,609	$ 18,874	$ 1,735	9 %
As a percentage of total revenues	28 %	34 %			30 %	37 %		

Selling, general, and administrative expenses consist primarily of compensation, benefits and stock-based compensation expense for sales, marketing and general and administrative personnel, legal and accounting services, marketing communications expenses, third-party cloud-services related costs, travel and facilities cost allocations.

Selling, general, and administrative expenses increased for the three months ended June 30, 2022, compared to the three months ended June 30, 2021, primarily due to (i) a $0.6 million increase in personnel-related costs mainly resulting from increases in stock-based compensation expense, headcount, bonus and commission expenses, benefit costs, and worldwide merit increases, (ii) a $0.2 million increase in facilities and information technology-related costs, including third-party cloud-services related costs, and (iii) a $0.3 million increase in various other expenses. These were partially offset by (i) a $0.5 million decrease in legal fees related to the arbitration proceeding over a disputed customer contract and (ii) a $0.3 million decrease in general legal expenses.

Selling, general, and administrative expenses increased for the six months ended June 30, 2022, compared to the six months ended June 30, 2021, primarily due to (i) a $1.8 million increase in personnel-related costs mainly resulting from increases in stock-based compensation expense, headcount, bonus and commission expense, benefit costs, and worldwide merit increases, (ii) a $0.2 million increase in facilities and information technology-related costs, and (iii) a $0.3 million increase in cloud-services related costs. These were partially offset by a (i) a $0.4 million decrease in legal fees related to the arbitration proceeding over a disputed customer contract and (ii) a$0.2 million decrease in subcontractor expenses.

We anticipate our selling, general, and administrative expenses will fluctuate in absolute dollars from period to period as a result of cost control initiatives and to support increased selling efforts in the future.

Amortization of Other Acquired Intangible Assets

	Three Months Ended June 30,		Change		Six Months Ended June 30,		Change	
(Dollars in thousands)	**2022**	**2021**	**$**	**%**	**2022**	**2021**	**$**	**%**
Amortization of acquired intangible assets	$ 314	$ 313	$ 1	0 %	$ 628	$ 627	$ 1	0 %

Amortization of other acquired intangible assets consists of amortization of intangibles acquired as a result of certain business combinations.

Interest and Other Expense (Income), Net

	Three Months Ended June 30,		Change		Six Months Ended June 30,		Change	
(Dollars in thousands)	**2022**	**2021**	**$**	**%**	**2022**	**2021**	**$**	**%**
Interest and other expense (income), net	$ (991)	$ 243	$ (1,234)	(508)%	$ (1,301)	$ (198)	$ (1,103)	557 %

Interest and other expense (income), net, primarily consists of interest income, and foreign currency transaction exchange gains and losses.

We had an interest and net other income of $1.0 million and $1.3 million during the three and six months ended June 30, 2022, respectively, compared to an interest and net other expense of $0.2 million and an interest and net other income of $0.2 million during the three and six months ended June 30, 2021, respectively. Our net other income increased in both periods primarily due to a higher foreign currency exchange gain resulting from net favorable fluctuation in foreign exchange rates. Our interest income increased in both periods due to higher interest rates for our money market and short-term investments. We anticipate interest and other income (expense) will fluctuate in future periods as a result of our projected use of cash, cash equivalents and short-term investments and fluctuations of foreign exchange rates.

Income Tax Expense

	Three Months Ended June 30,		Change		Six Months Ended June 30,		Change	
(Dollars in thousands)	**2022**	**2021**	**$**	**%**	**2022**	**2021**	**$**	**%**
Income tax expense	$ 1,306	$ 88	$ 1,218	1,384 %	$ 2,493	$ 1,044	$ 1,449	139 %

Income tax expense increased for the three and six months ended June 30, 2022, compared to the three and six months ended June 30, 2021, primarily due to increases in foreign withholding taxes and changes in the geographic mix of worldwide income, which is subject to taxation at different statutory tax rates.

Any significant change in our future effective tax rates could adversely impact our consolidated financial position, results of operations and cash flows. Our future tax rates may be adversely affected by a number of factors including increase in expenses not deductible for tax purposes, tax legislations in the United States and in foreign countries where we are subject to tax jurisdictions, the geographic composition of our pre-tax income, the amount of our pre-tax income as business activities fluctuate, our ability to use tax attributes such as research and development tax credits and net operation losses, the tax effects of employee stock activity, audit examinations with adverse outcomes, changes in general accepted accounting principles and the effectiveness of our tax planning strategies.

Liquidity and Capital Resources

As of June 30, 2022, our working capital, defined as total current assets less total current liabilities, was $122.0 million, compared to $144.7 million as of December 31, 2021. Total cash and cash equivalents, and short-term investments were $117.2 million as of June 30, 2022, compared to cash and cash equivalents of $140.2 million as of December 31, 2021. As of June 30, 2022, and December 31, 2021, cash and cash equivalents held by our foreign subsidiaries were $7.0 million and $5.3 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, other obligations for at least the next twelve months.

There has been no significant impact in respect to Liquidity and Capital Resources from the global COVID 19 pandemic. For risk discussion about the continuing impact of global COVID-19 pandemic on our operations or demand for our products, refer to Part I, Item 1A, “Risk Factors” of our Annual Report for the year ended December 31, 2021, filed with the SEC on March 1, 2022.

Repurchase of Company’s Common Stock

On June 4, 2020, the Company’s Board of Directors adopted a stock repurchase program (the “2020 Program”) to repurchase up to $25.0 million of the Company’s common stock both on the open market and in privately negotiated transactions, including through Rule 10b5-1 plans, over the next two years. During the six months ended June 30, 2022, 218,858 shares were repurchased under the 2020 Program at an average price of $26.40 per share, for a total price of $5.8 million under the 2020 Program. Through April 10, 2022, 470,070 shares had been repurchased under the 2020 Program at an average price of $21.91 per share, for a total price of $10.3 million. On April 11, 2022, the Board of Directors terminated the 2020 stock repurchase program, and adopted a new program (the “2022 Program”) to repurchase up to $35.0 million of the Company’s common stock both on the open market and in privately negotiated transactions, from time to time, over the next two years. During the three and six months ended June 30, 2022, 714,600 shares were repurchased under the 2022 Program at an average price of $23.36 per share for an aggregate total price of $16.7 million.

Cash Flow Data

The following table summarizes our cash flows for the periods presented:

	Six Months Ended June 30,		
	2022	2021	$ Change
(In thousands)			
Net cash flows provided by (used in):			
Operating activities	$ 6,620	$ (195)	$ 6,815
Investing activities	71,993	61,887	10,106
Financing activities	(24,370)	(5,159)	(19,211)
Effect of exchange rate changes on cash and cash equivalents	(584)	(128)	(456)
Net increase in cash, cash equivalents, and restricted cash	$ 53,659	$ 56,405	$ (2,746)

Net Cash Flows Provided by Operating Activities

Cash flows provided by operating activities during the six months ended June 30, 2022, consisted of net loss, adjusted for certain non-cash items which primarily consisted of depreciation and amortization, share-based compensation expense, amortization of acquired intangible expense, amortization of costs capitalized to obtain revenue contracts and net change in operating assets and liabilities. The $6.8 million increase in cash flows from operating activities for the six months ended June

30, 2022, compared to the six months ended June 30, 2021, was driven primarily by a $6.8 million decrease in net loss, a $3.0 million decrease in net change from operating assets and liabilities, and a $3.0 million increase in non-cash adjustments to net loss, which mainly resulted from an increase in stock-based compensation expense of $3.3 million and an increase in amortization of costs capitalized to obtain revenue contracts of $0.4 million, partially offset by a decrease in depreciation and amortization of $0.6 million.

The major contributors to the net change in operating assets and liabilities for the six months ended June 30, 2022, were as follows:

- Accounts receivable decreased by $3.9 million, primarily due to collections from customers partially offset by higher contractual invoicing activity;

- Prepaid expense and other current assets increased by $3.2 million, primarily due to the timing of billing of contract assets related to fixed-price service contracts, and increase in deferred commission expense, partially offset by a decrease in prepaid expenses related to third party software licenses and cloud-subscription related costs and a decrease in income tax receivable;

- Other non-current assets decreased by $1.0 million primarily due to the amortization of non-current prepaid expenses and deferred costs to obtain contracts with customers;

- Accounts payable decreased by $3.6 million primarily due to the timing of payments of vendor invoices;

- Accrued and other liabilities increased by $2.1 million primarily due to the timing of vendor invoices and accrued income taxes;

- Accrued compensation and related benefits increased by $1.4 million primarily due to accrued bonuses, unused vacation, the timing of payments of accrued sales commissions and accrued payroll taxes; and

- Deferred revenue decreased by $4.8 million, primarily due to the timing of billing and revenue recognition.

Net Cash Flows Provided by Investing Activities

Cash provided by investing activities increased by $10.1 million for the six months ended June 30, 2022, compared to the six months ended June 30, 2021.

For the six months ended June 30, 2022, cash provided by investing activities primarily related to proceeds from maturities and sales of short-term investments of $112.5 million, partially offset by purchases of short-term investments of $35.9 million, and purchases of and prepayments for property and equipment of $4.6 million primarily related to our DFI™ systems and CV® systems.

For the six months ended June 30, 2021, cash provided by investing activities primarily related to proceeds from maturities of short-term investments of $109.0 million, offset by purchases of short-term investments of $46.0 million and property and equipment of $1.1 million.

Net Cash Flows Used in Financing Activities

Net cash used in financing activities increased by $19.2 million for the six months ended June 30, 2022 compared to the six months ended June 30, 2021.

For the six months ended June 30, 2022, net cash used in financing activities primarily consisted of $22.5 million for the repurchase of shares of our common stock and $4.2 million in 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 plans and exercise of stock options.

For the six months ended June 30, 2021, net cash used in financing activities primarily consisted of $4.5 million for the repurchase of shares of our common stock and $2.4 million in cash payments for taxes related to net share settlement of equity awards, partially offset by $1.7 million of proceeds from our employee stock purchase plan and exercise of stock options.

Related Party Transactions

Refer to Note 3, *Strategic Partnership Agreement with Advantest and Related Party Transactions*, to our condensed consolidated financial statements in this Quarterly Report on Form 10-Q, for a discussion on related party transactions between the Company and Advantest.

Off-Balance Sheet Agreements

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

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 June 30, 2022, we had cash and cash equivalents and short-term investments of $117.2 million. Cash and cash equivalents consisted of cash and highly liquid money market instruments and short-term investments consisted of U.S. Government securities. 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 June 30, 2022, 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.

At June 30, 2022 and periodically throughout the year, we have maintained cash balances in various operating accounts in excess of federally insured limits. We limit the amount of credit exposure to any financial institution by evaluating the creditworthiness of the financial institutions with which we invest and investing through more than one financial institution.

Foreign Currency and Exchange Risk. Certain of our receivables and payables for our international offices are denominated in the local currency, including the Euro, Yen and RMB. Therefore, a portion of our revenues and operating expenditures are subject to foreign currency risks. From time to time, 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. As of June 30, 2022, we had no outstanding forward contracts.

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 June 30, 2022, in connection with the filing of this Quarterly Report on Form 10-Q. Based on that evaluation as of June 30, 2022, 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 June 30, 2022, 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

Refer to Note 12, Commitments and Contingencies to our condensed consolidated financial statements in this Quarterly Report on Form 10 Q, for information regarding our legal proceedings.

Item 1A. Risk Factors

As of the date of this Quarterly Report on Form 10 Q, there have been no material changes from the risk factors disclosed in Part I, Item 1A, "Risk Factors" of our Annual Report on Form 10 K for the year ended December 31, 2021, filed with the SEC on March 1, 2022. Any of such factors could result in a significant or material adverse effect on our result of operations or financial conditions. Additional risk factors not presently known to us or that we currently deem immaterial may also impair our business or results of operations. We may disclose changes to such factors or disclose additional factors from time to time in our future filings with the SEC.

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

Repurchase of Shares of Company Equity Securities

On April 11, 2022, the Board of Directors adopted a new stock repurchase program (the "2022 Program") to repurchase up to $35.0 million of the Company's common stock both on the open market and in privately negotiated transactions, from time to time, over the next two years.

The table below sets forth the information with respect to purchases made under the 2022 Program 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 June 30, 2022.

Period	Total Number of Shares Purchased (in thousands)	Average Price Paid Per Share	Total Number of Shares Purchased as Part of Publicly Announced Programs (in thousands)	Approximate Dollar Value of Shares that May Yet Be Purchased Under Programs (in thousands)
April 1, 2022 through April 30, 2022	715	$ 23.36	715	$ 18,307
May 1, 2022 through May 31, 2022	—	$ —	—	$ 18,307
June 1, 2022 through June 30, 2022	—	$ —	—	$ 18,307
Total	715	$ 23.36	715	

Item 3. Defaults Upon Senior Securities

None.

Item 4. Mine Safety Disclosures

None.

Item 5. Other Information

None.

Item 6. Exhibits

Exhibit Number	Description
10.01	PDF Solutions, Inc.'s Seventh Amended and Restated 2011 Stock Incentive Plan, (incorporated by reference to Appendix A to the Registrant's Proxy Statement filed on April 27, 2022).+
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	The following financial statements from the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2022, formatted in Inline XBRL: (i) Condensed Consolidated Balance Sheets, (ii) Condensed Consolidated Statements of Comprehensive Loss, (iii) Condensed Consolidated Statements of Stockholders' Equity, (iv) Condensed Consolidated Statements of Cash Flows and (v) Notes to Condensed Consolidated Financial Statements, tagged as blocks of text and including detailed tags.†
104	Cover Page Interactive Data File (formatted as Inline XBRL and contained in Exhibit 101).†

\+ Management contract or compensatory plan or arrangement.
† 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: August 11, 2022	By: /s/ JOHN K. KIBARIAN John K. Kibarian President and Chief Executive Officer (principal executive officer)
Date: August 11, 2022	By: /s/ ADNAN RAZA Adnan Raza 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 11, 2022

Exhibit 31.02

CERTIFICATIONS

I, Adnan Raza, 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/ Adnan Raza
Adnan Raza
Executive Vice President, Finance
and Chief Financial Officer
(principal financial and accounting
officer)

Date: August 11, 2022

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 June 30, 2022, as filed with the Securities and Exchange Commission on August 11, 2022 (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 11, 2022

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 June 30, 2022, as filed with the Securities and Exchange Commission on August 11, 2022 (the “Report”), I, Adnan Raza, 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/ Adnan Raza
Adnan Raza
Executive Vice President, Finance
and Chief Financial Officer
(principal financial and accounting officer)

Date: August 11, 2022