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

FORM 10-Q

(Mark One)

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

For the quarterly period ended September 30, 2019

OR

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

For the transition period from ___________ to __________

Commission File Number 1-12031

UNIVERSAL DISPLAY CORPORATION
(Exact name of registrant as specified in its charter)

Pennsylvania	**23-2372688**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
375 Phillips Boulevard, Ewing, New Jersey	**08618**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (609) 671-0980

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, $0.01 par value	OLED	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 Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

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

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, 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	☐	Emerging growth company	☐
Non-accelerated filer	☐	Smaller reporting 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 account 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 ☒

As of October 28, 2019, the registrant had outstanding 47,110,636 shares of common stock.

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PART I – FINANCIAL INFORMATION

ITEM 1. FINANCIAL STATEMENTS

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED BALANCE SHEETS

(UNAUDITED)

(in thousands, except share and per share data)

	September 30, 2019	December 31, 2018
ASSETS		
CURRENT ASSETS:		
Cash and cash equivalents	$ 235,541	$ 211,022
Short-term investments	361,515	304,323
Accounts receivable	65,774	43,129
Inventory	57,771	70,000
Other current assets	10,415	6,366
Total current assets	731,016	634,840
PROPERTY AND EQUIPMENT, net of accumulated depreciation of $53,900 and $44,943	86,266	69,739
ACQUIRED TECHNOLOGY, net of accumulated amortization of $127,323 and $111,890	95,919	110,951
OTHER INTANGIBLE ASSETS, net of accumulated amortization of $4,420 and $3,384	12,420	13,456
GOODWILL	15,535	15,535
INVESTMENTS	5,000	—
DEFERRED INCOME TAXES	26,437	24,377
OTHER ASSETS	89,957	64,526
TOTAL ASSETS	$ 1,062,550	$ 933,424
LIABILITIES AND SHAREHOLDERS' EQUITY		
CURRENT LIABILITIES:		
Accounts payable	$ 9,217	$ 10,532
Accrued expenses	35,360	36,057
Deferred revenue	91,188	80,782
Other current liabilities	12,627	5,811
Total current liabilities	148,392	133,182
DEFERRED REVENUE	50,495	41,785
RETIREMENT PLAN BENEFIT LIABILITY	46,007	44,055
OTHER LIABILITIES	31,089	23,896
Total liabilities	275,983	242,918
COMMITMENTS AND CONTINGENCIES (Note 15)		
SHAREHOLDERS' EQUITY:		
Preferred Stock, par value $0.01 per share, 5,000,000 shares authorized, 200,000 shares of Series A Nonconvertible Preferred Stock issued and outstanding (liquidation value of $7.50 per share or $1,500)	2	2
Common Stock, par value $0.01 per share, 200,000,000 shares authorized, 48,847,733 and 48,681,524 shares issued, and 47,482,085 and 47,319,887 shares outstanding, at September 30, 2019 and December 31, 2018, respectively	488	487
Additional paid-in capital	614,194	617,334
Retained earnings	227,286	129,552
Accumulated other comprehensive loss	(14,119)	(16,234)
Treasury stock, at cost (1,365,648 and 1,361,637 shares at September 30, 2019 and December 31, 2018, respectively)	(41,284)	(40,635)
Total shareholders' equity	786,567	690,506
TOTAL LIABILITIES AND SHAREHOLDERS' EQUITY	$ 1,062,550	$ 933,424

The accompanying notes are an integral part of these Consolidated Financial Statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF INCOME

(UNAUDITED)

(in thousands, except share and per share data)

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
REVENUE	$ 97,515	$ 77,550	$ 303,448	$ 177,271
COST OF SALES	17,286	16,123	57,172	35,216
Gross margin	80,229	61,427	246,276	142,055
OPERATING EXPENSES:				
Research and development	16,787	13,616	51,449	38,922
Selling, general and administrative	12,623	12,120	40,531	34,473
Amortization of acquired technology and other intangible assets	5,493	5,493	16,469	16,479
Patent costs	1,659	1,937	5,145	5,691
Royalty and license expense	2,837	2,229	8,828	5,028
Total operating expenses	39,399	35,395	122,422	100,593
OPERATING INCOME	40,830	26,032	123,854	41,462
Interest income, net	2,748	2,118	8,336	5,155
Other income (expense), net	53	(7)	740	(66)
Interest and other income, net	2,801	2,111	9,076	5,089
INCOME BEFORE INCOME TAXES	43,631	28,143	132,930	46,551
INCOME TAX EXPENSE	(6,669)	(5,325)	(21,054)	(6,960)
NET INCOME	$ 36,962	$ 22,818	$ 111,876	$ 39,591
NET INCOME PER COMMON SHARE:				
BASIC	$ 0.78	$ 0.48	$ 2.36	$ 0.83
DILUTED	$ 0.78	$ 0.48	$ 2.36	$ 0.83
WEIGHTED AVERAGE SHARES USED IN COMPUTING NET INCOME PER COMMON SHARE:				
BASIC	46,980,439	46,869,998	46,947,109	46,841,036
DILUTED	47,013,919	46,914,553	46,983,901	46,893,768
CASH DIVIDENDS DECLARED PER COMMON SHARE	$ 0.10	$ 0.06	$ 0.30	$ 0.18

The accompanying notes are an integral part of these Consolidated Financial Statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

(UNAUDITED)

(in thousands)

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
NET INCOME	$ 36,962	$ 22,818	$ 111,876	$ 39,591
OTHER COMPREHENSIVE INCOME, NET OF TAX:				
Unrealized gain on available-for-sale securities, net of tax of $7, $12, $49 and $60, respectively	27	43	178	214
Amortization of prior service cost and actuarial loss for retirement plan included in net periodic pension costs, net of tax of $175, $117, $525 and $351, respectively	634	422	1,903	1,266
Change in cumulative foreign currency translation adjustment	25	(8)	34	(10)
TOTAL OTHER COMPREHENSIVE INCOME	686	457	2,115	1,470
COMPREHENSIVE INCOME	$ 37,648	$ 23,275	$ 113,991	$ 41,061

The accompanying notes are an integral part of these Consolidated Financial Statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

(UNAUDITED)

(in thousands, except for share data)

	Three Months Ended September 30, 2019									
	Series A Nonconvertible Preferred Stock		Common Stock		Additional Paid-in Capital	Retained Earnings	Accumulated Other Comprehensive Loss	Treasury Stock		Total Shareholders' Equity
	Shares	Amount	Shares	Amount				Shares	Amount	
BALANCE, JUNE 30, 2019	200,000	$ 2	48,831,512	$ 488	$ 611,596	$ 195,036	$ (14,805)	1,365,648	$ (41,284)	$ 751,033
Net income	—	—	—	—	—	36,962	—	—	—	36,962
Other comprehensive income	—	—	—	—	—	—	686	—	—	686
Cash dividend	—	—	—	—	—	(4,712)	—	—	—	(4,712)
Issuance of common stock to employees	—	—	20,069	—	3,533	—	—	—	—	3,533
Shares withheld for employee taxes	—	—	(7,416)	—	(1,448)	—	—	—	—	(1,448)
Issuance of common stock to Board of Directors and Scientific Advisory Board	—	—	2,076	—	242	—	—	—	—	242
Issuance of common stock to employees under an ESPP	—	—	1,492	—	271	—	—	—	—	271
BALANCE, SEPTEMBER 30, 2019	200,000	$ 2	48,847,733	$ 488	$ 614,194	$ 227,286	$ (14,119)	1,365,648	$ (41,284)	$ 786,567

	Nine Months Ended September 30, 2019									
	Series A Nonconvertible Preferred Stock		Common Stock		Additional Paid-in Capital	Retained Earnings	Accumulated Other Comprehensive Loss	Treasury Stock		Total Shareholders' Equity
	Shares	Amount	Shares	Amount				Shares	Amount	
BALANCE, DECEMBER 31, 2018	200,000	$ 2	48,681,524	$ 487	$ 617,334	$ 129,552	$ (16,234)	1,361,637	$ (40,635)	$ 690,506
Net income	—	—	—	—	—	111,876	—	—	—	111,876
Other comprehensive income	—	—	—	—	—	—	2,115	—	—	2,115
Cash dividend	—	—	—	—	—	(14,142)	—	—	—	(14,142)
Issuance of common stock to employees	—	—	246,715	2	10,488	—	—	—	—	10,490
Shares withheld for employee taxes	—	—	(98,782)	(1)	(15,919)	—	—	—	—	(15,920)
Common shares repurchased	—	—	—	—	—	—	—	4,011	(649)	(649)
Issuance of common stock to Board of Directors and Scientific Advisory Board	—	—	12,424	—	1,426	—	—	—	—	1,426
Issuance of common stock to employees under an ESPP	—	—	5,852	—	865	—	—	—	—	865
BALANCE, SEPTEMBER 30, 2019	200,000	$ 2	48,847,733	$ 488	$ 614,194	$ 227,286	$ (14,119)	1,365,648	$ (41,284)	$ 786,567

The accompanying notes are an integral part of these Consolidated Financial Statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

(UNAUDITED)

(in thousands, except for share data)

Three Months Ended September 30, 2018

	Series A Nonconvertible Preferred Stock		Common Stock		Additional Paid-in	Retained	Accumulated Other Comprehensive	Treasury Stock		Total Shareholders'
	Shares	Amount	Shares	Amount	Capital	Earnings	Loss	Shares	Amount	Equity
BALANCE, JUNE 30, 2018	200,000	$ 2	48,650,696	$ 487	$ 608,932	$ 92,346	$ (10,451)	1,361,637	$ (40,635)	$ 650,681
Net income	—	—	—	—	—	22,818	—	—	—	22,818
Other comprehensive income	—	—	—	—	—	—	457	—	—	457
Cash dividend	—	—	—	—	—	(2,827)	—	—	—	(2,827)
Issuance of common stock to employees	—	—	19,472	—	3,422	—	—	—	—	3,422
Shares withheld for employee taxes	—	—	(6,339)	—	(567)	—	—	—	—	(567)
Issuance of common stock to Board of Directors and Scientific Advisory Board	—	—	6,250	—	1,231	—	—	—	—	1,231
Issuance of common stock to employees under an ESPP	—	—	2,459	—	292	—	—	—	—	292
BALANCE, SEPTEMBER 30, 2018	200,000	$ 2	48,672,538	$ 487	$ 613,310	$ 112,337	$ (9,994)	1,361,637	$ (40,635)	$ 675,507

Nine Months Ended September 30, 2018

	Series A Nonconvertible Preferred Stock		Common Stock		Additional Paid-in	Retained	Accumulated Other Comprehensive	Treasury Stock		Total Shareholders'
	Shares	Amount	Shares	Amount	Capital	Earnings	Loss	Shares	Amount	Equity
BALANCE, DECEMBER 31, 2017	200,000	$ 2	48,476,034	$ 485	$ 611,063	$ 99,126	$ (11,464)	1,357,863	$ (40,158)	$ 659,054
ASC Topic 606 Adoption	—	—	—	—	—	(17,894)	—	—	—	(17,894)
ADJUSTED BALANCE, JANUARY 1, 2018	200,000	2	48,476,034	485	611,063	81,232	(11,464)	1,357,863	(40,158)	641,160
Net income	—	—	—	—	—	39,591	—	—	—	39,591
Other comprehensive income	—	—	—	—	—	—	1,470	—	—	1,470
Cash dividend	—	—	—	—	—	(8,486)	—	—	—	(8,486)
Issuance of common stock to employees	—	—	270,451	3	9,454	—	—	—	—	9,457
Shares withheld for employee taxes	—	—	(107,920)	(1)	(11,597)	—	—	—	—	(11,598)
Common shares repurchased	—	—	—	—	—	—	—	3,774	(477)	(477)
Issuance of common stock to Board of Directors and Scientific Advisory Board	—	—	25,982	—	3,534	—	—	—	—	3,534
Issuance of common stock to employees under an ESPP	—	—	7,991	—	856	—	—	—	—	856
BALANCE, SEPTEMBER 30, 2018	200,000	$ 2	48,672,538	$ 487	$ 613,310	$ 112,337	$ (9,994)	1,361,637	$ (40,635)	$ 675,507

The accompanying notes are an integral part of these Consolidated Financial Statements

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF CASH FLOWS

(UNAUDITED)

(in thousands)

	Nine Months Ended September 30, 2019	Nine Months Ended September 30, 2018
CASH FLOWS FROM OPERATING ACTIVITIES:		
Net income	$ 111,876	$ 39,591
Adjustments to reconcile net income to net cash provided by operating activities:		
Amortization of deferred revenue and recognition of unbilled receivables	(101,079)	(52,325)
Depreciation	8,958	6,094
Amortization of intangibles	16,469	16,479
Change in excess inventory reserve	4,155	1,045
Amortization of premium and discount on investments, net	(4,528)	(4,191)
Stock-based compensation to employees	10,697	9,697
Stock-based compensation to Board of Directors and Scientific Advisory Board	1,126	3,234
Deferred income tax (benefit) expense	(2,633)	15,820
Retirement plan expense	4,379	3,378
Decrease (increase) in assets:		
Accounts receivable	(22,645)	9,148
Inventory	8,074	(33,811)
Other current assets	(4,602)	(116)
Other assets	(10,259)	(37,769)
Increase (decrease) in liabilities:		
Accounts payable and accrued expenses	(1,827)	439
Other current liabilities	5,587	(34)
Deferred revenue	113,849	99,940
Other liabilities	149	18,337
Net cash provided by operating activities	137,746	94,956
CASH FLOWS FROM INVESTING ACTIVITIES:		
Purchases of property and equipment	(25,317)	(20,925)
Purchases of intangibles	(401)	—
Purchases of investments	(648,006)	(500,985)
Proceeds from sale of investments	590,550	415,697
Net cash used in investing activities	(83,174)	(106,213)
CASH FLOWS FROM FINANCING ACTIVITIES:		
Proceeds from issuance of common stock	658	616
Repurchase of common stock	(649)	(477)
Payment of withholding taxes related to stock-based compensation to employees	(15,920)	(11,598)
Cash dividends paid	(14,142)	(8,486)
Net cash used in financing activities	(30,053)	(19,945)
INCREASE (DECREASE) IN CASH AND CASH EQUIVALENTS	24,519	(31,202)
CASH AND CASH EQUIVALENTS, BEGINNING OF PERIOD	211,022	132,840
CASH AND CASH EQUIVALENTS, END OF PERIOD	$ 235,541	$ 101,638
The following non-cash activities occurred:		
Unrealized gain on available-for-sale securities	$ 227	$ 274
Common stock issued to Board of Directors and Scientific Advisory Board that was earned and accrued for in a previous period	300	300
Net change in accounts payable and accrued expenses related to purchases of property and equipment	(168)	3,814

The accompanying notes are an integral part of these Consolidated Financial Statements.

1. BUSINESS:

Universal Display Corporation (the Company) is a leader in the research, development and commercialization of organic light emitting diode (OLED) technologies and materials for use in display and solid-state lighting applications. OLEDs are thin, lightweight and power-efficient solid-state devices that emit light that can be manufactured on both flexible and rigid substrates, making them highly suitable for use in full-color displays and as lighting products. OLED displays are capturing a growing share of the display market. The Company believes this is because OLEDs offer potential advantages over competing display technologies with respect to power efficiency, contrast ratio, viewing angle, video response time, form factor and manufacturing cost. The Company also believes that OLED lighting products have the potential to replace many existing light sources in the future because of their high power efficiency, excellent color rendering index, low operating temperature and novel form factor. The Company's technology leadership and intellectual property position should enable it to share in the revenues from OLED displays and lighting products as they enter mainstream consumer and other markets.

The Company's primary business strategy is to (1) further develop and license its proprietary OLED technologies to manufacturers of products for display applications, such as mobile phones, televisions, tablets, wearables, portable media devices, notebook computers, personal computers, and automotive applications, and specialty and general lighting products; and (2) develop new OLED materials and sell existing and any new materials to those product manufacturers. The Company has established a significant portfolio of proprietary OLED technologies and materials, primarily through internal research and development efforts and acquisitions of patents and patent applications, as well as maintaining its relationships with world-class partners such as Princeton University (Princeton), the University of Southern California (USC), the University of Michigan (Michigan) and PPG Industries, Inc. (PPG Industries). The Company currently owns, exclusively licenses or has the sole right to sublicense more than 5,000 patents issued and pending worldwide.

The Company sells its proprietary OLED materials to customers for evaluation and use in commercial OLED products. The Company also enters into agreements with manufacturers of OLED display and lighting products under which it grants them licenses to practice under its patents and to use the Company's proprietary know-how. At the same time, the Company works with these and other companies who are evaluating the Company's OLED technologies and materials for possible use in commercial OLED display and lighting products.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES:

Interim Financial Information

In the opinion of management, the accompanying unaudited Consolidated Financial Statements contain all adjustments (consisting of only normal recurring adjustments) necessary to present fairly the Company’s financial position as of September 30, 2019 and results of operations for the three and nine months ended September 30, 2019 and 2018, and cash flows for the nine months ended September 30, 2019 and 2018. While management believes that the disclosures presented are adequate to make the information not misleading, these unaudited Consolidated Financial Statements should be read in conjunction with the audited Consolidated Financial Statements and the notes thereto in the Company’s latest year-end Consolidated Financial Statements, which are included in the Company’s Annual Report on Form 10-K for the year ended December 31, 2018. The results of the Company’s operations for any interim period are not necessarily indicative of the results of operations for any other interim period or for the full year.

Principles of Consolidation

The Consolidated Financial Statements include the accounts of Universal Display Corporation and its wholly owned subsidiaries, UDC, Inc., UDC Ireland Limited, Universal Display Corporation Hong Kong, Limited, Universal Display Corporation Korea, Y.H., Universal Display Corporation Japan GK, Universal Display Corporation China, Ltd., Adesis, Inc. (Adesis) and UDC Ventures LLC. UDC Ventures LLC was formed on March 1, 2019 as a corporate venture capital entity that will assist in funding companies that are developing innovative products and technologies that may be synergistic to those of the Company. All intercompany transactions and accounts have been eliminated.

Management's Use of Estimates

The preparation of financial statements in conformity with U.S. generally accepted accounting principles (GAAP) requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and 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. The estimates made are principally in the areas of revenue recognition including estimates of material unit sales and royalties, the useful life of acquired intangibles, lease liabilities, right-of-use assets, the use and recoverability of inventories, intangibles, investments and income taxes including realization of deferred tax assets, stock-based compensation and retirement benefit plan liabilities. Actual results could differ from those estimates.

Inventories

Inventories consist of raw materials, work-in-process and finished goods, including inventory consigned to customers, and are stated at the lower of cost, determined on a first-in, first-out basis, or net realizable value. Inventory valuation and firm committed purchase order assessments are performed on a quarterly basis and those items that are identified to be obsolete or in excess of forecasted usage are written down to their estimated realizable value. Estimates of realizable value are based upon management's analyses and assumptions, including, but not limited to, forecasted sales levels by product, expected product lifecycle, product development plans and future demand requirements. A 12-month rolling forecast based on factors, including, but not limited to, production cycles, anticipated product orders, marketing forecasts, backlog, and shipment activities is used in the inventory analysis. If market conditions are less favorable than forecasts or actual demand from customers is lower than estimates, additional inventory write-downs may be required. If demand is higher than expected, inventories that had previously been written down may be sold.

Fair Value of Financial Instruments

The carrying values of accounts receivable, other current assets, and accounts payable approximate fair value in the accompanying Consolidated Financial Statements due to the short-term nature of those instruments. The Company's other financial instruments, which include cash equivalents and investments, are carried at fair value.

Leases

The Company is a lessee in operating leases primarily incurred to facilitate the expansion of manufacturing and research and development facilities. As discussed in Note 8, effective January 1, 2019, the Company accounts for leases in accordance with ASC Topic 842, *Leases*. At contract inception, the Company determines if an arrangement is or contains a lease, and if so recognizes a right of use asset and a lease liability at the lease commencement date. For operating leases, the lease liability is measured at the present value of the unpaid lease payments at the lease commencement date, whereas for finance leases, the lease liability is initially measured at the present value of the unpaid lease payments and subsequently measured at amortized cost using the interest method. Operating lease right-of-use assets are included in other assets. The current portion of operating lease liabilities is included in other current liabilities and the long-term portion is included in non-current other liabilities. As of September 30, 2019, the Company had no leases that qualified as financing arrangements.

Key estimates and judgments include how the Company determines the discount rate used to discount the unpaid lease payments to present value and the lease term. The Company monitors for events or changes in circumstances that could potentially require recognizing an impairment loss.

Minority Equity Investments

The Company accounts for minority equity investments in companies that are not accounted for under the equity method as equity securities without readily determinable fair values. The fair value of these securities is based on original cost less impairments, if any, plus or minus changes resulting from observable price changes in orderly transactions for the identical or similar investment of the same issuer. Under this method, the share of income or loss of such companies is not included in the Consolidated Statements of Income. The carrying value of these investments is included in Investments on the Consolidated Balance Sheets.

The Company's policy is to recognize an impairment in the value of its minority equity investments when clear evidence of an impairment exists. Factors considered in this assessment include a significant adverse change in the regulatory, economic, or technological environment, the completion of new equity financing that may indicate a decrease in value, the failure to complete new equity financing arrangements after seeking to raise additional funds, or the commencement of proceedings under which the assets of the business may be placed in receivership or liquidated to satisfy the claims of debt and equity stakeholders.

Revenue Recognition and Deferred Revenue

Material sales relate to the Company's sale of its OLED materials for incorporation into its customers' commercial OLED products or for their OLED development and evaluation activities. Material sales are recognized at the time title passes, which is typically at the time of shipment or at the time of delivery, depending upon the contractual agreement between the parties.

The rights and benefits to the Company's OLED technology are conveyed to the customer through technology license agreements and material supply agreements. These agreements are combined and the licenses and materials sold under these combined agreements are not distinct from each other for financial reporting purposes and as such, are accounted for as a single performance obligation. Accordingly, total contract consideration is estimated and recognized over the contract term based on material units sold during the period at their estimated per unit fee. Total contract consideration includes fixed amounts designated in contracts with customers as license fees as well as estimates of material fees and royalties to be earned.

Various estimates are relied upon to recognize revenue. The Company estimates total material units to be purchased by its customers over the contract term based on historical trends, industry estimates and its forecast process and related amounts to be charged. Additionally, management estimates the total sales-based royalties based on the estimated net sales revenue of its customers over the contract term.

Contract research services revenue is revenue earned by Adesis through performing organic and organometallic synthetics research, development and commercialization on a contractual basis. These services range from intermediates for structure-activity relationship studies, reference agents and building blocks for combinatorial synthesis, re-synthesis of key intermediates, specialty organic chemistry needs, and selective toll manufacturing. These services are provided to third-party pharmaceutical and life sciences firms and other technology firms at fixed costs or on an annual contract basis. Revenue is recognized as services are performed with billing schedules and payment terms negotiated on a contract-by-contract basis. Payments received in excess of revenue recognized are recorded as deferred revenue. In other cases, services may be provided and revenue is recognized before the customer is invoiced. In these cases, revenue recognized will exceed amounts billed and the difference, representing amounts which are currently unbillable to the customer pursuant to contractual terms, is recorded as an unbilled receivable.

Technology development and support revenue is revenue earned from government contracts, development and technology evaluation agreements and commercialization assistance fees, which includes reimbursements by government entities for all or a portion of the research and development costs the Company incurs in relation to its government contracts. Revenues are recognized proportionally as research and development costs are incurred, or as defined milestones are achieved, and are included in contract research services in the accompanying Consolidated Statements of Income.

In 2018, the Company entered into a commercial license agreement with Samsung Display Co., Ltd. (SDC). This agreement, which covers the manufacture and sale of specified OLED display materials, was effective as of January 1, 2018 and lasts through the end of 2022 with an additional two-year extension option. Under this agreement, the Company is being paid a license fee, payable in quarterly installments over the agreement term of five years. The agreement conveys to SDC the non-exclusive right to use certain of the Company's intellectual property assets for a limited period of time that is less than the estimated life of the assets.

At the same time the Company entered into the current patent license agreement with SDC, the Company also entered into a supplemental material purchase agreement with SDC. Under the supplemental material purchase agreement, SDC agrees to purchase from the Company a minimum amount of phosphorescent emitter materials for use in the manufacture of licensed products. This minimum commitment is subject to SDC's requirements for phosphorescent emitter materials and the Company's ability to meet these requirements over the term of the supplemental agreement.

In 2015, the Company entered into an OLED patent license agreement and an OLED commercial supply agreement with LG Display Co., Ltd. (LG Display) which were effective as of January 1, 2015 and superseded the existing 2007 commercial supply agreement between the parties. The new agreements have a term that is set to expire by the end of 2022. The patent license agreement provides LG Display a non-exclusive, royalty bearing portfolio license to make and sell OLED displays under the Company's patent portfolio. The patent license calls for license fees, prepaid royalties and running royalties on licensed products. The agreements include customary provisions relating to warranties, indemnities, confidentiality, assignability and business terms. The agreements provide for certain other minimum obligations relating to the volume of material sales anticipated over the life of the agreements as well as minimum royalty revenue to be generated under the patent license agreement. The Company generates revenue under these agreements that are predominantly tied to LG Display's sales of OLED licensed products. The OLED commercial supply agreement provides for the sale of materials for use by LG Display, which may include phosphorescent emitters and host materials.

In 2016, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Tianma Micro-electronics Co., Ltd. (Tianma). Under the license agreement, the Company has granted Tianma non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company supplies phosphorescent OLED materials to Tianma for use in its licensed products.

In 2017, the Company entered into long-term, multi-year agreements with BOE Technology Group Co., Ltd. (BOE). Under these agreements, the Company has granted BOE non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The Company supplies phosphorescent OLED materials to BOE.

In 2018, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Visionox Technology, Inc. (Visionox). Under the license agreement, the Company has granted Visionox non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company supplies phosphorescent OLED materials to Visionox for use in its licensed products.

The Company records taxes billed to customers and remitted to various governmental entities on a gross basis in both revenues and cost of material sales in the Consolidated Statements of Income. The amounts of these pass through taxes reflected in revenues and cost of material sales were $65,000 and $120,000 for the three and nine months ended September 30, 2019, respectively, and $35,000 and $64,000 for the three and nine months ended September 30, 2018, respectively.

All sales transactions are billed and due within 90 days and substantially all are transacted in U.S. dollars.

Cost of Sales

Cost of sales consists of labor and material costs associated with the production of materials processed at the Company's manufacturing partners and at the Company's internal manufacturing processing facility. The Company’s portion of cost of sales also includes depreciation of manufacturing equipment, as well as manufacturing overhead costs and inventory adjustments for excess and obsolete inventory.

Research and Development

Expenditures for research and development are charged to expense as incurred.

Patent Costs

Costs associated with patent applications, patent prosecution, patent defense and the maintenance of patents are charged to expense as incurred. Costs to successfully defend a challenge to a patent are capitalized to the extent of an evident increase in the value of the patent. Costs that relate to an unsuccessful outcome are charged to expense.

Amortization of Acquired Technology

Amortization costs primarily relate to technology acquired from BASF and Fujifilm. These acquisitions were completed in the years ended December 31, 2016 and 2012, respectively. Acquisition costs are being amortized over a period of 10 years for both the BASF and Fujifilm patents.

Amortization of Other Intangible Assets

Other intangible assets from the Adesis acquisition are being amortized over a period of 10 to 15 years. See Note 7 for further discussion.

Translation of Foreign Currency Financial Statements and Foreign Currency Transactions

The Company's reporting currency is the U.S. dollar. The functional currency for the Company's Ireland subsidiary is also the U.S. dollar and the functional currency for each of the Company's Asia-Pacific foreign subsidiaries is its local currency. The Company translates the amounts included in the Consolidated Statements of Income from its Asia-Pacific foreign subsidiaries into U.S. dollars at weighted-average exchange rates, which the Company believes are representative of the actual exchange rates on the dates of the transactions. The Company's foreign subsidiaries' assets and liabilities are translated into U.S. dollars from the local currency at the actual exchange rates as of the end of each reporting date, and the Company records the resulting foreign exchange translation adjustments in the Consolidated Balance Sheets as a component of accumulated other comprehensive loss. The overall effect of the translation of foreign currency and foreign currency transactions to date has been insignificant.

Income Taxes

Income taxes are accounted for under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases and operating loss and tax credit carryforwards. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date. The Company recognizes the effect of income tax positions only if those positions are more likely than not of being sustained. Recognized income tax positions are measured at the largest amount of which the likelihood of realization is greater than 50%. Changes in recognition or measurement are reflected in the period in which the change in judgment occurs. The Company records interest and penalties, if any, related to unrecognized tax benefits as a component of tax expense.

Share-Based Payment Awards

The Company recognizes in the Consolidated Statements of Income the grant-date fair value of equity based awards such as shares issued under employee stock purchase plans, restricted stock awards, restricted stock units and performance unit awards issued to employees and directors.

The grant-date fair value of stock awards is based on the closing price of the stock on the date of grant. The fair value of share-based awards is recognized as compensation expense on a straight-line basis over the requisite service period, net of forfeitures. The Company issues new shares upon the respective grant, exercise or vesting of the share-based payment awards, as applicable.

Performance unit awards are subject to either a performance-based or market-based vesting requirement. For performance-based vesting, the grant-date fair value of the award, based on fair value of the Company's common stock, is recognized over the service period based on an assessment of the likelihood that the applicable performance goals will be achieved and compensation expense is periodically adjusted based on actual and expected performance. Compensation expense for performance unit awards with market-based vesting is calculated based on the estimated fair value as of the grant date utilizing a Monte Carlo simulation model and is recognized over the service period on a straight-line basis.

Recent Accounting Pronouncements

In February 2016, the FASB issued ASU No. 2016-02, *Leases,* which addresses the classification and recognition of lease assets and liabilities formerly classified as operating leases under generally accepted accounting principles. The guidance addresses certain aspects of recognition and measurement, and quantitative and qualitative aspects of presentation and disclosure. The guidance is effective for fiscal years beginning after December 31, 2018, including interim periods within those fiscal years. The Company adopted the standard beginning January 1, 2019 using the “modified retrospective” approach, meaning the standard was applied only to the most current period presented in the Consolidated Financial Statements and have applied all practical expedients related to leases existing at the date of initial application including the exception for short-term leases. Adoption of the new standard resulted in an increase in operating lease right-of-use assets and operating lease liabilities of $8.3 million based on the present value of the future minimum rental payments for existing operating leases. The Company has no leases that qualify as financing arrangements. See Note 8 for additional information.

In January 2017, the FASB issued ASU No. 2017-04, *Intangibles – Goodwill and Other (Topic 350): Simplifying the Test of Goodwill Impairment* eliminating the requirement to calculate the implied fair value, essentially eliminating step two from the goodwill impairment test. The new standard requires goodwill impairment to be based upon the results of step one of the impairment test, which is defined as the excess of the carrying value of a reporting unit over its fair value. The impairment charge will be limited to the amount of goodwill allocated to that reporting unit. The standards update is effective prospectively for annual and interim goodwill impairment testing performed in fiscal years beginning after December 15, 2019, with early adoption permitted. The Company is evaluating the effect that adoption of ASU 2017-04 may have on its Consolidated Financial Statements and related disclosures.

In June 2016, the FASB issued ASU No. 2016-13, *Financial Instruments: Credit Losses (Topic 326)*, which requires measurement and recognition of expected losses for financial assets held. Topic 326 changes the impairment model for most financial instruments, including trade receivables, from an incurred loss method to a new forward-looking approach, based on expected losses. The estimate of expected credit losses will require organizations to incorporate considerations of historical information, current conditions and reasonable and supportable forecasts. The standards update is effective prospectively for annual and interim periods in fiscal years beginning after December 15, 2019, with early adoption permitted. The Company is evaluating the effect that adoption of ASU 2016-13 may have on its Consolidated Financial Statements and related disclosures.

3. CASH, CASH EQUIVALENTS AND INVESTMENTS:

The Company's portfolio of fixed income securities consists of term bank certificates of deposit, U.S. Government and corporate bonds. The Company considers all highly liquid debt instruments purchased with an original maturity (maturity at the purchase date) of three months or less to be cash equivalents. The Company classifies its remaining debt security investments as available-for-sale. These debt securities are carried at fair market value, with unrealized gains and losses reported in shareholders' equity. Gains or losses on securities sold are based on the specific identification method.

Cash and Cash Equivalents

The following table provides details regarding the Company's portfolio of cash and cash equivalents (in thousands):

Cash and Cash Equivalents Classification	Amortized Cost	Unrealized Gains	Unrealized (Losses)	Aggregate Fair Market Value
September 30, 2019				
Cash accounts in banking institutions	$ 72,536	$ —	$ —	$ 72,536
Money market accounts	11,230	—	—	11,230
U.S. Government bonds	151,748	27	—	151,775
	$ 235,514	$ 27	$ —	$ 235,541
December 31, 2018				
Cash accounts in banking institutions	$ 71,217	$ —	$ —	$ 71,217
Money market accounts	11,014	—	—	11,014
U.S. Government bonds	128,782	9	—	128,791
	$ 211,013	$ 9	$ —	$ 211,022

Short-term Investments

The following table provides details regarding the Company's portfolio of short-term investments (in thousands):

Short-term Investments Classification	Amortized Cost	Unrealized Gains	Unrealized (Losses)	Aggregate Fair Market Value
September 30, 2019				
Certificates of deposit	$ 800	$ —	$ —	$ 800
U.S. Government bonds	360,564	151	—	360,715
	$ 361,364	$ 151	$ —	$ 361,515
December 31, 2018				
Certificates of deposit	$ 500	$ —	$ (1)	$ 499
Corporate bonds	114,678	1	(19)	114,660
U.S. Government bonds	189,202	5	(43)	189,164
	$ 304,380	$ 6	$ (63)	$ 304,323

Minority Investments

The Company's portfolio of minority investments consists of investments in privately held early stage companies primarily motivated to gain early access to new technology and are passive in nature in that the Company does not obtain representation on the board of directors of the companies in which it invests. As of September 30, 2019, the Company had one minority investment with a carrying value of $5.0 million accounted for as an equity security without a readily determinable fair value.

4. FAIR VALUE MEASUREMENTS:

The following table provides the assets and liabilities carried at fair value measured on a recurring basis as of September 30, 2019 (in thousands):

	Total carrying value as of September 30, 2019	Fair Value Measurements, Using: Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
Cash equivalents	$ 163,005	$ 163,005	$ —	$ —
Short-term investments	361,515	361,515	—	—

The following table provides the assets and liabilities carried at fair value measured on a recurring basis as of December 31, 2018 (in thousands):

	Total carrying value as of December 31, 2018	Fair Value Measurements, Using: Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
Cash equivalents	$ 139,805	$ 139,805	$ —	$ —
Short-term investments	304,323	304,323	—	—

Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets or liabilities. Level 2 inputs are quoted prices for similar assets and liabilities in active markets or inputs that are observable for the asset or liability, either directly or indirectly through market corroboration, for substantially the full term of the financial instrument. Level 3 inputs are unobservable inputs based on management's own assumptions used to measure assets and liabilities at fair value. A financial asset's or liability's classification is determined based on the lowest level input that is significant to the fair value measurement.

Changes in fair value of the debt investments are recorded as unrealized gains and losses in other comprehensive income. If a decline in fair value of an investment is deemed to be other than temporary, the cost of the Company's investment will be written down by the amount of the other-than-temporary impairment with a resulting charge to net income. There were no other-than-temporary impairments of investments as of September 30, 2019 or December 31, 2018.

5. INVENTORY:

Inventory consisted of the following (in thousands):

	September 30, 2019	December 31, 2018
Raw materials	$ 27,454	$ 31,203
Work-in-process	7,036	781
Finished goods	23,281	38,016
Inventory	$ 57,771	$ 70,000

The Company recorded an increase in inventory reserve of none and $1.0 million for the three months ended September 30, 2019 and 2018, respectively, and $4.2 million and $1.0 million for the nine months ended September 30, 2019 and 2018, respectively, due to excess inventory levels in certain products.

6. PROPERTY AND EQUIPMENT:

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

	September 30, 2019	December 31, 2018
Land	$ 2,642	$ 1,006
Building and improvements	46,982	39,285
Office and lab equipment	64,536	55,333
Furniture, fixtures and computer related assets	7,391	6,941
Construction-in-progress	18,615	12,117
	140,166	114,682
Less: Accumulated depreciation	(53,900)	(44,943)
Property and equipment, net	$ 86,266	$ 69,739

Depreciation expense was $3.2 million and $1.7 million for the three months ended September 30, 2019 and 2018, respectively, and $9.0 million and $6.1 million for the nine months ended September 30, 2019 and 2018, respectively.

During the nine months ended September 30, 2019, the Company purchased property in Ewing, New Jersey, adjacent to its headquarters, as part of its plan to expand operations. The new facilities added approximately 88,000 square feet at a cost of $8.2 million and will allow for the expansion of research and development activities, manufacturing logistics and other corporate functions.

7. GOODWILL AND INTANGIBLE ASSETS:

The Company monitors the recoverability of goodwill annually or whenever events or changes in circumstances indicate the carrying value may not be recoverable. Purchased intangible assets subject to amortization consist primarily of acquired technology and other intangible assets that include trade names, customer relationships and developed IP processes.

Acquired Technology

Acquired technology consists of acquired license rights for patents and know-how obtained from PD-LD, Inc., Motorola, BASF SE (BASF) and Fujifilm. These intangible assets consist of the following (in thousands):

	September 30, 2019
PD-LD, Inc.	$ 1,481
Motorola	15,909
BASF	95,989
Fujifilm	109,462
Other	401
	223,242
Less: Accumulated amortization	(127,323)
Acquired technology, net	$ 95,919

Amortization expense related to acquired technology was $5.1 million for both three month periods ended September 30, 2019 and 2018, and $15.4 million for both nine month periods ended September 30, 2019 and 2018. Amortization expense is included in amortization of acquired technology and other intangible assets expense line item on the Consolidated Statements of Income and is expected to be $5.1 million for the three months ended December 31, 2019, $20.6 million in each of the years ending December 31, 2020 through 2021, $15.8 million in the year ending December 31, 2022, $9.7 million in the year ending December 31, 2023 and $24.1 million in total thereafter.

Fujifilm Patent Acquisition

On July 23, 2012, the Company entered into a Patent Sale Agreement with Fujifilm. Under the agreement, Fujifilm sold more than 1,200 OLED-related patents and patent applications in exchange for a cash payment of $105.0 million, plus costs incurred in connection with the purchase. The agreement contains customary representations and warranties and covenants, including respective covenants not to sue by both parties thereto. The agreement permitted the Company to assign all of its rights and obligations under the agreement to its affiliates, and the Company assigned, prior to the consummation of the transactions contemplated by the agreement, its rights and obligations to UDC Ireland Limited (UDC Ireland), a wholly-owned subsidiary of the Company formed under the laws of the Republic of Ireland. The transactions contemplated by the agreement were consummated on July 26, 2012. The Company recorded the $105.0 million plus $4.5 million of purchase costs as acquired technology, which is being amortized over a period of 10 years.

BASF Patent Acquisition

On June 28, 2016, UDC Ireland entered into and consummated an IP Transfer Agreement with BASF. Under the IP Transfer Agreement, BASF sold to UDC Ireland all of its rights, title and interest to certain of its owned and co-owned intellectual property rights relating to the composition of, development, manufacture and use of OLED materials, including OLED lighting and display stack technology, as well as certain tangible assets. The intellectual property includes knowhow and more than 500 issued and pending patents in the area of phosphorescent materials and technologies. These assets were acquired in exchange for a cash payment of €86.8 million ($95.8 million). In addition, UDC Ireland also took on certain rights and obligations under three joint research and development agreements to which BASF was a party. The IP Transfer Agreement also contains customary representations, warranties and covenants of the parties. UDC Ireland recorded the payment of €86.8 million ($95.8 million) and acquisition costs incurred of $217,000 as acquired technology which is being amortized over a period of 10 years.

Other Intangible Assets

As a result of the Adesis acquisition in June 2016, the Company recorded $16.8 million of other intangible assets, including $10.5 million assigned to customer relationships with a weighted average life of 11.5 years, $4.8 million of internally developed IP, processes and recipes with a weighted average life of 15 years, and $1.5 million assigned to trade name and trademarks with a weighted average life of 10 years. At September 30, 2019, these other intangible assets consist of the following (in thousands):

	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
Customer relationships	$ 10,520	$ (2,912)	$ 7,608
Developed IP, processes and recipes	4,820	(1,028)	3,792
Trade name/Trademarks	1,500	(480)	1,020
Total identifiable intangible assets	$ 16,840	$ (4,420)	$ 12,420

Amortization expense related to other intangible assets was $348,000 for both three month periods ended September 30, 2019 and 2018, and $1.0 million for both nine month periods ended September 30, 2019 and 2018. Amortization expense is included in the amortization of acquired technology and other intangible assets expense line item on the Consolidated Statements of Income and is expected to be $348,000 for the three months ended December 31, 2019, $1.4 million in each of the years ending December 31, 2020 through 2023, and $6.5 million in total thereafter.

8. LEASES:

The Company has entered operating leases to facilitate the expansion of its manufacturing, research and development, and general and administrative activities. For purposes of calculating operating lease liabilities, lease terms may be deemed to include options to extend or terminate the lease when those events are reasonably certain to occur. The interest rate implicit in lease contracts is typically not readily determinable and as such the Company uses the appropriate incremental borrowing rate based on information available at the lease commencement date in determining the present value of the lease payments. The Company used the incremental borrowing rate on January 1, 2019 for operating leases that commenced prior to that date. Current lease agreements do not contain any residual value guarantees or material restrictive covenants. As of September 30, 2019, the Company did not have any finance leases and no additional operating leases that have not yet commenced.

As stated in Note 2, effective January 1, 2019, the Company adopted ASC Topic 842 using the modified retrospective transition method. As such, the Company did not restate financial statement or lease disclosure data for periods prior to January 1, 2019, which was prepared in accordance with ASC Topic 840 – *Leases*.

The following table presents the Company's operating lease cost and supplemental cash flow information related to the Company's operating leases (in thousands):

	Three Months Ended September 30, 2019	Nine Months Ended September 30, 2019
Operating lease cost	$ 456	$ 1,316
Non-cash activity:		
Right-of-use assets obtained in exchange for lease obligations	$ 1,503	$ 9,776

As of September 30, 2019, current operating leases had remaining terms between 1 and 9 years with options to extend the lease terms and the Company had operating lease right-of-use assets of $8.8 million, current operating lease liabilities of $1.7 million and long-term operating lease liabilities of $7.1 million.

Operating lease cost was $1.7 million for the full year 2018.

The following table presents weighted average assumptions used to compute the Company's right-of-use assets and lease liabilities:

	September 30, 2019
Weighted average remaining lease term (in years)	7.5
Weighted average discount rate	5.5%

Undiscounted future minimum lease payments as of September 30, 2019, by year and in the aggregate, having non-cancelable lease terms in excess of one year were as follows (in thousands):

	Maturities of Operating Lease Liabilities
2019 (1)	$ 517
2020	1,932
2021	1,252
2022	1,183
2023	1,044
Thereafter	4,829
Total lease payments	10,757
Less imputed interest	(1,969)
Present value of lease payments	$ 8,788

(1) Scheduled maturities of lease liabilities represent the time-period of October 1, 2019 to December 31, 2019.

Future minimum lease payments as of December 31, 2018, by year and in the aggregate, having non-cancelable lease terms in excess of one year were expected to be as follows (in thousands):

	Total Minimum Lease Payments
2019	$ 1,652
2020	1,512
2021	833
2022	833
2023	833
Thereafter	4,721
Total lease payments	$ 10,384

9. RESEARCH AND LICENSE AGREEMENTS WITH PRINCETON UNIVERSITY, UNIVERSITY OF SOUTHERN CALIFORNIA AND THE UNIVERSITY OF MICHIGAN:

The Company funded OLED technology research at Princeton University and, on a subcontractor basis, at the University of Southern California for 10 years under a Research Agreement executed with Princeton University in August 1997 (the 1997 Research Agreement). The principal investigator conducting work under the 1997 Research Agreement transferred to the University of Michigan in January 2006. Following this transfer, the 1997 Research Agreement was allowed to expire on July 31, 2007.

As a result of the transfer, the Company entered into a new Sponsored Research Agreement with the University of Southern California to sponsor OLED technology research and, on a subcontractor basis, with the University of Michigan. This new Sponsored Research Agreement (as amended, the 2006 Research Agreement) was effective as of May 1, 2006 and had an original term of three years. On May 1, 2009, the Company amended the 2006 Research Agreement to extend the term of the agreement for an additional four years. The 2006 Research Agreement superseded the 1997 Research Agreement with respect to all work being performed at the University of Southern California and the University of Michigan. Payments under the 2006 Research Agreement were made to the University of Southern California on a quarterly basis as actual expenses were incurred. The Company incurred a total of $5.0 million in research and development expense for work performed under the 2006 Research Agreement during the extended term, which ended on April 30, 2013.

Effective June 1, 2013, the Company amended the 2006 Research Agreement again to extend the term of the agreement for an additional four years. The Company incurred a total of $4.6 million in research and development expense for work performed under the 2006 Research Agreement during the extended term.

Effective May 1, 2017, the Company amended the 2006 Research Agreement once again to extend the term of the agreement for an additional three years. As of September 30, 2019, in connection with this amendment, the Company was obligated to pay the University of Southern California up to $2.1 million for work to be performed during the remaining extended term, which expires April 30, 2020. From May 1, 2017 through September 30, 2019, the Company incurred $2.3 million in research and development expense for work performed under the 2006 Research Agreement.

On October 9, 1997, the Company, Princeton University and the University of Southern California entered into an Amended License Agreement (as amended, the 1997 Amended License Agreement) under which Princeton University and the University of Southern California granted the Company worldwide, exclusive license rights, with rights to sublicense, to make, have made, use, lease and/or sell products and to practice processes based on patent applications and issued patents arising out of work performed by Princeton University and the University of Southern California under the 1997 Research Agreement. Under this 1997 Amended License Agreement, the Company is required to pay Princeton University royalties for licensed products sold by the Company or its sublicensees. For licensed products sold by the Company, the Company is required to pay Princeton University 3% of the net sales price of these products. For licensed products sold by the Company's sublicensees, the Company is required to pay Princeton 3% of the revenues received by the Company from these sublicensees. These royalty rates are subject to renegotiation for products not reasonably conceivable as arising out of the 1997 Research Agreement if Princeton University reasonably determines that the royalty rates payable with respect to these products are not fair and competitive.

The Company is obligated, under the 1997 Amended License Agreement, to pay to Princeton University minimum annual royalties. The minimum royalty payment is $100,000 per year. The Company recorded royalty expense in connection with this agreement of $2.8 million and $2.2 million for the three months ended September 30, 2019 and 2018, respectively, and $8.8 million and $5.0 million for the nine months ended September 30, 2019 and 2018, respectively.

The Company also is required, under the 1997 Amended License Agreement, to use commercially reasonable efforts to bring the licensed OLED technology to market. However, this requirement is deemed satisfied if the Company invests a minimum of $800,000 per year in research, development, commercialization or patenting efforts respecting the patent rights licensed to the Company.

In connection with entering into the 2006 Research Agreement, the Company amended the 1997 Amended License Agreement to include the University of Michigan as a party to that agreement effective as of January 1, 2006. Under this amendment, Princeton University, the University of Southern California and the University of Michigan have granted the Company a worldwide exclusive license, with rights to sublicense, to make, have made, use, lease and/or sell products and to practice processes based on patent applications and issued patents arising out of work performed under the 2006 Research Agreement. The financial terms of the 1997 Amended License Agreement were not impacted by this amendment.

10. EQUITY AND CASH COMPENSATION UNDER THE PPG AGREEMENTS:

On September 22, 2011, the Company entered into an Amended and Restated OLED Materials Supply and Service Agreement with PPG Industries (the New OLED Materials Agreement), which replaced the original OLED Materials Agreement with PPG Industries effective as of October 1, 2011. The term of the New OLED Materials Agreement ran through December 31, 2015 and shall be automatically renewed for additional one year terms, unless terminated by the Company by providing prior notice of one year or terminated by PPG by providing prior notice of two years. The agreement was automatically renewed through December 31, 2019. The New OLED Materials Agreement contains provisions that are substantially similar to those of the original OLED Materials Agreement. Under the New OLED Materials Agreement, PPG Industries continues to assist the Company in developing its proprietary OLED materials and supplying the Company with those materials for evaluation purposes and for resale to its customers.

Under the New OLED Materials Agreement, the Company compensates PPG Industries on a cost-plus basis for the services provided during each calendar quarter. The Company is required to pay for some of these services in all cash. Up to 50% of the remaining services are payable, at the Company's sole discretion, in cash or shares of the Company's common stock, with the balance payable in cash. The actual number of shares of common stock issuable to PPG Industries is determined based on the average closing price for the Company's common stock during a specified number of days prior to the end of each calendar half-year period ending on March 31 and September 30. If, however, this average closing price is less than $20.00, the Company is required to compensate PPG Industries in cash. No shares were issued for services to PPG for the three or nine months ended September 30, 2019 or 2018.

The Company is also required to reimburse PPG Industries for raw materials used for research and development. The Company records the purchases of these raw materials as a current asset until such materials are used for research and development efforts.

The Company recorded research and development expense of $580,000 and $203,000 for the three months ended September 30, 2019 and 2018, respectively, and $941,000 and $403,000 for the nine months ended September 30, 2019 and 2018, respectively, in relation to the cash portion of the reimbursement of expenses and work performed by PPG Industries, excluding amounts paid for commercial chemicals.

11. SHAREHOLDERS' EQUITY:

Common and Preferred Stock

The Company is authorized to issue 200,000,000 shares of $0.01 par value common stock and 5,000,000 shares of $0.01 par value preferred stock. Each share of the Company's common stock entitles the holder to one vote on all matters to be voted upon by the shareholders. As of September 30, 2019, the Company had issued 48,847,733 shares of common stock, of which 47,482,085 were outstanding, and had issued 200,000 shares of preferred stock, all of which were outstanding. During the three months ended September 30, 2019 and 2018, the Company repurchased no shares of common stock. During the nine months ended September 30, 2019 and 2018, the Company repurchased 4,011 and 3,774 shares, respectively, of common stock, now held as treasury stock, for an aggregate purchase price of $649,000 and $477,000, respectively.

Scientific Advisory Board Awards

During the nine months ended September 30, 2019 and 2018, the Company granted a total of 1,960 and 2,456 shares, respectively, of fully vested common stock to non-employee members of the Scientific Advisory Board for services performed in 2018 and 2017, respectively. The fair value of shares issued to members of the Scientific Advisory Board was $300,000 for both nine-month periods.

Dividends

During the three months ended September 30, 2019, the Company declared and paid cash dividends of $0.10 per common share, or $4.7 million, and during the nine months ended September 30, 2019, the Company declared and paid cash dividends of $0.30 per common share, or $14.1 million, on the Company's outstanding common stock.

On October 29, 2019, the Company's Board of Directors declared a fourth quarter dividend of $0.10 per common share to be paid on December 31, 2019 to all shareholders of record as of the close of business on December 13, 2019. All future dividends will be subject to the approval of the Company's Board of Directors.

12. ACCUMULATED OTHER COMPREHENSIVE LOSS:

Amounts related to the changes in accumulated other comprehensive loss were as follows (in thousands):

	Unrealized gain (loss) on available-for-sale debt securities	Net unrealized gain (loss) on retirement plan (2)	Change in cumulative foreign currency translation adjustment	Total	Affected line items in the Consolidated Statements of Income
Balance December 31, 2018, net of tax	$ 10	$ (16,198)	$ (46)	$ (16,234)	
Other comprehensive gain before reclassification	178	—	34	212	
Reclassification to net income (1)	—	1,903	—	1,903	Selling, general and administrative, research and development, and cost of sales
Change during period	178	1,903	34	2,115	
Balance September 30, 2019, net of tax	$ 188	$ (14,295)	$ (12)	$ (14,119)	

	Unrealized gain (loss) on available-for-sale debt securities	Net unrealized gain (loss) on retirement plan (2)	Change in cumulative foreign currency translation adjustment	Total	Affected line items in the Consolidated Statements of Income
Balance December 31, 2017, net of tax	$ (258)	$ (11,169)	$ (37)	$ (11,464)	
Other comprehensive gain (loss) before reclassification	214	—	(10)	204	
Reclassification to net income (1)	—	1,266	—	1,266	Selling, general and administrative, research and development, and cost of sales
Change during period	214	1,266	(10)	1,470	
Balance September 30, 2018, net of tax	$ (44)	$ (9,903)	$ (47)	$ (9,994)	

(1) The Company reclassified amortization of prior service cost and actuarial loss for its retirement plan from accumulated other comprehensive loss to net income of $1.9 million and $1.3 million for the nine months ended September 30, 2019 and 2018, respectively.

(2) Refer to Note 14: Supplemental Executive Retirement Plan.

13. STOCK-BASED COMPENSATION:

The Company recognizes in the Consolidated Statements of Income the grant-date fair value of equity based awards, such as shares issued under employee stock purchase plans, restricted stock awards, restricted stock units and performance unit awards issued to employees and directors.

The grant-date fair value of stock awards is based on the closing price of the stock on the date of grant. The fair value of share-based awards is recognized as compensation expense on a straight-line basis over the requisite service period, net of forfeitures. The Company issues new shares upon the respective grant, exercise or vesting of share-based payment awards, as applicable.

Performance unit awards are subject to either a performance-based or market-based vesting requirement. For performance-based vesting, the grant-date fair value of the award, based on fair value of the Company's common stock, is recognized over the service period based on an assessment of the likelihood that the applicable performance goals will be achieved, and compensation expense is periodically adjusted based on actual and expected performance. Compensation expense for performance unit awards with market-based vesting is calculated based on the estimated fair value as of the grant date utilizing a Monte Carlo simulation model and is recognized over the service period on a straight-line basis.

Equity Compensation Plan

The Equity Compensation Plan provides for the granting of incentive and nonqualified stock options, shares of common stock, stock appreciation rights and performance units to employees, directors and consultants of the Company. Stock options are exercisable over periods determined by the Compensation Committee, but for no longer than 10 years from the grant date. Through September 30, 2019, the Company's shareholders have approved increases in the number of shares reserved for issuance under the Equity Compensation Plan to 10,500,000, and have extended the term of the plan through 2024. As of September 30, 2019, there were 2,328,225 shares that remained available to be granted under the Equity Compensation Plan.

Stock Awards

Restricted Stock Awards and Units

The Company has issued restricted stock awards and units to employees and non-employees with vesting terms of one to six years. The fair value is equal to the market price of the Company's common stock on the date of grant for awards granted to employees and equal to the market price at the end of the reporting period for unvested non-employee awards or upon the date of vesting for vested non-employee awards. Expense for restricted stock awards and units is amortized ratably over the vesting period for the awards issued to employees and using a graded vesting method for the awards issued to non-employees.

During the nine months ended September 30, 2019, the Company granted 51,579 shares of restricted stock awards and restricted stock units to employees and non-employees, which had a total fair value of $8.5 million on the respective dates of grant, and will vest over three to five years from the date of grant, provided that the grantee is still an employee of the Company or is still providing services to the Company on the applicable vesting date.

For the three months ended September 30, 2019 and 2018, the Company recorded, as compensation charges related to all restricted stock awards and units granted to employees and non-employees, selling, general and administrative expense of $2.2 million for both three month periods, research and development expense of $641,000 and $517,000, respectively, and cost of sales of $273,000 and $201,000, respectively. For the nine months ended September 30, 2019 and 2018, the Company recorded, as compensation charges related to all restricted stock awards and units granted to employees and non-employees, selling, general and administrative expense of $7.1 million and $5.7 million, respectively, research and development expense of $1.8 million and $1.5 million, respectively, and cost of sales of $769,000 and $548,000, respectively

In connection with the vesting of restricted stock awards and units during the three months ended September 30, 2019 and 2018, 7,416 and 6,339 shares, with aggregate fair values of $1.4 million and $566,000, respectively, were withheld in satisfaction of tax withholding obligations. For the nine months ended September 30, 2019 and 2018, 85,758 and 86,486 shares, with aggregate fair values of $14.0 million and $9.2 million, respectively, were withheld in satisfaction of tax withholding obligations.

For the three months ended September 30, 2019 and 2018, the Company recorded as compensation charges related to all restricted stock units granted to non-employee members of the Scientific Advisory Board, research and development expense of $54,000 and $165,000, respectively. For the nine months ended September 30, 2019 and 2018, the Company recorded as compensation charges related to all restricted stock units granted to non-employee members of the Scientific Advisory Board, research and development expense of $467,000 and $49,000, respectively.

Board of Directors Compensation

The Company has granted restricted stock units to non-employee members of the Board of Directors with quarterly vesting over a period of approximately one year. The fair value is equal to the market price of the Company's common stock on the date of grant. The restricted stock units are issued and expense is recognized ratably over the vesting period. For the three months ended September 30, 2019 and 2018, the Company recorded compensation charges for services performed, related to all restricted stock units granted to non-employee members of the Board of Directors, selling, general and administrative expense of $187,000 and $1.1 million, respectively. For the nine months ended September 30, 2019 and 2018, the Company recorded compensation charges for services performed, related to all restricted stock units granted to non-employee members of the Board of Directors, selling, general and administrative expense of $659,000 and $3.2 million, respectively. In connection with the vesting of the restricted stock, the Company issued to non-employee members of the Board of Directors 7,256 and 18,750 shares, respectively, during the nine months ended September 30, 2019 and 2018.

Performance Unit Awards

During the nine months ended September 30, 2019, the Company granted 10,096 performance units, of which 5,050 are subject to a performance-based vesting and 5,046 are subject to a market-based vesting requirement and will vest over the terms described below. Total fair value of the performance unit awards granted was $2.0 million on the date of grant.

Each performance unit award is subject to both a performance-vesting requirement (either performance-based or market-based) and a service-vesting requirement.

The performance-based vesting requirement is tied to the Company's cumulative revenue growth compared to the cumulative revenue growth of companies comprising the Nasdaq Electronics Components Index, as measured over a specific performance period. The market-based vesting requirement is tied to the Company's total shareholder return relative to the total shareholder return of companies comprising the Nasdaq Electronics Components Index, as measured over a specific performance period.

The maximum number of performance units that may vest based on performance is two times the shares granted. Further, if the Company's cumulative revenue growth or total shareholder return is negative, the performance units may not vest at all.

For the three months ended September 30, 2019 and 2018, the Company recorded selling, general and administrative expense of $289,000 and $352,000, respectively, research and development expense of $70,000 and $86,000, respectively, and cost of sales of $34,000 and $38,000, respectively, related to performance units. For the nine months ended September 30, 2019 and 2018, the Company recorded selling, general and administrative expense of $566,000 and $1.3 million, respectively, research and development expense of $138,000 and $319,000, respectively, and cost of sales of $64,000 and $138,000, respectively, related to performance units.

In connection with the vesting of performance units during the nine months ended September 30, 2019 and 2018, 16,668 and 25,208 shares with an aggregate fair value of $2.6 million and $2.9 million, respectively, were withheld in satisfaction of tax withholding obligations.

Employee Stock Purchase Plan

On April 7, 2009, the Board of Directors of the Company adopted an Employee Stock Purchase Plan (ESPP). The ESPP was approved by the Company's shareholders and became effective on June 25, 2009. The Company has reserved 1,000,000 shares of common stock for issuance under the ESPP. Unless terminated by the Board of Directors, the ESPP will expire when all reserved shares have been issued.

Eligible employees may elect to contribute to the ESPP through payroll deductions during consecutive three-month purchase periods. Each employee who elects to participate will be deemed to have been granted an option to purchase shares of the Company's common stock on the first day of the purchase period. Unless the employee opts out during the purchase period, the option will automatically be exercised on the last day of the period, which is the purchase date, based on the employee's accumulated contributions to the ESPP. The purchase price will equal 85% of the lesser of the closing price per share of common stock on the first day of the period or the last business day of the period.

Employees may allocate up to 10% of their base compensation to purchase shares of common stock under the ESPP; however, each employee may purchase no more than 12,500 shares on a given purchase date, and no employee may purchase more than $25,000 of common stock under the ESPP during a given calendar year.

During the nine months ended September 30, 2019 and 2018, the Company issued 5,852 and 7,991 shares, respectively, of its common stock under the ESPP, resulting in proceeds of $658,000 and $616,000, respectively.

For the three months ended September 30, 2019 and 2018, the Company recorded charges of $19,000 and $31,000, respectively, to selling, general and administrative expense, $24,000 and $50,000, respectively, to research and development expense, and $16,000 and $31,000, respectively, to cost of sales related to the ESPP equal to the amount of the discount and the value of the look-back feature. For the nine months ended September 30, 2019 and 2018, the Company recorded charges of $66,000 and $71,000, respectively, to selling, general and administrative expense, $88,000 and $105,000, respectively, to research and development expense, and $53,000 and $64,000, respectively, to cost of sales related to the ESPP equal to the amount of the discount and the value of the look-back feature.

14. SUPPLEMENTAL EXECUTIVE RETIREMENT PLAN:

On March 18, 2010, the Compensation Committee and the Board of Directors of the Company approved and adopted the Universal Display Corporation Supplemental Executive Retirement Plan (SERP), effective as of April 1, 2010. On March 3, 2015, the Compensation Committee and the Board of Directors amended the SERP to include salary and bonus as part of the plan. Prior to this amendment, the SERP benefit did not take into account any bonuses. This change increased the liability for certain participants in the SERP. The purpose of the SERP, which is unfunded, is to provide certain of the Company's key employees with supplemental retirement benefits following a cessation of their employment and to encourage their continued employment with the Company. As of September 30, 2019, there were seven participants in the SERP.

The Company records amounts relating to the SERP based on calculations that incorporate various actuarial and other assumptions, including discount rates, rate of compensation increases, retirement dates and life expectancies. The net periodic costs are recognized as employees render the services necessary to earn the SERP benefits.

The components of net periodic pension cost were as follows (in thousands):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Service cost	$ 227	$ 326	$ 742	$ 976
Interest cost	403	261	1,209	785
Amortization of prior service cost	399	420	1,197	1,262
Amortization of loss	410	119	1,231	355
Total net periodic benefit cost	$ 1,439	$ 1,126	$ 4,379	$ 3,378

15. COMMITMENTS AND CONTINGENCIES:

Commitments

Under the 2006 Research Agreement with USC, the Company is obligated to make certain payments to USC based on work performed by USC under that agreement, and by Michigan under its subcontractor agreement with USC. See Note 9 for further explanation.

Under the terms of the 1997 Amended License Agreement, the Company is required to make minimum royalty payments to Princeton. See Note 9 for further explanation.

The Company has agreements with six executive officers and one employee which provide for certain cash and other benefits upon termination of employment in connection with a change in control of the Company. If the executive's employment is terminated in connection with the change in control, the executive is entitled to a lump-sum cash payment equal to two times the sum of the average annual base salary and bonus of the officer and immediate vesting of all stock options and other equity awards that may be outstanding at the date of the change in control, among other items.

In order to manage manufacturing lead times and help ensure adequate material supply, the Company entered into the New OLED Materials Agreement (see Note 10) that allows PPG Industries to procure and produce inventory based upon criteria as defined by the Company. These purchase commitments consist of firm, noncancelable and unconditional commitments. In certain instances, this agreement allows the Company the option to reschedule and adjust the Company's requirements based on its business needs prior to firm orders being placed. As of September 30, 2019 and December 31, 2018, the Company had purchase commitments for inventory of $23.6 million and $15.9 million, respectively.

Patent Related Challenges and Oppositions

Each major jurisdiction in the world that issues patents provides both third parties and applicants an opportunity to seek a further review of an issued patent. The process for requesting and considering such reviews is specific to the jurisdiction that issued the patent in question, and generally does not provide for claims of monetary damages or a review of specific claims of infringement. The conclusions made by the reviewing administrative bodies tend to be appealable and generally are limited in scope and applicability to the specific claims and jurisdiction in question.

The Company believes that opposition proceedings are frequently commenced in the ordinary course of business by third parties who may believe that one or more claims in a patent do not comply with the technical or legal requirements of the specific jurisdiction in which the patent was issued. The Company views these proceedings as reflective of its goal of obtaining the broadest legally permissible patent coverage permitted in each jurisdiction. Once a proceeding is initiated, as a general matter, the issued patent continues to be presumed valid until the jurisdiction's applicable administrative body issues a final non-appealable decision. Depending on the jurisdiction, the outcome of these proceedings could include affirmation, denial or modification of some or all of the originally issued claims. The Company believes that as OLED technology becomes more established and its patent portfolio increases in size, so will the number of these proceedings.

Below is a summary of an active proceeding that has been commenced against an issued patent that is exclusively licensed to the Company. The Company does not believe that the confirmation, loss or modification of the Company's rights in any individual claim or set of claims that are the subject of the following legal proceeding would have a material impact on the Company's materials sales or licensing business or on the Company's Consolidated Financial Statements, including its Consolidated Statements of Income, as a whole. However, as noted within the description, the following proceeding involves an issued patent that relates to the Company's fundamental phosphorescent OLED technologies and the Company intends to vigorously defend against claims that, in the Company's opinion, seek to restrict or reduce the scope of the originally issued claim, which may require the expenditure of significant amounts of the Company's resources. In certain circumstances, when permitted, the Company may also utilize a proceeding to request modification of the claims to better distinguish the patented invention from any newly identified prior art and/or improve the claim scope of the patent relative to commercially important categories of the invention.

Opposition to European Patent No. 1390962

On November 16, 2011, Osram AG and BASF SE each filed a Notice of Opposition to European Patent No. 1390962 (EP '962 patent), which relates to the Company's white phosphorescent OLED technology. The EP '962 patent, which was issued on February 16, 2011, is a European counterpart patent to U.S. patents 7,009,338 and 7,285,907. They are exclusively licensed to the Company by Princeton, and the Company is required to pay all legal costs and fees associated with this proceeding.

The EPO combined the oppositions into a single opposition proceeding, and a hearing on this matter was held in December 2015, wherein the EPO Opposition Division revoked the patent claims for alleged insufficiencies under EPC Article 83. The Company believes the EPO's decision relating to the original claims is erroneous, and has appealed the decision. Subsequent to the filing of the appeal, BASF withdrew its opposition to the patent. The patent, as originally granted, is deemed valid during the pendency of the appeals process.

At this time, based on its current knowledge, the Company believes that the patent being challenged should be declared valid, and that all or a significant portion of the Company's claims should be upheld. However, the Company cannot make any assurances of this result.

In addition to the above proceeding and now concluded proceedings which have been referenced in prior filings, from time to time, the Company may have other proceedings that are pending which relate to patents the Company acquired as part of the Fujifilm patent or BASF OLED patent acquisitions or which relate to technologies that are not currently widely utilized in the marketplace.

16. CONCENTRATION OF RISK:

Revenues and accounts receivable from the Company's largest customers were as follows (in thousands):

Customer	% of Revenues for the Three Months Ended September 30, 2019	2018	% of Revenues for the Nine Months Ended September 30, 2019	2018	Accounts Receivable as of September 30, 2019
A	56%	50%	45%	36%	$ 21,615
B	21%	19%	24%	35%	$ 9,820
C	12%	9%	17%	8%	$ 19,609
D	1%	10%	5%	9%	$ 444

Revenues from outside of North America represented approximately 97% and 96% of consolidated revenue for the three months ended September 30, 2019 and 2018, respectively, and 97% and 95% of consolidated revenue for the nine months ended September 30, 2019 and 2018, respectively. Revenues by geographic area are as follows (in thousands):

Country	Three Months Ended September 30, 2019	2018	Nine Months Ended September 30, 2019	2018
South Korea	$ 70,042	$ 53,883	$ 190,303	$ 126,789
China	23,205	17,037	98,955	34,368
Japan	1,137	3,076	3,802	4,637
Other non-U.S. locations	539	457	1,718	2,078
Total non-U.S. locations	94,923	74,453	294,778	167,872
United States	2,592	3,097	8,670	9,399
Total revenue	$ 97,515	$ 77,550	$ 303,448	$ 177,271

The Company attributes revenue to different geographic areas on the basis of the location of the customer.

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

	September 30, 2019	December 31, 2018
United States	$ 79,437	$ 64,560
Other	6,829	5,179
Total long-lived assets	$ 86,266	$ 69,739

Substantially all chemical materials were purchased from one supplier. See Note 10.

17. INCOME TAXES:

The Company is subject to income taxes in both the United States and foreign jurisdictions. The effective income tax rate was an expense of 15.3% and 18.9% for the three months ended September 30, 2019 and 2018, respectively, and 15.8% and 15.0% for the nine months ended September 30, 2019 and 2018, respectively. The Company recorded an income tax expense of $6.7 million and $5.3 million for the three months ended September 30, 2019 and 2018, respectively, and $21.1 million and $7.0 million for the nine months ended September 30, 2019 and 2018, respectively. The recorded amounts include deductions for employee share awards in excess of compensation costs (“windfalls”) under ASU No. 2016-09 of $693,000 and $29,000 for the three months ended September

30, 2019 and 2018, respectively, and $3.5 million and $1.8 million for the nine months ended September 30, 2019 and 2018, respectively. For the three months ended September 30, 2019, the Company released a deferred tax liability of $1.9 million due to the expiration of the statute of limitations for the 2015 Federal tax return.

In assessing the realizability of deferred tax assets, management considers whether it is more likely than not that some portion or all of the deferred tax assets will not be realized. The ultimate realization of deferred tax assets is dependent on the Company's ability to generate future taxable income to obtain benefit from the reversal of temporary differences, net operating loss carryforwards and tax credits. As part of its assessment management considers the scheduled reversal of deferred tax liabilities, projected future taxable income, and tax planning strategies. At this time there is no evidence to release the valuation allowance that relates to the New Jersey research and development credit.

On December 27, 2018 the Korean Supreme Court, citing prior cases, held that the applicable law and interpretation of the Korea-US Tax Treaty were clear that only royalties paid with respect to Korean registered patents are Korean source income and subject to Korean withholding tax. Based on this decision, the Company has decided to immediately litigate the Korean withholding taxes paid or withheld on the 2018 and 2019 royalty payments and has engaged a leading Korean law firm which has advised that there is a more-likely-than-not chance of success. As a result, as of September 30, 2019 and December 31, 2018, the Company has recorded a long-term asset of $23.5 million and $13.6 million, respectively, representing the allocation of withholding to non-Korean patents.

With respect to the Korean withholding for the years 2011 through 2017, the Company has decided to continue the U.S.-Korean Mutual Agreement Procedure which was accepted by the Korean National Tax Service on September 15, 2017. The Company believes that it is more-likely-than-not that a favorable settlement will be reached resulting in a reduction of the Korean withholding taxes previously withheld since 2011. A long-term asset of $36.9 million for estimated refunds due from the Korean government, a long-term payable of $16.2 million for estimated amounts due to the U.S. Federal government based on amendment of prior year U.S. tax returns for the lower withholding amounts, and a reduction of deferred tax assets for foreign tax credits and R&D credits of $20.7 million has been recorded on the September 30, 2019 and December 31, 2018 Consolidated Balance Sheets for this matter.

On October 30, 2018, the Korean National Tax Service (KNTS) concluded a tax audit with LG Display (LGD) that included the licensing and royalty payments made to UDC Ireland during the years 2015 through 2017. KNTS questioned whether UDC Ireland was the beneficial owner of these payments and assessed UDC Ireland a charge of $13.2 million for withholding and interest for the three-year period. UDC Ireland has engaged a leading Korean law firm which believes it is more-likely-than-not that UDC Ireland has beneficial ownership of the underlining intellectual property. As a result, a petition has been filed with the Tax Tribunal. Based on this authority, UDC Ireland has paid the assessment which is recorded as a long-term asset as of September 30, 2019 and December 31, 2018.

The above estimates may change in the future and ultimately upon settlement of these uncertain tax positions.

18. REVENUE RECOGNITION:

The Company recognizes revenue in accordance with ASC Topic 606, *Revenue from Contracts with Customers* (“ASC 606”). The standard establishes the principles that an entity shall apply to report useful information to users of financial statements about the nature, amount, timing, and uncertainty of revenue and cash flows from a contract with a customer.

The rights and benefits to the Company’s OLED technology are conveyed to the customer through technology license agreements and material supply agreements. The Company believes that the licenses and materials sold under these combined agreements are not distinct from each other for financial reporting purposes and as such, are accounted for as a single performance obligation. Accordingly, total contract consideration, including material, license and royalty fees, is estimated and recognized over the contract term based on material units sold at the estimated per unit fee over the life of the contract.

Various estimates are relied upon to recognize revenue. The Company estimates total material units to be purchased by its customers over the contract term based on historical trends, industry estimates and its forecast process. Additionally, management estimates the total sales-based royalties based on the estimated net sales revenue of its customers over the contract term. Management is using the expected value method to estimate the material per unit fee.

For the three months ended September 30, 2019 and 2018, the Company recorded 97% and 96% of its revenue from sales of materials and 3% and 4% from the providing of services through Adesis, respectively. For the nine months ended September 30, 2019 and 2018, the Company recorded 97% and 95% of its revenue from sales of materials and 3% and 5% from the providing of services through Adesis, respectively.

Contract Balances

The following table provides information about assets and liabilities associated with our contracts from customers (in thousands):

		As of September 30, 2019
Accounts receivable	$	65,774
Short-term unbilled receivables		467
Long-term unbilled receivables		6,899
Short-term deferred revenue		91,188
Long-term deferred revenue		50,495

Short-term and long-term unbilled receivables are classified as other current assets and other assets, respectively, on the Consolidated Balance Sheet. The deferred revenue balance at September 30, 2019 will be recognized as materials are shipped to customers over the remaining contract periods. The significant customer contracts (individually representing greater than 10% of revenue) expire in 2022. As of September 30, 2019, the Company had $11.3 million of backlog associated with committed purchase orders from its customers for phosphorescent emitter material. These orders are anticipated to be fulfilled within the next 90 days.

Significant changes in the unbilled receivables and deferred liabilities balances during the period are as follows (in thousands):

	Nine Months Ended September 30, 2019			
	Unbilled Receivables Increase (Decrease)		Deferred Revenue (Increase) Decrease	
Balance at December 31, 2018	$	1,020	$	(122,567)
Revenue recognized that was previously included in deferred revenue		—		94,044
Increases due to cash received		—		(113,849)
Cumulative catch-up adjustment arising from changes in estimates of transaction price		—		689
Unbilled receivables recognized		7,571		—
Transferred to receivables from unbilled receivables		(1,225)		—
Net change		6,346		(19,116)
Balance at September 30, 2019	$	7,366	$	(141,683)

19. NET INCOME PER COMMON SHARE:

The Company computes earnings per share in accordance with ASC Topic 260, *Earnings per Share* ("ASC 260"), which requires earnings per share for each class of stock to be calculated using the two-class method. The two-class method is an allocation of income between the holders of common stock and the Company's participating security holders. Under the two-class method, income for the reporting period is allocated between common shareholders and other security holders based on their respective participation rights in undistributed income. Unvested share-based payment awards that contain non-forfeitable rights to dividends or dividend equivalents are participating securities and, therefore, are included in computing earnings per share pursuant to the two-class method.

Basic net income per common share is computed by dividing net income allocated to common shareholders by the weighted-average number of shares of common stock outstanding for the period excluding unvested restricted stock units and performance units. Net income allocated to the holders of the Company's unvested restricted stock awards is calculated based on the shareholder’s proportionate share of weighted average shares of common stock outstanding on an if-converted basis.

For purposes of determining diluted net income per common share, basic net income per share is further adjusted to include the effect of potential dilutive common shares outstanding, including stock options, restricted stock units and performance units, and the impact of shares to be issued under the ESPP.

The following table is a reconciliation of net income and the shares used in calculating basic and diluted net income per common share for the three and nine months ended September 30, 2019 and 2018 (in thousands, except share and per share data):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Numerator:				
Net income	$ 36,962	$ 22,818	$ 111,876	$ 39,591
Adjustment for Basic EPS:				
Earnings allocated to unvested shareholders	(260)	(242)	(922)	(481)
Adjusted net income	$ 36,702	$ 22,576	$ 110,954	$ 39,110
Denominator:				
Weighted average common shares outstanding – Basic	46,980,439	46,869,998	46,947,109	46,841,036
Effect of dilutive shares:				
Common stock equivalents arising from stock options and ESPP	249	754	1,142	1,682
Restricted stock awards and units and performance units	33,231	43,801	35,650	51,050
Weighted average common shares outstanding – Diluted	47,013,919	46,914,553	46,983,901	46,893,768
Net income per common share:				
Basic	$ 0.78	$ 0.48	$ 2.36	$ 0.83
Diluted	$ 0.78	$ 0.48	$ 2.36	$ 0.83

For the three months ended September 30, 2019 and 2018, the combined effects of unvested restricted stock awards, restricted stock units, performance unit awards and stock options of none and 5,464, respectively, were excluded from the calculation of diluted EPS as their impact would have been antidilutive. For the nine months ended September 30, 2019 and 2018, the combined effects of unvested restricted stock awards, restricted stock units, performance unit awards and stock options of none and 4,143, respectively, were excluded from the calculation of diluted EPS as their impact would have been antidilutive. The impact of shares to be issued under the ESPP, which was not significant, was excluded from the calculation of diluted EPS as their impact would have been antidilutive.

ITEM 2. ***MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS***

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with the Consolidated Financial Statements and related notes above.

CAUTIONARY STATEMENT
CONCERNING FORWARD-LOOKING STATEMENTS

This discussion and analysis contains some "forward-looking statements." Forward-looking statements concern possible or assumed future results of operations, including descriptions of our business strategies and customer relationships. These statements often include words such as "believe," "expect," "anticipate," "intend," "plan," "estimate," "seek," "will," "may" or similar expressions. These statements are based on assumptions that we have made in light of our experience in the industry, as well as our perceptions of historical trends, current conditions, expected future developments and other factors that we believe are appropriate in these circumstances.

As you read and consider this discussion and analysis, you should not place undue reliance on any forward-looking statements. You should understand that these statements involve substantial risk and uncertainty and are not guarantees of future performance or results. They depend on many factors that are discussed further in the section entitled (Risk Factors) in our Annual Report on Form 10-K for the year ended December 31, 2018, as supplemented by disclosures, if any, in Item 1A of Part II below. Changes or developments in any of these areas could affect our financial results or results of operations and could cause actual results to differ materially from those contemplated in the forward-looking statements.

All forward-looking statements speak only as of the date of this report or the documents incorporated by reference, as the case may be. We do not undertake any duty to update any of these forward-looking statements to reflect events or circumstances after the date of this report or to reflect the occurrence of unanticipated events.

OVERVIEW

We are a leader in the research, development and commercialization of organic light emitting diode, or OLED, technologies and materials for use in displays for mobile phones, televisions, tablets, wearables, portable media devices, notebook computers, personal computers and automotive applications, as well as specialty and general lighting products. Since 1994, we have been exclusively engaged, and expect to continue to be primarily engaged, in funding and performing research and development activities relating to OLED technologies and materials, and commercializing these technologies and materials. We derive our revenue primarily from the following:

- sales of OLED materials for evaluation, development and commercial manufacturing;
- intellectual property and technology licensing;
- contract research services in the areas of organic and organometallic materials synthesis research, development and commercialization; and
- technology development and support, including government contract work and support provided to third parties for commercialization of their OLED products.

Material sales relate to our sale of OLED materials for incorporation into our customers' commercial OLED products or for their OLED development and evaluation activities. Material sales are recognized at the time title passes, which is typically at the time of shipment or at the time of delivery, depending upon the contractual agreement between the parties.

We receive license and royalty payments under certain commercial, development and technology evaluation agreements, some of which are non-refundable advances. These payments may include royalty and license fees made pursuant to license agreements and also license fees included as part of certain commercial supply agreements. These payments are included in the estimate of total contract consideration by customer and recognized as revenue over the contract term based on material units sold at the estimated per unit fee over the life of the contract.

In 2018, the Company entered into a commercial license agreement with Samsung Display Co., Ltd. (SDC). This agreement, which covers the manufacture and sale of specified OLED display materials, was effective as of January 1, 2018 and lasts through the end of 2022 with an additional two-year extension option. Under this agreement, the Company is being paid a license fee, payable in quarterly installments over the agreement term of five years. The agreement conveys to SDC the non-exclusive right to use certain of the Company's intellectual property assets for a limited period of time that is less than the estimated life of the assets.

At the same time the Company entered into the current patent license agreement with SDC, the Company also entered into a supplemental material purchase agreement with SDC. Under the supplemental material purchase agreement, SDC agrees to purchase from the Company a minimum amount of phosphorescent emitter materials for use in the manufacture of licensed products. This minimum commitment is subject to SDC’s requirements for phosphorescent emitter materials and the Company’s ability to meet these requirements over the term of the supplemental agreement.

In 2015, the Company entered into an OLED patent license agreement and an OLED commercial supply agreement with LG Display Co., Ltd. (LG Display), which were effective as of January 1, 2015 and superseded the existing 2007 commercial supply agreement between the parties. The new agreements have a term that is set to expire by the end of 2022. The patent license agreement provides LG Display a non-exclusive, royalty bearing portfolio license to make and sell OLED displays under the Company's patent portfolio. The patent license calls for license fees, prepaid royalties and running royalties on licensed products. The agreements include customary provisions relating to warranties, indemnities, confidentiality, assignability and business terms. The agreements provide for certain other minimum obligations relating to the volume of material sales anticipated over the term of the agreements as well as minimum royalty revenue to be generated under the patent license agreement. The Company generates revenue under these agreements that are predominantly tied to LG Display's sales of OLED licensed products. The OLED commercial supply agreement provides for the sales of materials for use by LG Display, which may include phosphorescent emitters and host materials.

In 2016, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Tianma Micro-electronics Co. Ltd. (Tianma). Under the license agreement, the Company has granted Tianma non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company supplies phosphorescent OLED materials to Tianma for use in its licensed products.

In 2017, the Company entered into long-term, multi-year agreements with BOE Technology Group Co., Ltd. (BOE). Under these agreements, the Company has granted BOE non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The Company also supplies phosphorescent OLED materials to BOE.

In 2018, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Visionox Technology, Inc. (Visionox). Under the license agreement, the Company has granted Visionox non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company supplies phosphorescent OLED materials to Visionox for use in its licensed products.

In 2016, we acquired Adesis, Inc. (Adesis) with operations in New Castle, Delaware. Adesis is a contract research organization (CRO) that provides support services to the OLED, pharma, biotech, catalysis and other industries. As of September 30, 2019, Adesis employed a team of 91 research scientists, chemists, engineers, and laboratory technicians. Prior to our acquisition in 2016, we utilized more than 50% of Adesis’ technology service and production output. We continue to utilize a significant portion of its technology research capacity for the benefit of our OLED technology development, and Adesis uses the remaining capacity to operate as a CRO in the above-mentioned industries providing contract research services to those third party customers. Contract research services revenue is earned by performing organic and organometallic synthetics research, development and commercialization on a contractual basis for our customers.

We also generate technology development and support revenue earned from government contracts, development and technology evaluation agreements and commercialization assistance fees, which include reimbursements by government entities for all or a portion of the research and development costs we incur in relation to our government contracts. Revenues are recognized as services are performed, proportionally as research and development costs are incurred, or as defined milestones are achieved.

We anticipate fluctuations in our annual and quarterly results of operations due to uncertainty regarding, among other factors:

- the timing, cost and volume of sales of our OLED materials;
- the timing of our receipt of license fees and royalties, as well as fees for future technology development and evaluation;
- the timing and magnitude of expenditures we may incur in connection with our ongoing research and development and patent-related activities; and
- the timing and financial consequences of our formation of new business relationships and alliances.

RESULTS OF OPERATIONS

Comparison of the Three Months Ended September 30, 2019 and 2018

	Three Months Ended September 30, 2019	Three Months Ended September 30, 2018	Increase (Decrease)
REVENUE	$ 97,515	$ 77,550	$ 19,965
COST OF SALES	17,286	16,123	1,163
Gross margin	80,229	61,427	18,802
OPERATING EXPENSES:			
Research and development	16,787	13,616	3,171
Selling, general and administrative	12,623	12,120	503
Amortization of acquired technology and other intangible assets	5,493	5,493	—
Patent costs	1,659	1,937	(278)
Royalty and license expense	2,837	2,229	608
Total operating expenses	39,399	35,395	4,004
OPERATING INCOME	40,830	26,032	14,798
Interest income, net	2,748	2,118	630
Other income (expense), net	53	(7)	60
Interest and other income, net	2,801	2,111	690
INCOME BEFORE INCOME TAXES	43,631	28,143	15,488
INCOME TAX EXPENSE	(6,669)	(5,325)	(1,344)
NET INCOME	$ 36,962	$ 22,818	$ 14,144

Revenue

During the three months ended September 30, 2019, we recognized revenue of $97.5 million, an increase of $19.9 million from $77.6 million in the three months ended September 30, 2018. The increase in revenue was due to higher material sales as a result of stronger demand in the OLED display market.

Revenue derived from OLED sales comprised 97% of total revenue for the three months ended September 30, 2019 as compared to 96% for the three months ended September 30, 2018. The remaining portion of our revenue was derived from contract research services. Contract research services include revenue earned by our subsidiary, Adesis, which performs organic and organometallic synthetics research, development and commercialization on a contractual basis for our customers.

Cost of sales

Cost of sales for the three months ended September 30, 2019 increased by $1.2 million as compared to the three months ended September 30, 2018, primarily due to an increase in the level of material sales. Included in the cost of sales for the three months ended September 30, 2018, was an increase in inventory reserve of $1.0 million due to excess inventory levels in certain products. There was no increase in inventory reserve for the three months ended September 30, 2019. As a result of the increase in material sales, gross margin for the three months ended September 30, 2019 increased by $18.8 million as compared to the three months ended September 30, 2018, with gross margin as a percentage of revenue increasing to 82% from 79%.

Research and development

Research and development expenses increased to $16.8 million for the three months ended September 30, 2019, as compared to $13.6 million for the three months ended September 30, 2018. The increase in research and development expenses was primarily due to higher employee-related compensation expenses and operating costs, including increased contract research activity.

Selling, general and administrative

Selling, general and administrative expenses increased to $12.6 million for the three months ended September 30, 2019, as compared to $12.1 million for the three months ended September 30, 2018. The increase in selling, general and administrative expenses was primarily due to higher employee-related compensation expenses.

Amortization of acquired technology and other intangible assets

Amortization of acquired technology and other intangible assets was $5.5 million for both of the three-month periods ended September 30, 2019 and 2018.

Patent costs

Patent costs decreased to $1.7 million for the three months ended September 30, 2019, as compared to $1.9 million for the three months ended September 30, 2018.

Royalty and license expense

Royalty and license expense increased to $2.8 million for the three months ended September 30, 2019, as compared to $2.2 million for the three months ended September 30, 2018. The increase was due to increased royalties incurred under our amended license agreement with Princeton, USC and Michigan, resulting from an increase in qualifying material sales. See Note 9 to the Consolidated Financial Statements for further discussion.

Interest and other income, net

Interest income, net was $2.7 million for the three months ended September 30, 2019, as compared to $2.1 million for the three months ended September 30, 2018. The increase in interest income, net was primarily due to the increase in available-for-sale investments held in the current quarter over amounts held in the comparable period in 2018. Other income (expense), net primarily consisted of net exchange gains and losses on foreign currency transactions and rental income. We recorded other income, net of $53,000 for the three months ended September 30, 2019 as compared to other expense, net of $7,000 for the three months ended September 30, 2018.

Income tax expense

We are subject to income taxes in both the United States and foreign jurisdictions. The effective income tax rate was an expense of 15.3% and 18.9% for the three months ended September 30, 2019 and 2018, respectively, and we recorded income tax expense of $6.7 million and $5.3 million, respectively, for those periods. The recorded amounts include deductions for employee share awards in excess of compensation costs (“windfalls”) under ASU No. 2016-09. For the three months ended September 30, 2019, without the $693,000 benefit of ASU No. 2016-09, the effective income tax rate and income tax expense would have been 16.9% and $7.4 million, respectively, and for the three months ended September 30, 2018, without the $29,000 benefit of ASU No. 2016-09, the effective income tax rate and income tax expense would have been 19.0% and $5.4 million, respectively.

During the three months ended September 30, 2019, the Company released a deferred tax liability of $1.9 million due to the expiration of the statute of limitations for the 2015 Federal tax return. Without the release of the deferred tax liability, the effective income tax rate and income tax expense would have been 19.6% and $8.6 million, respectively for the three months ended September 30, 2019.

Comparison of the Nine Months Ended September 30, 2019 and 2018

	Nine Months Ended September 30, 2019	Nine Months Ended September 30, 2018	Increase (Decrease)
REVENUE	$ 303,448	$ 177,271	$ 126,177
COST OF SALES	57,172	35,216	21,956
Gross margin	246,276	142,055	104,221
OPERATING EXPENSES:			
Research and development	51,449	38,922	12,527
Selling, general and administrative	40,531	34,473	6,058
Amortization of acquired technology and other intangible assets	16,469	16,479	(10)
Patent costs	5,145	5,691	(546)
Royalty and license expense	8,828	5,028	3,800
Total operating expenses	122,422	100,593	21,829
OPERATING INCOME	123,854	41,462	82,392
Interest income, net	8,336	5,155	3,181
Other income (expense), net	740	(66)	806
Interest and other income, net	9,076	5,089	3,987
INCOME BEFORE INCOME TAXES	132,930	46,551	86,379
INCOME TAX EXPENSE	(21,054)	(6,960)	(14,094)
NET INCOME	$ 111,876	$ 39,591	$ 72,285

Revenue

During the nine months ended September 30, 2019, we recognized revenue of $303.4 million, an increase of $126.1 million from $177.3 million in the nine months ended September 30, 2018. The increase in revenue was due to higher material sales as a result of stronger demand in the OLED display market.

Revenue derived from OLED sales comprised 97% of total revenue for the nine months ended September 30, 2019 as compared to 95% for the nine months ended September 30, 2018. The remaining portion of our revenue was derived from contract research services. Contract research services include revenue earned by our subsidiary, Adesis, which performs organic and organometallic synthetics research, development and commercialization on a contractual basis for our customers.

Cost of sales

Cost of sales for the nine months ended September 30, 2019 increased by $22.0 million as compared to the nine months ended September 30, 2018, primarily due to an increase in the level of material sales. Included in the cost of sales for the nine months ended September 30, 2019 and 2018, was an increase in inventory reserve of $4.2 million and $1.0 million, respectively, due to excess inventory levels in certain products. As a result of the increase in material sales, gross margin for the nine months ended September 30, 2019 increased by $104.2 million as compared to the nine months ended September 30, 2018, with gross margin as a percentage of revenue increasing to 81% from 80%.

Research and development

Research and development expenses increased to $51.4 million for the nine months ended September 30, 2019, as compared to $38.9 million for the nine months ended September 30, 2018. The increase in research and development expenses was primarily due to higher employee-related compensation expenses and operating costs, including increased contract research activity.

Selling, general and administrative

Selling, general and administrative expenses increased to $40.5 million for the nine months ended September 30, 2019, as compared to $34.5 million for the nine months ended September 30, 2018. The increase in selling, general and administrative expenses was primarily due to higher employee-related compensation expenses.

Amortization of acquired technology and other intangible assets

Amortization of acquired technology and other intangible assets was $16.5 million for both of the nine-month periods ended September 30, 2019 and 2018.

Patent costs

Patent costs decreased to $5.1 million for the nine months ended September 30, 2019, as compared to $5.7 million for the nine months ended September 30, 2018.

Royalty and license expense

Royalty and license expense increased to $8.8 million for the nine months ended September 30, 2019, as compared to $5.0 million for the nine months ended September 30, 2018. The increase was due to increased royalties incurred under our amended license agreement with Princeton, USC and Michigan, resulting from an increase in qualifying material sales. See Note 9 to the Consolidated Financial Statements for further discussion.

Interest and other income, net

Interest income, net was $8.3 million for the nine months ended September 30, 2019, as compared to $5.2 million for the nine months ended September 30, 2018. The increase in interest income, net was primarily due to the increase in available-for-sale investments held in the current year over amounts held in the comparable period in 2018. Other income (expense), net primarily consisted of net exchange gains and losses on foreign currency transactions and rental income. We recorded other income, net of $740,000 for the nine months ended September 30, 2019 as compared to other expense, net of $66,000 for the nine months ended September 30, 2018.

Income tax expense

We are subject to income taxes in both the United States and foreign jurisdictions. The effective income tax rate was an expense of 15.8% and 15.0% for the nine months ended September 30, 2019 and 2018, respectively, and we recorded income tax expense of $21.1 million and $7.0 million, respectively, for those periods. The recorded amounts include deductions for employee share awards in excess of compensation costs (“windfalls”) under ASU No. 2016-09. For the nine months ended September 30, 2019, without the $3.5 million benefit of ASU No. 2016-09, the effective income tax rate and income tax expense would have been 18.5% and $24.6 million, respectively, and for the nine months ended September 30, 2018, without the $1.8 million benefit of ASU No. 2016-09, the effective income tax rate and income tax expense would have been 18.8% and $8.8 million, respectively

During the nine months ended September 30, 2019, the Company released a deferred tax liability of $1.9 million due to the expiration of the statute of limitations for the 2015 Federal tax return. Without the release of the deferred tax liability, the effective income tax rate and income tax expense would have been 17.2% and $23.0 million, respectively for the nine months ended September 30, 2019.

Liquidity and Capital Resources

Our principal sources of liquidity are our cash and cash equivalents and our short-term investments. As of September 30, 2019, we had cash and cash equivalents of $235.5 million and short-term investments of $361.5 million, for a total of $597.0 million. This compares to cash and cash equivalents of $211.0 million and short-term investments of $304.3, for a total of $515.3 million, as of December 31, 2018.

Cash provided by operating activities for the nine months ended September 30, 2019 was $137.7 million resulting from $111.9 million of net income and $88.3 million due to changes in our operating assets and liabilities, partially offset by a $62.5 million reduction due to non-cash items including amortization of deferred revenue, amortization of intangibles and stock-based compensation. Changes in our operating assets and liabilities related to an increase in deferred revenue of $113.8 million, a reduction of inventory of $8.1 million and an increase in other liabilities of $5.7 million, partially offset by an increase in accounts receivable of $22.6 million, an increase in other assets of $14.9 million, and a reduction of accounts payable and accrued expenses of $1.8 million.

Cash provided by operating activities for the nine months ended September 30, 2018 was $95.0 million resulting from $39.6 million of net income and $56.1 million due to changes in our operating assets and liabilities. This increase was partially offset by a $769,000 decrease due to non-cash items including amortization of deferred revenue, amortization of intangibles and deferred income taxes. Changes in our operating assets and liabilities related to an increase in deferred revenue of $99.9 million, an increase in other liabilities of $18.3 million, a decrease in accounts receivable of $9.2 million, and an increase in accounts payable and accrued expenses of $439,000, partially offset by an increase in other assets of $37.9 million and an increase in inventory of $33.8 million.

Cash used in investing activities was $83.2 million for the nine months ended September 30, 2019, as compared to $106.2 million for the nine months ended September 30, 2018. The decrease in cash used in investing activities of $23.0 million was primarily due to the timing of maturities and purchases of investments resulting in net purchases of $57.5 million for the nine months ended September 30, 2019, as compared to $85.3 million for the nine months ended September 30, 2018, partially offset by an increase in purchases of intangibles and property, plant and equipment of $4.8 million for the nine months ended September 30, 2019 compared to the nine months ended September 30, 2018. The increase in property, plant and equipment purchases during 2019 was primarily due to the purchase of additional property in Ewing, New Jersey as part of our plan to expand operations.

Cash used in financing activities was $30.1 million for the nine months ended September 30, 2019, as compared to $19.9 million for the nine months ended September 30, 2018. The increase in cash used in financing activities of $10.2 million was due to an increase in the cash payment of dividends in the current year of $5.7 million, an increase in the payment of withholding taxes related to stock-based compensation to employees of $4.3 million and an increase in the repurchase of common stock of $172,000, partially offset by an increase in proceeds from the issuance of common stock of $42,000.

Working capital was $582.6 million as of September 30, 2019, compared to $501.7 million as of December 31, 2018. The increase in working capital was primarily due to an increase in short-term investments, cash and cash equivalents and accounts receivable, partially offset by a decrease in inventory and an increase in deferred revenue.

We anticipate, based on our internal forecasts and assumptions relating to our operations (including, among others, assumptions regarding our working capital requirements, the progress of our research and development efforts, the availability of sources of funding for our research and development work, and the timing and costs associated with the preparation, filing, prosecution, maintenance, defense and enforcement of our patents and patent applications), that we have sufficient cash, cash equivalents and short-term investments to meet our obligations for at least the next twelve months.

We believe that potential additional financing sources for us include long-term and short-term borrowings, public and private sales of our equity and debt securities and the receipt of cash upon the exercise of outstanding stock options. It should be noted, however, that additional funding may be required in the future for research, development and commercialization of our OLED technologies and materials, to obtain, maintain and enforce patents respecting these technologies and materials, and for working capital and other purposes, the timing and amount of which are difficult to ascertain. There can be no assurance that additional funds will be available to us when needed, on commercially reasonable terms or at all, particularly in the current economic environment.

Critical Accounting Policies and Estimates

The discussion and analysis of our financial condition and results of operations is based on our Consolidated Financial Statements, which have been prepared in accordance with U.S. generally accepted accounting principles. The preparation of these Consolidated Financial Statements requires us to make estimates and judgments that affect our reported assets and liabilities, revenues and expenses, and other financial information. Actual results may differ significantly from our estimates under other assumptions and conditions.

We believe that our accounting policies related to revenue recognition and deferred revenue, inventories, and income taxes are our "critical accounting policies" as contemplated by the SEC.

Refer to our Annual Report on Form 10-K for the year ended December 31, 2018, for additional discussion of our critical accounting policies.

Contractual Obligations

Refer to our Annual Report on Form 10-K for the year ended December 31, 2018 for a discussion of our contractual obligations.

Off-Balance Sheet Arrangements

As of September 30, 2019, we had no off-balance sheet arrangements in the nature of guarantee contracts, retained or contingent interests in assets transferred to unconsolidated entities (or similar arrangements serving as credit, liquidity or market risk support to unconsolidated entities for any such assets), or obligations (including contingent obligations) arising out of variable interests in unconsolidated entities providing financing, liquidity, market risk or credit risk support to us, or that engage in leasing, hedging or research and development services with us.

ITEM 3. *QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK*

We do not utilize financial instruments for trading purposes and hold no derivative financial instruments, other financial instruments or derivative commodity instruments that could expose us to significant market risk other than our investments disclosed in "Fair Value Measurements" in Note 4 to the Consolidated Financial Statements included herein. We generally invest in investment grade financial instruments to reduce our exposure related to investments. Our primary market risk exposure with regard to such financial instruments is to changes in interest rates, which would impact interest income earned on investments. However, based upon the conservative nature of our investment portfolio and current experience, we do not believe a decrease in investment yields would have a material negative effect on our interest income.

Substantially all our revenue is derived from outside of North America. All revenue is primarily denominated in U.S. dollars and therefore we bear no significant foreign exchange risk.

ITEM 4. *CONTROLS AND PROCEDURES*

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and Chief Financial Officer, evaluated the effectiveness of our disclosure controls and procedures as of September 30, 2019. Based on that evaluation, the Chief Executive Officer and Chief Financial Officer concluded that our disclosure controls and procedures, as of the end of the period covered by this report, are effective to provide reasonable assurance that the information required to be disclosed by us in reports filed or submitted under the Securities Exchange Act of 1934, as amended, is (i) recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and (ii) accumulated and communicated to our management, including the Chief Executive Officer and Chief Financial Officer, as appropriate to allow timely decisions regarding disclosure. However, a controls system, no matter how well designed and operated, cannot provide absolute assurance that the objectives of the controls system are met, and no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, within a company have been detected.

Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting during the quarter ended September 30, 2019 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

PART II – OTHER INFORMATION

ITEM 1. *LEGAL PROCEEDINGS*

Patent Related Challenges and Oppositions

Each major jurisdiction in the world that issues patents provides both third parties and applicants an opportunity to seek a further review of an issued patent. The process for requesting and considering such reviews is specific to the jurisdiction that issued the patent in question, and generally does not provide for claims of monetary damages or a review of specific claims of infringement. The conclusions made by the reviewing administrative bodies tend to be appealable and generally are limited in scope and applicability to the specific claims and jurisdiction in question.

We believe that opposition proceedings are frequently commenced in the ordinary course of business by third parties who may believe that one or more claims in a patent do not comply with the technical or legal requirements of the specific jurisdiction in which the patent was issued. We view these proceedings as reflective of our goal of obtaining the broadest legally permissible patent coverage permitted in each jurisdiction. Once a proceeding is initiated, as a general matter, the issued patent continues to be presumed valid until the jurisdiction's applicable administrative body issues a final non-appealable decision. Depending on the jurisdiction, the outcome of these proceedings could include affirmation, denial or modification of some or all of the originally issued claims. We believe that as OLED technology becomes more established and as our patent portfolio increases in size, so will the number of these proceedings.

Below is a summary of a certain active proceeding that has been commenced against an issued patent that is exclusively licensed to us. We do not believe that the confirmation, loss or modification of our rights in any individual claim or set of claims that are the subject of the following legal proceeding would have a material impact on our materials sales or licensing business or on our Consolidated Financial Statements, including our Consolidated Statements of Income, as a whole. However, as noted within the description, the following proceeding involves an issued patent that relates to our fundamental phosphorescent OLED technologies and we intend to vigorously defend against claims that, in our opinion, seek to restrict or reduce the scope of the originally issued claim, which may require the expenditure of significant amounts of our resources. In certain circumstances, when permitted, we may also utilize a proceeding to request modification of the claims to better distinguish the patented invention from any newly identified prior art and/or improve the claim scope of the patent relative to commercially important categories of the invention.

Opposition to European Patent No. 1390962

On November 16, 2011, Osram AG and BASF SE each filed a Notice of Opposition to European Patent No. 1390962 (EP '962 patent), which relates to our white phosphorescent OLED technology. The EP '962 patent, which was issued on February 16, 2011, is a European counterpart patent to U.S. patents 7,009,338 and 7,285,907. They are exclusively licensed to us by Princeton, and we are required to pay all legal costs and fees associated with this proceeding.

The EPO combined the oppositions into a single opposition proceeding, and a hearing was held in December 2015, wherein the EPO Opposition Division revoked the patent claims for alleged insufficiencies under EPC Article 83. We believe the EPO's decision relating to the original claims is erroneous, and we have appealed the decision. Subsequent to the filing of the appeal, BASF withdrew its opposition to the patent. This patent, as originally granted, is deemed valid during the pendency of the appeals process.

At this time, based on our current knowledge, we believe that the patent being challenged should be declared valid, and that all or a significant portion of our claims should be upheld. However, we cannot make any assurances of this result.

In addition to the above proceeding and now concluded proceedings which have been referenced in prior filings, from time to time, we may have other proceedings that are pending which relate to patents we acquired as part of the Fujifilm patent or BASF OLED patent acquisitions or which relate to technologies that are not currently widely utilized in the marketplace.

ITEM 1A. *RISK FACTORS*

There have been no material changes to the risk factors previously discussed in Part I, Item 1A "Risk Factors" in our Annual Report on Form 10-K for the year ended December 31, 2018.

ITEM 2. *UNREGISTERED SALES OF EQUITY SECURITIES AND USE OF PROCEEDS*

None.

ITEM 3. *DEFAULTS UPON SENIOR SECURITIES*

None.

ITEM 4. *MINE SAFETY DISCLOSURES*

Not applicable.

ITEM 5. *OTHER INFORMATION*

None.

ITEM 6. *EXHIBITS*

The following is a list of the exhibits filed as part of this report. Where so indicated by footnote, exhibits that were previously filed are incorporated by reference. For exhibits incorporated by reference, the location of the exhibit in the previous filing is indicated parenthetically, together with a reference to the filing indicated by footnote.

Exhibit Number	Description
31.1*	Certifications of Steven V. Abramson, Chief Executive Officer, as required by Rule 13a-14(a) or Rule 15d-14(a)
31.2*	Certifications of Sidney D. Rosenblatt, Chief Financial Officer, as required by Rule 13a-14(a) or Rule 15d-14(a)
32.1**	Certifications of Steven V. Abramson, Chief Executive Officer, as required by Rule 13a-14(b) or Rule 15d-14(b), and by 18 U.S.C. Section 1350. (This exhibit shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or otherwise subject to the liability of that section. Further, this exhibit shall not be deemed to be incorporated by reference into any filing under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended.)
32.2**	Certifications of Sidney D. Rosenblatt, Chief Financial Officer, as required by Rule 13a-14(b) or Rule 15d-14(b), and by 18 U.S.C. Section 1350. (This exhibit shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or otherwise subject to the liability of that section. Further, this exhibit shall not be deemed to be incorporated by reference into any filing under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended.)
101.INS*	XBRL Instance Document – the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.
101.SCH*	XBRL Taxonomy Extension Schema Document
101.CAL*	XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF*	XBRL Taxonomy Extension Definition Linkbase Document
101.LAB*	XBRL Taxonomy Extension Label Linkbase Document
101.PRE*	XBRL Taxonomy Extension Presentation Linkbase Document
104	The cover page of this Quarterly Report on Form 10-Q for the quarter ended September 30, 2019, formatted in Inline XBRL (included in Item 101.INS)

Explanation of footnotes to listing of exhibits:

* Filed herewith.
** Furnished herewith.

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:

UNIVERSAL DISPLAY CORPORATION

Date: October 30, 2019

By: /s/ Sidney D. Rosenblatt

Sidney D. Rosenblatt
Executive Vice President, Chief Financial Officer,
Treasurer and Secretary

Exhibit 31.1

CERTIFICATIONS REQUIRED BY
RULE 13a-14(a)/15d-14(a)

I, Steven V. Abramson, certify that:

1. I have reviewed this quarterly report on Form 10-Q of Universal Display Corporation (the “registrant”) for the quarter ended September 30, 2019;

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

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

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

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

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

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

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

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

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

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

Date: October 30, 2019

By: /s/ Steven V. Abramson
Steven V. Abramson
President and Chief Executive Officer

Exhibit 31.2

CERTIFICATIONS REQUIRED BY
RULE 13a-14(a)/15d-14(a)

I, Sidney D. Rosenblatt, certify that:

1. I have reviewed this quarterly report on Form 10-Q of Universal Display Corporation (the “registrant”) for the quarter ended September 30, 2019;

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

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

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

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

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

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

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

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

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

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

Date: October 30, 2019

By: /s/ Sidney D. Rosenblatt
Sidney D. Rosenblatt
Executive Vice President and Chief Financial Officer

Exhibit 32.1

CERTIFICATIONS REQUIRED BY
RULE 13a-14(b)/15d-14(b) AND 18 U.S.C. SECTION 1350

In connection with the quarterly report of Universal Display Corporation (the “Company”) on Form 10-Q for the quarter ended September 30, 2019, as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Steven V. Abramson, President and Chief Executive Officer of the Company, hereby certify, based on my knowledge, that:

(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 results of operations of the Company.

Date:	October 30, 2019	By:	/s/ Steven V. Abramson
			Steven V. Abramson
			President and Chief Executive Officer

Exhibit 32.2

CERTIFICATIONS REQUIRED BY
RULE 13a-14(b)/15d-14(b) AND 18 U.S.C. SECTION 1350

In connection with the quarterly report of Universal Display Corporation (the "Company") on Form 10-Q for the quarter ended September 30, 2019, as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, Sidney D. Rosenblatt, Executive Vice President and Chief Financial Officer of the Company, hereby certify, based on my knowledge, that:

(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 results of operations of the Company.

Date: October 30, 2019

By: /s/ Sidney D. Rosenblatt
Sidney D. Rosenblatt
Executive Vice President and Chief Financial Officer