MOOG INC.
Form 10-K
November 13, 2018

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

FORM 10-K

(Mark One)

ý ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended September 29, 2018

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 **1-05129**

(Exact Name of Registrant as Specified in its Charter)

New York	**16-0757636**
(State or Other Jurisdiction of Incorporation or Organization)	(I.R.S. Employer Identification No.)
East Aurora, New York	**14052-0018**
(Address of Principal Executive Offices)	(Zip Code)

Registrant's Telephone Number, Including Area Code: **(716) 652-2000**

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

Title of Each Class	Name of Each Exchange on Which Registered
Class A Common Stock, $1.00 Par Value	New York Stock Exchange
Class B Common Stock, $1.00 Par Value	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act: None

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

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

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 ý No ¨

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Website, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulations S-T
(§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). Yes ý No ¨
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of the registrant’s knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.ý

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

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

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

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

The aggregate market value of the common stock outstanding and held by non-affiliates (as defined in Rule 405 under the Securities Act of 1933) of the registrant, based upon the closing sale price of the common stock on the New York Stock Exchange on March 31, 2018, the last business day of the registrant’s most recently completed second fiscal quarter, was approximately $2,718 million.

The number of shares of common stock outstanding as of the close of business on November 6, 2018 was: Class A 32,496,875; Class B 2,300,417.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Moog Inc. Proxy Statement for the Annual Meeting of Shareholders to be held on February 12, 2019 (“2018 Proxy”) are incorporated by reference into Part III of this Form 10-K.

FORM 10-K INDEX

PART I

PART II

PART III

PART IV

Disclosure Regarding Forward-Looking Statements

Information included or incorporated by reference in this report that does not consist of historical facts, including statements accompanied by or containing words such as “may,” “will,” “should,” “believes,” “expects,” “expected,” “intends,” “plans,” “projects,” “approximate,” “estimates,” “predicts,” “potential,” “outlook,” “forecast,” “anticipates,” “presume” and “assume,” are forward-looking statements. Such forward-looking statements are made pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. These statements are not guarantees of future performance and are subject to several factors, risks and uncertainties, the impact or occurrence of which could cause actual results to differ materially from the expected results described in the forward-looking statements. Certain of these factors, risks and uncertainties are discussed in the sections of this report entitled “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations.” New factors, risks and uncertainties may emerge from time to time that may affect the forward-looking statements made herein. Given these factors, risks and uncertainties, investors should not place undue reliance on forward-looking statements as predictive of future results. We disclaim any obligation to update the forward-looking statements made in this report.

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PART I

The Registrant, Moog Inc., a New York corporation formed in 1951, is referred to in this report as “Moog” or in the nominative “we” or the possessive “our.”

Unless otherwise noted or the context otherwise requires, all references to years in this report are to fiscal years.

Item 1. Business.

Description of the Business. Moog is a worldwide designer, manufacturer and systems integrator of high performance precision motion and fluid controls and controls systems for a broad range of applications in aerospace and defense and industrial markets. We have three operating segments: Aircraft Controls, Space and Defense Controls and Industrial Systems.

Additional information describing the business and comparative segment revenues, operating profits and related financial information for 2018, 2017 and 2016 are provided in Note 19 of Item 8, Financial Statements and Supplementary Data of this report.

Distribution. Our sales and marketing organization consists of individuals possessing highly specialized technical expertise. This expertise is required in order to effectively evaluate a customer’s precision control requirements and to facilitate communication between the customer and our engineering staff. Our sales staff is the primary contact with customers. Manufacturers’ representatives are used to cover certain domestic aerospace markets. Distributors are used selectively to cover certain industrial and medical markets.

Industry and Competitive Conditions. We experience considerable competition in our aerospace and defense and industrial markets. We believe that the principal points of competition in our markets are product quality, reliability, price, design and engineering capabilities, product development, conformity to customer specifications, timeliness of delivery, effectiveness of the distribution organization and quality of support after the sale. We believe we compete effectively on all of these bases. Competitors in our three operating segments include:

- Aircraft Controls: Curtiss-Wright, Liebherr, Nabtesco, Parker Hannifin, UTC and Woodward.
- Space and Defense Controls: Airbus, ATA Engineering, Bradford Engineering, Chess Dynamics, Cobham, Curtiss-Wright, ESW, EOS, Fulcrum Concepts LLC, General Dynamics, Glenair, Honeywell, Kearfott, Kollmorgan, Kongsberg, LORD, Marotta, Mission Systems, RUAG, Rafael, PVP Advanced, SABCA, Sargent Aerospace & Defense, Schleifring, SEAKR, Silent Sentinel, SL Montevideo, SwRI, UTC, Vacco, Valcor, ValveTech and Woodward.
- Industrial Systems: Atos, Allen-Bradley, Bosch Rexroth, Cardinal Health, Danaher, DEIF Wind Power, E2M Technologies, Eaton, ICU Medical, KEB, MTS Systems Corp., Parker Hannifin, Siemens, Smiths Medical and SSB Wind Systems.

Government Contracts. All U.S. Government contracts are subject to termination by the U.S. Government. In 2018, sales under U.S. Government contracts represented 33% of total sales and were primarily within our Aircraft Controls and Space and Defense Controls segments.

Backlog. Our twelve-month backlog represents confirmed orders we believe will be recognized as revenue within the next twelve months. As noted in Item 6, Selected Financial Data of this report, as of September 29, 2018, our twelve-month backlog was $1.5 billion, an increase of 22% compared to September 30, 2017. See Item 7, Management’s Discussion and Analysis of Financial Condition and Results of Operations of this report for a discussion on the various business drivers and conditions contributing to the twelve-month backlog change.

Raw Materials. Materials, supplies and components are purchased from numerous suppliers. We believe the loss of any one supplier, although potentially disruptive in the short-term, would not materially affect our operations in the long-term.

Working Capital. See the discussion on operating cycle in Note 1 of Item 8, Financial Statements and Supplementary Data of this report.

Seasonality. Our business is generally not seasonal; however, certain products and systems, such as those in the energy market of our Industrial Systems segment, do experience seasonal variations in sales levels.

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Patents. We maintain a patent portfolio of issued or pending patents and patent applications worldwide that generally includes the U.S., Europe, China, Japan and India. The portfolio includes patents that relate to electrohydraulic, electromechanical, electronics, hydraulics, components and methods of operation and manufacture as related to motion control and actuation systems. The portfolio also includes patents related to wind turbines, robotics, surveillance/security, vibration control and medical devices. We do not consider any one or more of these patents or patent applications to be material in relation to our business as a whole. The patent portfolio related to certain medical devices is significant to our position in this market as several of these products work exclusively together, and provide us future revenue opportunities.

Research Activities. Research and development activity has been, and continues to be, significant for us. Research and development expense was at least $130 million in each of the last three years and represented approximately 5% of sales in 2018.

Employees. On September 29, 2018, we employed 11,787 full-time employees.

Customers. Our principal customers are Original Equipment Manufacturers, or OEMs, and end users for whom we provide aftermarket support. Aerospace and defense OEM customers collectively represented 53% of 2018 sales. The majority of these sales are to a small number of large companies. Due to the long-term nature of many of the programs, many of our relationships with aerospace and defense OEM customers are based on long-term agreements. Our industrial OEM sales, which represented 34% of 2018 sales, are to a wide range of global customers and are normally based on lead times of 90 days or less. We also provide aftermarket support, consisting of spare and replacement parts and repair and overhaul services, for all of our products. Our major aftermarket customers are the U.S. Government and commercial airlines. In 2018, aftermarket sales accounted for 13% of total sales.

Significant customers in our three operating segments include:

- Aircraft Controls: Boeing, Airbus, Lockheed Martin, Northrup Grumman, Japan Aerospace, General Dynamics, United Technologies, Honeywell, Bombardier, Embraer and the U.S. Government.
- Space and Defense Controls: Lockheed Martin, Raytheon, Northrup Grumman, Boeing, General Dynamics, Aerojet Rocketdyne, United Launch Alliance, Rockwell Collins, Airbus, Honeywell and the U.S. Government.
- Industrial Systems: McKesson, Phillips Healthcare, CAE, Nutricia, Integrated Medical Systems,TurboChef Technologies, Oceaneering, MacArtney, Flight Safety and Arburg.

International Operations. Our operations outside the United States are conducted primarily through wholly-owned foreign subsidiaries and are located predominantly in Europe and the Asia-Pacific region. See Note 19 of Item 8, Financial Statements and Supplementary Data of this report for information regarding sales by geographic area and Exhibit 21 of Item 15, Exhibits and Financial Statement Schedules of this report for a list of subsidiaries. Our international operations are subject to the usual risks inherent in international trade, including currency fluctuations, local government contracting regulations, local governmental restrictions on foreign investment and repatriation of profits, exchange controls, regulation of the import and distribution of foreign goods, as well as changing economic and social conditions in countries in which our operations are conducted.

Environmental Matters. See the discussion in Note 21 of Item 8, Financial Statements and Supplementary Data of this report.

Website Access to Information. Our internet address is www.moog.com. We make our annual reports on Form 10 K, quarterly reports on Form 10-Q, current reports on Form 8-K and, if applicable, amendments to those reports, available on the investor relations portion of our website. The reports are free of charge and are available as soon as reasonably practicable after they are filed with the Securities and Exchange Commission. We have posted our corporate governance guidelines, Board committee charters and code of ethics to the investor relations portion of our website. This information is available in print to any shareholder upon request. All requests for these documents should be made to Moog’s Manager of Investor Relations by calling 716-687-4225.

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Executive Officers of the Registrant. Other than the changes noted below, the principal occupations of our executive officers for the past five years have been their employment with us in the same positions they currently hold.
On January 5, 2018, Jennifer Walter was named Vice President - Finance. She will continue as Controller and Principal Accounting Officer.
On December 1, 2017, Paul Wilkinson was named Vice President and Chief HR Officer. Previously, he was a Group Vice President and Global HR Director, Aircraft Group.
On August 11, 2015, Maureen M. Athoe was named Vice President and President, Space and Defense Group. Previously, she was a Group Vice President, Group General Manager and Site Manager.
On August 11, 2015, R. Eric Burghardt was named Vice President and President, Aircraft Group. Previously, he was a Group Vice President and Financial Director.
On August 11, 2015, Mark J. Trabert was named Vice President and President, Aircraft Group. Previously, he was a Group Vice President and Deputy General Manager.

Executive Officers	Age	Year First Elected Officer
John R. Scannell Chairman of the Board; Chief Executive Officer Director	55	2006
Richard A. Aubrecht Vice President - Strategy and Technology	74	1980
Donald R. Fishback Director; Vice President; Chief Financial Officer	62	1985
Paul Wilkinson Vice President	38	2017
Patrick J. Roche Vice President	55	2012
Maureen M. Athoe Vice President	60	2015
R. Eric Burghardt Vice President	59	2015
Mark J. Trabert Vice President	59	2015
Jennifer Walter Vice President - Finance; Principal Accounting Officer	47	2008
Timothy P. Balkin Treasurer; Assistant Secretary	59	2000

In addition to the executive officers noted above, Robert J. Olivieri, 68, was elected Secretary in 2014. Mr. Olivieri's principal occupation is partner in the law firm of Hodgson Russ LLP.

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Item 1A. Risk Factors.

The markets we serve are cyclical and sensitive to domestic and foreign economic conditions and events, which may cause our operating results to fluctuate. The markets we serve are sensitive to fluctuations in general business cycles, domestic and foreign governmental tariff and trade policies, and economic conditions and events. For example, our defense programs are largely contingent on U.S. Department of Defense funding. In addition, our space programs rely on the same governmental funding as well as investment for commercial and exploration activities. Our aerospace programs are dependent on the highly cyclical commercial airline industry, driven by fuel price increases, demand for travel and economic conditions. Demand for our industrial products is dependent upon several factors, including capital investment, product innovations, economic growth, the price of oil and natural gas, cost-reduction efforts and technology upgrades. Our sales and operating profit have been affected by the continued moderate rates of recovery in the economies in which we conduct business. If global economic uncertainties continue or economic conditions deteriorate, our operations could be negatively impacted through declines in our sales, profitability and cash flows due to lower orders, payment delays and price pressures for our products.

We operate in highly competitive markets with competitors who may have greater resources than we possess. Many of our products are sold in highly competitive markets. Some of our competitors, especially in our industrial markets and medical markets, are larger, more diversified and have greater financial, marketing, production and research and development resources. Within the aerospace industry, suppliers have consolidated to widen their product offerings and secure long-term sole-source positions. As a result, these competitors may be better able to withstand the effects of periodic economic downturns, and their program wins could reduce the total number of viable suppliers and increase their competitiveness. Our sales and operating margins will be negatively impacted if our competitors:

- develop products that are superior to our products,
- develop products of comparable quality and performance that are more competitively priced than our products,
- develop methods of more efficiently and effectively providing products and services, or
- adapt more quickly than we do to new technologies or evolving customer requirements.

We believe that the principal points of competition in our markets are product quality, reliability, design and engineering capabilities, price, innovation, conformity to customers' specifications, timeliness of delivery, effectiveness of the distribution organization and quality of support after the sale. Maintaining or improving our competitive position requires continued investment in manufacturing, engineering, quality standards, marketing, customer service and support and our distribution networks. If we do not maintain sufficient resources to make these investments, are not successful in meeting our quality or delivery standards or are not successful in maintaining our competitive position, we could face pricing pressures or loss in market share, causing our operations and financial performance to suffer.

We depend heavily on government contracts that may not be fully funded or may be terminated, and the failure to receive funding or the termination of one or more of these contracts could reduce our sales and increase our costs. Sales to the U.S. Government and its prime contractors and subcontractors represent a significant portion of our business. In 2018, sales under U.S. Government contracts represented 33% of our total sales, primarily within Aircraft Controls and Space and Defense Controls. Sales to foreign governments represented 5% of our total sales. Funding for government programs can be structured into a series of individual contracts and depend on annual congressional appropriations, which are subject to change. Additionally, the 2011 Budget Control Act reduced the Department of Defense spending (or sequestration) by approximately $500 billion. The Bipartisan Budget Act of 2013 and the Bipartisan Budget Act of 2015 provided stability and modest growth in the Department of Defense spending through 2017. After operating under continuing resolutions, which restrict new program starts, the U.S. Government signed the 2019 defense appropriations budget in September 2018, with moderate growth in defense spending. However, future budgeted levels of defense spending beyond

2019 are uncertain and subject to debate. As a result of this uncertainty, we expect discretionary government spending levels will face pressure, and potentially lead to procurement reductions. Any reduction in future Department of Defense spending levels could adversely impact our sales, operating profit and our cash flow. We have resources applied to specific government contracts and if any of those contracts are rescheduled or terminated, we may incur substantial costs redeploying those resources.

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We make estimates in accounting for long-term contracts, and changes in these estimates may have significant impacts on our earnings. We have long-term contracts with some of our customers. These contracts are predominantly within Aircraft Controls and Space and Defense Controls. Revenue representing 39% of 2018 sales was accounted for using the percentage of completion, cost-to-cost method of accounting. Under this method, we recognize revenue as work progresses toward completion as determined by the ratio of cumulative costs incurred to date to estimated total contract costs at completion, multiplied by the total estimated contract revenue, less cumulative revenue recognized in prior periods. Changes in these required estimates could have a material adverse effect on sales and profits. Any adjustments are recognized in the period in which the change becomes known using the cumulative catch-up method of accounting. For contracts with anticipated losses at completion, we establish a provision for the entire amount of the estimated remaining loss and charge it against income in the period in which the loss becomes known. Amounts representing performance incentives, penalties, contract claims or impacts of scope change negotiations are considered in estimating revenues, costs and profits when they can be reliably estimated and realization is considered probable. Due to the substantial judgments involved with this process, our actual results could differ materially or could be settled unfavorably from our estimates.

We enter into fixed-price contracts, which could subject us to losses if we have cost overruns. In 2018, fixed-price contracts represented 88% of our sales that were accounted for using the percentage of completion, cost-to-cost method of accounting. On fixed-price contracts, we agree to perform the scope of work specified in the contract for a predetermined price. Depending on the fixed price negotiated, these contracts may provide us with an opportunity to achieve higher profits based on the relationship between our total contract costs and the contract's fixed price. However, we bear the risk that increased or unexpected costs may reduce our profit or cause us to incur a loss on the contract, which would reduce our net earnings. Loss reserves are most commonly associated with fixed-price contracts that involve the design and development of new and unique controls or control systems to meet the customer's specifications.

We may not realize the full amounts reflected in our backlog as revenue, which could adversely affect our future revenue and growth prospects. As of September 29, 2018, our twelve-month backlog was $1.5 billion, which represents confirmed orders we believe will be recognized as revenue within the next twelve months. There is no assurance that our customers will purchase all the orders represented in our backlog, due in part to the U.S. Government's ability not to exercise contract options or to modify, curtail or terminate major programs. Due to the uncertain nature of our contracts with the U.S. Government, we may never realize revenue from some of the orders that are included in our backlog. A portion of our backlog also relates to commercial aircraft programs, and if there are entry into service delays or lower than anticipated deliveries due to production issues, we may never realize the full amounts included in our backlog. If this occurs, our future revenue and growth prospects may be adversely affected.

If our subcontractors or suppliers fail to perform their contractual obligations, our prime contract performance and our ability to obtain future business could be materially and adversely impacted. We rely on subcontracts with other companies to perform a portion of the service we provide to our customers on many of our contracts. There is a risk that we may have disputes with our subcontractors, including disputes regarding the quality and timeliness of work performed by the subcontractor, customer concerns about the subcontractor, our failure to extend existing task orders or issue new task orders under a subcontract or our hiring of personnel of a subcontractor. Failure by our subcontractors to satisfactorily provide on a timely basis the agreed-upon supplies, or perform the agreed-upon services, may materially and adversely impact our ability to perform our obligations as the prime contractor. Subcontractor performance deficiencies could result in a customer terminating our contract for default. A default termination could expose us to liability and substantially impair our ability to compete for future contracts and orders. In addition, a delay or failure in our ability to obtain components and equipment parts from our suppliers may adversely affect our ability to perform our obligations to our customers.

Contracting on government programs is subject to significant regulation, including rules related to bidding, billing and accounting kickbacks and false claims, and any non-compliance could subject us to fines and penalties or possible debarment. Like all government contractors, we are subject to risks associated with this contracting, including substantial civil and criminal fines and penalties. These fines and penalties could be imposed for failing to follow procurement integrity and bidding rules, employing improper billing practices or otherwise failing to follow cost accounting standards, receiving or paying kickbacks or filing false claims. We have been, and expect to continue to be, subjected to audits and investigations by U.S. and foreign government agencies and authorities. The failure to comply with the terms of our government contracts could harm our business reputation. It could also result in our progress payments being withheld or our suspension or debarment from future government contracts, which could have a material affect on our operational and financial results.

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The loss of The Boeing Company as a customer or a significant reduction in sales to The Boeing Company could adversely impact our operating results. We provide The Boeing Company, or Boeing, with controls for both military and commercial applications, which, in total, were 14% of our 2018 sales. Sales to Boeing's commercial airplane group are generally made under a long-term supply agreement through 2021 for the Boeing 787 and through 2019 for other commercial airplanes. Boeing operates in a competitive environment and continues to evaluate the size, scope and cost of their supplier base. Any detrimental impact to Boeing's production rates or a reduction in our awarded content could reduce our orders from Boeing. A reduction in sales or the loss of Boeing as a customer could reduce our sales and earnings.

Our new product research and development efforts may not be successful which could reduce our sales and earnings. Technologies related to our products have undergone, and in the future may undergo, significant changes. We have incurred, and we expect to continue to incur, expenses associated with lengthy research and development activities and the introduction of new products in order to succeed in the future. Our technology has been developed through customer-funded and internally-funded research and development, as well as through business acquisitions. If we fail to predict customers' preferences or fail to provide viable technological solutions, we may experience difficulties that could delay or prevent the acceptance of new products or product enhancements. Also, the research and development expenses we incur may exceed our cost estimates and new products we develop may not generate sales sufficient to offset our costs. Additionally, our competitors may develop technologies and products that have more competitive advantages than ours and render our technology uncompetitive or obsolete.

Our inability to adequately enforce and protect our intellectual property or defend against assertions of infringement could prevent or restrict our ability to compete. Protecting our intellectual property is critical in order to maintain a competitive advantage. We therefore rely on internally developed and acquired patents, trademarks and proprietary knowledge and technologies. Our inability to defend against the unauthorized use of these rights and assets could have an adverse effect on our competitive position and on our results of operations and financial condition. Litigation may be necessary to protect our intellectual property rights or defend against claims of infringement. This litigation could result in significant costs and divert management's focus away from operations.

Our business operations may be adversely affected by information systems interruptions, intrusions or new software implementations. We are dependent on various information technologies throughout our company and third parties to administer, store and support multiple business activities. In addition, we store sensitive data including proprietary business information, intellectual property and confidential employee data on our servers and databases. Furthermore, we may have access to sensitive, confidential or personal information that may be subject to privacy and security laws and controls. Although we continue to review and enhance our computer systems and cybersecurity controls, information system disruptions, equipment failures or cybersecurity attacks, such as unauthorized access, malicious software and other intrusions, could still occur and may lead to potential data corruption and exposure of proprietary and confidential information. Any intrusion may cause operational stoppages, fines, penalties, diminished competitive advantages through reputational damages and increased operational costs. Additionally, we may incur additional costs to comply with our customers', including the U.S. Government's, increased cybersecurity protections and standards in our products. Prior cyberattacks directed at us have not had a material impact on our financial results. In addition, we are in the early stages of a multi-year business information system transformation and standardization project. This endeavor will occupy additional resources, diverting attention from other operational activities, may cause our information systems to perform unexpectedly and may increase our exposure to cyber risks. While we expect to invest significant resources throughout the planning and project management process, unanticipated delays could occur and would adversely affect our financial results.

Our indebtedness and restrictive covenants under our credit facilities could limit our operational and financial flexibility. We have incurred significant indebtedness, and may incur additional debt for acquisitions, operations, research and development and capital expenditures. Our ability to make interest and scheduled principal payments and meet restrictive covenants could be adversely impacted by changes in the availability, terms and cost of capital, changes in interest rates or changes in our credit ratings or our outlook. These changes could increase our cost of business, limiting our ability to pursue acquisition opportunities, react to market conditions and meet operational and capital needs, thereby placing us at a competitive disadvantage.

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Significant changes in discount rates, rates of return on pension assets, mortality tables and other factors could adversely affect our earnings and equity and increase our pension funding requirements. Pension costs and obligations are determined using actual results as well as actuarial valuations that involve several assumptions. The most critical assumptions are the discount rate, the long-term expected return on assets and mortality tables. Other assumptions include salary increases and retirement age. Some of these assumptions, such as the discount rate and return on pension assets, are reflective of economic conditions and largely out of our control. Despite fully funding our largest pension plan, changes in the pension assumptions could adversely affect our earnings, equity and funding requirements.

A write-off of all or part of our goodwill or other intangible assets could adversely affect our operating results and net worth. Goodwill and other intangible assets are a substantial portion of our assets. At September 29, 2018, goodwill was $797 million and other intangible assets were $96 million of our total assets of $3.0 billion. Our goodwill and other intangible assets may increase in the future since our growth strategy includes acquisitions. However, we may have to write off all or part of our goodwill or other intangible assets if their value becomes impaired. Although this write-off would be a non-cash charge, it could reduce our earnings and our financial condition significantly.

Our sales and earnings may be affected if we cannot identify, acquire or integrate strategic acquisitions, or if we engage in divesting activities. Acquisitions are a key part of our growth strategy. Our historical growth has depended, and our future growth is likely to depend, in part, on our ability to successfully identify, acquire and integrate acquired businesses. We intend to continue to seek additional acquisition opportunities, both to expand into new markets and to enhance our position in existing markets throughout the world. Growth by acquisition involves risk that could adversely affect our financial condition and operating results. We may not know the potential exposure to unanticipated liabilities. Additionally, the expected benefits or synergies might not be fully realized, integrating operations and personnel may be slowed and key employees, suppliers or customers of the acquired business may depart. We may also continue to engage in divesting activities if we deem the operations as non-strategic or underperforming. Divestitures could adversely affect our profitability and, under certain circumstances, require us to record impairment charges or a loss as a result of a transaction. In pursuing acquisition opportunities, integrating acquired businesses, or divesting business operations, management's time and attention may be diverted from our core business, while consuming resources and incurring expenses for these activities.

Our operations in foreign countries expose us to political and currency risks and adverse changes in local legal and regulatory environments. We have significant manufacturing and sales operations in foreign countries. In addition, our domestic operations sell to foreign customers. In 2018, 41% of our net sales were to customers outside of the United States. Our financial results may be adversely affected by fluctuations in foreign currencies and by the translation of the financial statements of our foreign subsidiaries from local currencies into U.S. dollars. We expect international operations and export sales to contribute to our earnings for the foreseeable future. Both the sales from international operations and export sales are subject in varying degrees to risks inherent in doing business outside of the United States. Such risks include the possibility of unfavorable circumstances arising from host country laws or regulations including privacy laws protecting personal data, changes in tariff and trade barriers and import or export licensing requirements. In addition, any local or global health issue or uncertain political climates, international hostilities, natural disasters, or any other terrorist activities could adversely affect customer demand, our operations and our ability to source and deliver products and services to our customers.

Unforeseen exposure to additional income tax liabilities may affect our operating results. Our distribution of taxable income is subject to domestic and, as a result of our significant manufacturing and sales presence in foreign countries, foreign tax jurisdictions. Our effective tax rate and earnings may be affected by shifts in our mix of earnings in countries with varying statutory tax rates, changes in the valuation of deferred tax assets and outcomes of any audits performed on previous tax returns. Additionally, any alterations to tax regulations or interpretations could have significant impacts on our effective tax rates and on our deferred tax assets and liabilities. Specifically, with the enactment of the Tax Cuts and Jobs Act of 2017, we have made a reasonable estimate of the effects of the one-time transition tax based on our current interpretation. This estimate could differ materially from the resulting actual liability due to changes in our calculations and interpretation, as well as additional guidance yet to be issued through U.S. Treasury regulations.

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Government regulations could limit our ability to sell our products outside the United States and otherwise adversely affect our business. In 2018, approximately 18% of our sales were subject to compliance with the United States export regulations. Our failure to obtain, or fully adhere to the limitations contained in the requisite licenses, meet registration standards or comply with other government export regulations would hinder our ability to generate revenues from the sale of our products outside the United States. In addition, the U.S. Government has established, and from time to time, revises, sanctions that restrict or prohibit U.S. companies and their subsidiaries from doing business with certain foreign countries, entities and individuals. The absence of comparable restrictions on competitors in other countries may adversely affect our competitive position. In order to sell our products in European Union countries, we must satisfy certain technical requirements. If we are unable to comply with those requirements with respect to a significant quantity of our products, our sales in Europe would be restricted. Doing business internationally also subjects us to numerous U.S. and foreign laws and regulations, including regulations relating to import-export control, technology transfer restrictions, foreign corrupt practices, privacy regulations and anti-boycott provisions. From time to time, we may file voluntary disclosure reports with the U.S. Department of State and the Department of Commerce regarding certain violations of U.S. export laws and regulations discovered by us in the course of our business activities, employee training or internal reviews and audits. To date, our voluntary disclosures have not resulted in a fine, penalty, or export privilege denial or restriction that has had a material adverse impact on our financial condition or ability to export. Our failure, or failure by an authorized agent or representative that is attributable to us, to comply with these laws and regulations could result in administrative, civil or criminal liabilities. In the extreme case, these failures could result in financial penalties, suspension or debarment from government contracts or suspension of our export privileges, which could have a material adverse effect on us.

The failure or misuse of our products may damage our reputation, necessitate a product recall or result in claims against us that exceed our insurance coverage, thereby requiring us to pay significant damages. Defects in the design and manufacture of our products may necessitate a product recall. We include complex system designs and components in our products that could contain errors or defects, particularly when we incorporate new technologies into our products. If any of our products are defective, we could be required to redesign or recall those products, pay substantial damages or warranty claims and face actions by regulatory bodies and government authorities. Such an event could result in significant expenses, disrupt sales, affect our reputation and that of our products and cause us to withdraw from certain markets. We are also exposed to product liability claims. Many of our products are used in applications where their failure or misuse could result in significant property loss and serious personal injury or death. We carry product liability insurance consistent with industry norms. However, these insurance coverages may not be sufficient to fully cover the payment of any potential claim. A product recall or a product liability claim not covered by insurance could have a material adverse effect on our business, financial condition and results of operations.

We are involved in various legal proceedings, the outcome of which may be unfavorable to us. Our business may be adversely impacted by the outcome of legal proceedings and other contingencies that cannot be predicted with certainty. We estimate loss contingencies and establish reserves based on our assessment where liability is deemed probable and reasonably estimable given the facts and circumstances known to us at a particular point in time. Subsequent developments may affect our assessment and estimates of the loss contingencies recorded as liabilities.

Future terror attacks, war, natural disasters or other catastrophic events beyond our control could negatively impact our business. Terror attacks, war or other civil disturbances, natural disasters and other catastrophic events could lead to economic instability and decreased demand for commercial products, which could negatively impact our business, financial condition, results of operations and cash flows. From time to time, terrorist attacks worldwide have caused instability in global financial markets and the aviation industry. In 2018, 24% of our net sales were in the commercial aircraft market. Also, our facilities and suppliers are located throughout the world and could be subject to damage from fires, floods, earthquakes or other natural or man-made disasters. Although we carry third party property insurance covering these and other risks, our inability to meet customers' schedules as a result of a catastrophe may result in the loss of customers or significantly increase costs, including penalty claims under customer contracts.

Our operations are subject to environmental laws, and complying with those laws may cause us to incur significant costs. Our operations and facilities are subject to numerous stringent environmental laws and regulations. Although we believe that we are in material compliance with these laws and regulations, future changes in these laws, regulations or interpretations of them, or changes in the nature of our operations may require us to make significant capital expenditures to ensure compliance. We have been and are currently involved in environmental remediation activities. The cost of these activities may become significant depending on the discovery of additional environmental exposures at sites that we currently own or operate, at sites that we formerly owned or operated, or at sites to which we have sent hazardous substances or wastes for treatment, recycling or disposal.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

On September 29, 2018, we occupied 5,143,000 square feet of space, distributed by segment as follows:

	Square Feet		
	Owned	Leased	Total
Aircraft Controls	1,468,000	396,000	1,864,000
Space and Defense Controls	828,000	312,000	1,140,000
Industrial Systems	1,588,000	529,000	2,117,000
Corporate Headquarters	20,000	2,000	22,000
Total	3,904,000	1,239,000	5,143,000

We have principal manufacturing facilities in the United States and countries throughout the world in the following locations:

- Aircraft Controls - U.S., Philippines and United Kingdom.
- Space and Defense Controls - U.S., United Kingdom and Ireland.
- Industrial Systems - U.S., Germany, Czech Republic, Italy, Costa Rica, China, United Kingdom, Netherlands, Luxembourg, Philippines, Japan, Canada, India and Lithuania.

Our corporate headquarters is located in East Aurora, New York.

We believe that our properties have been adequately maintained and are generally in good condition. Operating leases for our properties expire at various times from 2019 through 2036. Upon the expiration of our current leases, we believe that we will be able to either secure renewal terms or enter into leases for alternative locations at market terms.

Item 3. Legal Proceedings.

From time to time, we are involved in legal proceedings. We are not a party to any pending legal proceedings that management believes will result in a material adverse effect on our financial condition, results of operations or cash flows.

Item 4. Mine Safety Disclosures.

Not applicable.

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PART II

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

Our two classes of common shares, Class A common stock and Class B common stock, are traded on the New York Stock Exchange ("NYSE") under the ticker symbols MOG.A and MOG.B. The following chart sets forth, for the periods indicated, the high and low sales prices of the Class A common stock and Class B common stock on the NYSE.

Quarterly Stock Prices

	Class A		Class B	
Fiscal Year Ended	High	Low	High	Low
September 29, 2018				
1st Quarter	**$89.97**	**$78.27**	**$88.97**	**$78.89**
2nd Quarter	**93.93**	**79.58**	**91.71**	**79.95**
3rd Quarter	**88.31**	**75.62**	**85.84**	**77.67**
4th Quarter	**87.85**	**71.56**	**84.00**	**72.60**
September 30, 2017				
1st Quarter	$73.05	$55.35	$71.81	$56.44
2nd Quarter	69.80	60.29	68.49	63.00
3rd Quarter	74.50	64.82	73.23	64.87
4th Quarter	85.30	70.47	83.16	72.70

The number of shareholders of record of Class A common stock and Class B common stock was 641 and 299, respectively, as of November 6, 2018.

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The following table summarizes our purchases of our common stock for the quarter ended September 29, 2018.

Issuer Purchases of Equity Securities

Period	(a) Total Number of Shares Purchased (1)(2)	(b) Average Price Paid Per Share	(c) Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs (3)	(d) Maximum Number (or Approx. Dollar Value) of Shares that May Yet Be Purchased Under Plans or Programs (3)
July 1, 2018 - July 31, 2018	31,728	$ 78.24	—	3,349,491
August 1, 2018 - August 31, 2018	1,012,369	75.78	—	3,349,491
September 1, 2018 - September 29, 2018	8,602	83.62	—	3,349,491
Total	1,052,699	$ 75.92	—	3,349,491

(1) Reflects purchases by the Moog Inc. Stock Employee Compensation Trust Agreement ("SECT") of shares of Class B common stock from the Moog Inc. Retirement Savings Plan ("RSP") as follows: 7,106 shares at $79.23 per share during August; and 6,471 shares at $82.44 per share during September. Also reflects purchases by the SECT of shares of Class B common stock from the Moog Inc. Employee Retirement Plan ("ERP") as follows: 274,864 shares at $75.74 per share during August and purchases by the Moog Inc. Supplemental Retirement Plan Trust ("SERP") of shares of Class B common stock from the ERP as follows: 726,170 shares at $75.74 per share during August. In connection with the issuance of shares to the Employee Stock Purchase Plan ('ESPP"), we purchased 31,716 Class B shares at $78.24 per share from the SECT.

(2) In connection with the exercise of equity-based compensation awards, we accept delivery of shares to pay for the exercise price and withhold shares for tax withholding obligations. In July, we accepted delivery of 12 shares at $82.17 per share, in August, we accepted delivery of 4,229 shares at $80.31 per share and in September, we accepted delivery of 2,131 shares at $87.20 per share, in connection with the exercise of equity-based awards.

(3) The Board of Directors has authorized a share repurchase program. This program has been amended from time to time to authorize additional repurchases up to an aggregate 13 million common shares. The program permits the purchase of shares of Class A or Class B common stock in open market or privately negotiated transactions at the discretion of management. The purchases identified in column (a) are not included in this program.

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Performance Graph

The following graph and tables show the performance of the Company's Class A common stock compared to the NYSE Composite-Total Return Index and the S&P Aerospace & Defense Index for a $100 investment made on September 30, 2013, including reinvestment of any dividends.

	9/13	9/14	9/15	9/16	9/17	9/18
Moog Inc. - Class A Common Stock	$100.00	$116.58	$92.16	$101.48	$142.20	$147.44
NYSE Composite - Total Return Index	100.00	113.92	106.88	120.08	140.19	153.94
S&P Aerospace & Defense Index	100.00	118.18	122.62	144.53	207.46	256.64

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Item 6. Selected Financial Data.

For a more detailed discussion of 2016 through 2018, refer to Item 7, Management's Discussion and Analysis of Financial Condition and Results of Operations of this report and Item 8, Financial Statements and Supplementary Data of this report.

(dollars in thousands, except per share data)	**2018(1)(3)**	2017(1)(3)	2016(1)(2)(3)	2015(1)	2014(1)
RESULTS FROM OPERATIONS					
Net sales	**$2,709,468**	$2,497,524	$2,411,937	$2,525,532	$2,648,385
Net earnings (4)	**96,507**	141,280	126,745	131,883	158,198
Net earnings per share (4)					
Basic	**$2.71**	$3.94	$3.49	$3.39	$3.57
Diluted	**$2.68**	$3.90	$3.47	$3.35	$3.52
Dividends declared per share	**$0.50**	$—	$—	$—	$—
Weighted-average shares outstanding					
Basic	**35,661,638**	35,852,448	36,277,445	38,945,880	44,362,412
Diluted	**36,052,307**	36,230,043	36,529,344	39,334,520	44,952,437
FINANCIAL POSITION					
Cash and cash equivalents	**$125,584**	$368,073	$325,128	$309,853	$231,292
Working capital	**795,797**	997,005	938,295	931,297	849,417
Total assets	**2,964,048**	3,090,592	3,004,974	3,036,573	3,140,287
Indebtedness - total	**862,824**	957,037	1,006,393	1,069,643	872,094
Shareholders' equity	**1,224,986**	1,214,304	988,411	994,532	1,347,415
Shareholders' equity per common share outstanding	**$35.20**	$33.94	$27.56	$27.09	$32.51
SUPPLEMENTAL FINANCIAL DATA					
Capital expenditures	**$94,517**	$75,798	$67,208	$80,693	$78,771
Depreciation and amortization	**88,572**	90,167	98,732	103,609	109,259
Research and development	**130,186**	144,646	147,336	132,271	139,462
Twelve-month backlog (5)	**1,481,230**	1,211,797	1,224,878	1,273,495	1,339,959
RATIOS					
Net return on sales	**3.6%**	5.7%	5.3%	5.2%	6.0%
Return on shareholders' equity	**7.8%**	13.3%	12.6%	11.3%	10.4%
Current ratio	**2.2**	2.6	2.6	2.5	2.2
Net debt to capitalization (6)	**37.6%**	32.7%	40.8%	43.3%	32.2%

(1) Includes the effects of our share repurchase program. See the Consolidated Statements of Shareholders' Equity and Consolidated Statements of Cash Flow at Item 8, Financial Statements and Supplementary Data of this report.

(2) Includes goodwill impairment charge. See Note 6 of the Consolidated Financial Statements at Item 8, Financial Statements and Supplementary Data of this report.

(3) Includes the effects of acquisitions and divestitures. See Note 2 of the Consolidated Financial Statements at Item 8, Financial Statements and Supplementary Data of this report.

(4) Represents net earnings attributable to common shareholders and net earnings per share attributable to common shareholders.

(5) Twelve-month backlog is defined as confirmed orders we believe will be recognized as revenue within the next twelve months.

(6) Net debt is total debt less cash and cash equivalents. Capitalization is the sum of net debt and shareholders' equity.

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

OVERVIEW

We are a worldwide designer, manufacturer and systems integrator of high performance precision motion and fluid controls and control systems for a broad range of applications in aerospace and defense and industrial markets.

Within the aerospace and defense market, our products and systems include:

- Defense market - primary and secondary flight controls for military aircraft, stabilization and automatic ammunition loading controls for armored combat vehicles, tactical and strategic missile steering controls and gun aiming controls.
- Commercial aircraft market - primary and secondary flight controls for commercial aircraft.
- Commercial space market - satellite positioning controls and thrust vector controls for space launch vehicles.

In the industrial market, our products are used in a wide range of applications including:

- Industrial automation market - injection molding, metal forming, heavy industry, material and automotive testing and pilot training simulators.
- Energy market - power generation, oil and gas exploration and wind energy.
- Medical market - enteral clinical nutrition and infusion therapy pumps, ultrasonic sensors and surgical handpieces and CT scanners.

We operate under three segments, Aircraft Controls, Space and Defense Controls and Industrial Systems. Our principal manufacturing facilities are located in the United States, Philippines, United Kingdom, Germany, Czech Republic, Italy, Costa Rica, China, Netherlands, Luxembourg, Japan, Canada, India and Lithuania.

We have long-term contracts with some of our customers. These contracts are predominantly within Aircraft Controls and Space and Defense Controls and represent 39%, 38% and 34% of our sales in 2018, 2017 and 2016, respectively. We recognize revenue on these contracts using the percentage of completion, cost-to-cost method of accounting as work progresses toward completion. The remainder of our sales are recognized when the risks and rewards of ownership and title to the product are transferred to the customer, principally as units are delivered or as service obligations are satisfied. This method of revenue recognition is predominantly used within the Industrial Systems segment, as well as with aftermarket activity.

We concentrate on providing our customers with products designed and manufactured to the highest quality standards. Our products are applied in demanding applications, where the cost of failure is high and "When Performance Really Matters®." We believe we have achieved a leadership position in the high performance, precision controls market, by capitalizing on our core foundational strengths, which are our technical experts working collaboratively around the world and the capabilities we deliver for mission-critical solutions. These strengths yield a broad control product portfolio, across a diverse base of customers and end markets.

By focusing on customer intimacy and commitment to solving their most demanding technical problems, we have been able to innovate our control product franchise from one market to another, organically growing from a high-performance components supplier to a high-performance systems supplier. In addition, we continue achieving substantial content positions on the platforms on which we currently participate, seeking to be the dominant supplier in the current niche markets we serve. We also look for innovation in all aspects of our business, exploring the next generation of opportunities for our capabilities, employing new technologies to improve productivity and to develop innovative business models.

Our fundamental strategies to achieve our goals center around talent, lean and innovation and include:

- a strong leadership team that has positioned the company for growth,
- utilizing our global capabilities and strong engineering heritage to innovate,
-

- maintaining our technological excellence by solving our customers’ most demanding technical problems in applications "When Performance Really Matters®,"
- continuing to invest in talent development to strengthen employee performance, and
- maximizing customer value by implementing lean enterprise principles.

These activities will help us achieve our financial objective of increasing shareholder value with sustainable competitive advantages across our segments. In doing so, we expect to maintain a balanced, diversified portfolio in terms of markets served, product applications, customer base and geographic presence.

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We focus on driving long-term value for our shareholders through strategic revenue growth, both acquired and organic, through improving operating efficiencies and manufacturing initiatives and through utilizing low cost manufacturing facilities without compromising quality. Additionally, we take a balanced approach to capital deployment, which may include strategic acquisitions or further share buyback activity, in order to maximize shareholder returns over the long-term.

We face numerous challenges to improving shareholder value. These include, but are not limited to, adjusting to dynamic global economic conditions that are influenced by governmental, industrial and commercial factors, pricing pressures from customers, strong competition, foreign currency fluctuations and increases in employee benefit costs. We may also engage in restructuring and divesting activities, including reducing overhead, consolidating facilities and exiting some product lines if we deem the operations as non-strategic or underperforming.

Financial Highlights

- Net sales for fiscal 2018 increased 8% to $2.7 billion.
- Total operating profit increased 3% to $258 million, and includes $39 million of charges related to our exit of the wind pitch controls business.
- Effective tax rate was 47.4%, and includes the impacts of the Tax Cuts and Jobs Act of 2017.
- Net earnings attributable to Moog decreased 32% to $97 million.
- Diluted earnings per share decreased 31% to $2.68.
- Cash from operating activities was $102 million, and includes $85 million of accelerated pension funding.

Acquisitions, Divestitures and Equity Method Investments

All of our acquisitions are accounted for under the purchase method and, accordingly, the operating results for the acquired companies are included in the consolidated statements of earnings from the respective dates of acquisition. Under purchase accounting, we record assets and liabilities at fair value and such amounts are reflected in the respective captions on the consolidated balance sheets. The purchase price described for each acquisition below is net of any cash acquired, includes debt issued or assumed and the fair value of contingent consideration.

On April 30, 2018, we acquired Electro-Optical Imaging, a designer and manufacturer of video trackers and imaging products, located in Florida, for $5 million. This operation is included in our Space and Defense Controls segment.

On March 29, 2018, we acquired a 100% ownership interest in VUES Brno s.r.o located in the Czech Republic, which includes a 74% ownership interest in a subsidiary located in Germany, for $64 million. VUES designs and manufactures customized electric motors, generators and solutions. This operation is included in our Industrial Systems segment. On September 6, 2018, we acquired the remaining 26% noncontrolling interest for $2 million in cash.

On October 3, 2017, we, in collaboration with SIA Engineering Company, announced the joint venture company, Moog Aircraft Services Asia ("MASA"), in Singapore, of which we currently hold a 51% ownership. MASA is intended to provide maintenance, repair and overhaul services for our manufactured flight control systems. As we hold a majority ownership in MASA, but share voting control, we are accounting for this investment using the equity method. As of September 29, 2018, we have made total contributions of $5 million to MASA. This operation is included in our Aircraft Controls segment.

In 2018, we sold a non-core business of our Space and Defense Controls segment for $5 million in cash, plus a $1 million note receivable and recorded losses in other expense of $2 million.

In 2017, we acquired Rotary Transfer Systems, a manufacturer of electromechanical systems, located in Germany and France for $43 million. This acquisition is included in our Industrial Systems segment. We also sold non-core businesses in our Space and Defense Controls segment for $7 million and recorded losses in other expense of $13 million related to the sales.

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CRITICAL ACCOUNTING POLICIES

Our financial statements and accompanying notes are prepared in accordance with U.S. generally accepted accounting principles. The preparation of these consolidated financial statements requires us to make estimates, assumptions and judgments that affect the amounts reported. These estimates, assumptions and judgments are affected by our application of accounting policies, which are discussed in Note 1 of Item 8, Financial Statements and Supplementary Data of this report. We believe the accounting policies discussed below are the most critical in understanding and evaluating our financial results. These critical accounting policies have been reviewed with the Audit Committee of our Board of Directors.

Revenue Recognition on Long-Term Contracts

Revenue representing 39% of 2018 sales was accounted for using the percentage of completion, cost-to-cost method of accounting. This method of revenue recognition is predominantly used within the Aircraft Controls and Space and Defense Controls segments due to the contractual nature of the business activities, with the exception of their respective aftermarket activities. The contractual arrangements are either firm fixed-price or cost-plus contracts and are with the U.S. Government or its prime subcontractors, foreign governments or commercial aircraft manufacturers, including Boeing and Airbus. The nature of the contractual arrangements includes customers' requirements for delivery of hardware as well as funded nonrecurring development work in anticipation of follow-on production orders.

We recognize revenue on contracts in the current period using the percentage of completion, cost-to-cost method of accounting as work progresses toward completion as determined by the ratio of cumulative costs incurred to date to estimated total contract costs at completion, multiplied by the total estimated contract revenue, less cumulative revenue recognized in prior periods. Changes in estimates affecting sales, costs and profits are recognized in the period in which the change becomes known using the cumulative catch-up method of accounting, resulting in the cumulative effect of changes reflected in the period. Estimates are reviewed and updated quarterly for substantially all contracts. A significant change in an estimate on one or more contracts could have a material effect on our results of operations.

Occasionally, it is appropriate to combine or segment contracts. Contracts are combined in those limited circumstances when they are negotiated as a package in the same economic environment with an overall profit margin objective and constitute, in essence, an agreement to do a single project. In such cases, we recognize revenue and costs over the performance period of the combined contracts as if they were one. Contracts are segmented in limited circumstances if the customer has the right to accept separate elements of the contract and the total amount of the proposals on the separate components approximate the amount of the proposal on the entire project. For segmented contracts, we recognize revenue and costs as if they were separate contracts over the performance periods of the individual elements or phases.

Contract costs include only allocable, allowable and reasonable costs which are included in cost of sales when incurred. For applicable U.S. Government contracts, contract costs are determined in accordance with the Federal Acquisition Regulations and the related Cost Accounting Standards. The nature of these costs includes development engineering costs and product manufacturing costs such as direct material, direct labor, and other direct costs. Contract profit is recorded as a result of the revenue recognized less costs incurred in any reporting period. Amounts representing performance incentives, penalties, contract claims or change orders are considered in estimating revenues, costs and profits when they can be reliably estimated and realization is considered probable. Revenue recognized on contracts for unresolved claims or unapproved contract change orders was not material in 2018, 2017 or 2016.

Contract and Contract-Related Loss Reserves

At September 29, 2018, we had contract and contract-related loss reserves of $42 million. For contracts with anticipated losses at completion, a provision for the entire amount of the estimated remaining loss is charged against income in the period in which the loss becomes known. Contract losses are determined considering all direct and indirect contract costs, exclusive of any selling, general or administrative cost allocations that are treated as period expenses. Loss reserves are more common on firm fixed-price contracts that involve, to varying degrees, the design and development of new and unique controls or control systems to meet the customers’ specifications. Contract-related loss reserves are recorded for the additional work needed on completed and delivered products in order for them to meet contract specifications.

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Reserves for Inventory Valuation

At September 29, 2018, we had net inventories of $513 million, or 35% of current assets. Reserves for inventory were $125 million, or 20% of gross inventories. Inventories are stated at the lower of cost or net realizable value with cost determined primarily on the first-in, first-out method of valuation.

We record valuation reserves to provide for slow-moving or obsolete inventory by principally using a formula-based method that increases the valuation reserve as the inventory ages. We also take specific circumstances into consideration. We consider overall inventory levels in relation to firm customer backlog in addition to forecasted demand including aftermarket sales. Changes in these and other factors, such as low demand and technological obsolescence, could cause us to increase our reserves for inventory valuation, which would negatively impact our gross margin. As we record provisions within cost of sales to increase inventory valuation reserves, we establish a new, lower cost basis for the inventory.

Reviews for Impairment of Goodwill

At September 29, 2018, we had $797 million of goodwill, or 27% of total assets. We test goodwill for impairment for each of our reporting units at least annually, during our fourth quarter, and whenever events occur or circumstances change, such as changes in the business climate, poor indicators of operating performance or the sale or disposition of a significant portion of a reporting unit. We also test goodwill for impairment when there is a change in reporting units.

We identify our reporting units by assessing whether the components of our operating segments constitute businesses for which discrete financial information is available and segment management regularly reviews the operating results of those components. We aggregate certain components based upon an evaluation of the facts and circumstances, including the nature of products and services and the extent of shared assets and resources. As a result, we have four reporting units.

Companies may perform a qualitative assessment as the initial step in the annual goodwill impairment testing process for all or selected reporting units. Companies are also allowed to bypass the qualitative analysis and perform a quantitative analysis if desired. Economic uncertainties and the length of time from the calculation of a baseline fair value are factors that we consider in determining whether to perform a quantitative test.

When we evaluate the potential for goodwill impairment using a qualitative assessment, we consider factors including, but not limited to, macroeconomic conditions, industry conditions, the competitive environment, changes in the market for our products and services, regulatory and political developments, entity specific factors such as strategy and changes in key personnel and overall financial performance. If, after completing this assessment, it is determined that it is more likely than not that the fair value of a reporting unit is less than its carrying value, we proceed to a quantitative two-step impairment test.

Quantitative testing first requires a comparison of the fair value of each reporting unit to its carrying value. We principally use the discounted cash flow method to estimate the fair value of our reporting units. The discounted cash flow method incorporates various assumptions, the most significant being projected revenue growth rates, operating margins and cash flows, the terminal growth rate and the discount rate. Management projects revenue growth rates, operating margins and cash flows based on each reporting unit's current business, expected developments and operational strategies typically over a five-year period. If the carrying value of the reporting unit exceeds its fair value, goodwill is considered impaired and any loss must be measured.

In measuring the impairment loss, the implied fair value of goodwill is determined by assigning a fair value to all of the reporting unit's assets and liabilities, including any unrecognized intangible assets, as if the reporting unit had been acquired in a business combination at fair value. If the carrying amount of the reporting unit's goodwill exceeds the implied fair value of that goodwill, an impairment loss would be recognized in an amount equal to that excess.

The determination of our assumptions is subjective and requires significant estimates. Changes in these estimates and assumptions could materially affect the results of our reviews for impairment of goodwill.

During the first quarter of 2018, we changed our reporting segment structure, which led to a change in our reporting units and an interim test of goodwill using the quantitative method.

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Interim Test
Effective October 1, 2017, we changed our segment reporting structure from four to three reporting segments. The former Components reporting segment has been divided and merged into the Space and Defense Controls and Industrial Systems reporting segments. This modification changed the number of reporting units we use to review goodwill for impairment from five to four - Aircraft Controls, Space and Defense Controls, Industrial Systems and Medical Devices.
We allocated the assets and liabilities of the former Components reporting unit to the new reporting units - Space and Defense Controls and Industrial Systems. As part of this transfer, we allocated the goodwill of the former Components reporting unit to the new reporting units based on the relative fair value of the new reporting units. We then compared the fair values to the carrying values of the new reporting units and the resulting fair values exceeded the carrying values, so we determined that goodwill was not impaired.
The fair value of each of these two reporting units exceeded the carrying amounts by over 100%. While any individual assumption could differ from those that we used, we believe the overall fair values of these reporting units are reasonable, as the values are derived from a mix of reasonable assumptions. Had we used discount rates that were 100 basis points higher or a terminal growth rate that was 100 basis points lower than those we assumed, the fair values of each of these reporting units would have continued to exceed its carrying amount by at least 80%.
Annual Test
For our annual test of goodwill for impairment in 2018, we performed a qualitative assessment for each of our four reporting units.
We evaluated the potential for goodwill impairment by considering macroeconomic conditions, industry and market conditions, cost factors, both current and future expected financial performance, and relevant entity-specific events for each of the reporting units. We also considered our overall market performance discretely as well as in relation to our peers. The results of our qualitative assessment indicated that it is more likely than not that the fair value of each of the reporting units exceed its carrying value; and therefore, a quantitative two-step impairment test was not necessary and goodwill was not impaired.
Reviews for Impairment of Long-Lived Assets
Long-lived assets held for use, which primarily includes finite-lived intangible assets and property, plant and equipment, are evaluated for impairment whenever events or circumstances indicate that the undiscounted net cash flows to be generated by their use over their expected useful lives and eventual disposition are less than their carrying value. The long-term nature of these assets requires the estimation of their cash inflows and outflows several years into the future and only takes into consideration technological advances known at the time of the impairment test. During 2018, we recorded $14 million of impairment charges on long-lived assets as a result of our decision to phase out our participation in the wind pitch control business.

Pension Assumptions
We maintain various defined benefit pension plans covering employees at certain locations. Pension expense for all defined benefit plans for 2018 was $36 million. Pension obligations and the related costs are determined using actuarial valuations that involve several assumptions. The most critical assumptions are the discount rate, long-term expected return on assets and the mortality rates. Other assumptions include salary increases and retirement age.
We use the spot rate approach to estimate the service and interest cost components of the net periodic benefit cost for most of our plans. Under this approach the service cost is determined by applying the discount rates along the yield curve to the specific service cost cash flows to determine the present value. The interest cost component is computed by using each assumed discount rate along the curve. The discount rates used in determining expense for the U.S. Employees’ Retirement Plan, our largest plan, in 2018 were 4.2% for service cost and 3.5% for interest cost, compared to 4.0% and 3.2%, respectively, in 2017. A 50 basis point decrease in the discount rates would increase our annual pension expense by $6 million. The discount rates are used to state expected future cash flows at present value. Using a higher

discount rate decreases the present value of pension obligations and decreases pension expense. We use the Aon Hewitt AA Above Median yield curve to determine the discount rate for our U.S. defined benefit plans at year end. We believe that the Aon Hewitt AA Above Median Discount Yield Curve best mirrors the yields of bonds that would be selected by management if actions were taken to settle our obligation.

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The long-term expected return on assets assumption reflects the average rate of return expected on funds invested or to be invested to provide for the benefits included in the projected benefit obligation. In determining the long-term expected return on assets assumption, we consider our current and target asset allocations. We consider the relative weighting of plan assets, the historical performance of total plan assets and individual asset classes and economic and other indicators of future performance. Asset management objectives include maintaining an adequate level of diversification to reduce interest rate and market risk and to provide adequate liquidity to meet immediate and future benefit payment requirements. In determining the 2018 expense for our largest plan, we used a 7.0% return on assets assumption, compared to 7.5% for 2017. A 50 basis point decrease in the long-term expected return on assets assumption would increase our annual pension expense by $4 million.

Mortality rates are used to estimate the life expectancy of plan participants during which they are expected to receive benefit payments. We use a modified version of the mortality table and projection scale published by the Society of Actuaries (SOA), which reflects improvements consistent with the Social Security Administration, as a basis for our mortality assumptions for our U.S. plans. We believe the use of this modified table and projection scale best reflects our demographics and anticipated plan outcomes.

Income Taxes

Our annual tax rate is based on our earnings before tax by jurisdiction, applicable statutory tax rates, the impacts of permanent differences, tax incentives and tax planning opportunities in the various jurisdictions in which we operate. Significant judgment is required in determining our annual tax rate and in evaluating our tax positions.

An estimated annual effective tax rate is applied to our quarterly ordinary operating results. For certain significant, unusual or infrequent events, we recognize the tax impact in the quarter in which it occurs. The financial impacts of our decisions to phase out our participation in the wind pitch control business and the related tax consequences were recorded as discrete items during the interim quarters of 2018. In addition, the one-time effects of tax reform have been recorded as discrete items.

We record reserves against tax benefits when it’s more likely than not that we will not sustain a position if the appropriate taxing jurisdiction had full information and examined our position. We adjust these reserves when facts and circumstances change, such as when progress is made by taxing authorities in their review of our position. There is a considerable amount of judgment in making these assessments. There were no significant reserves recorded in 2018.

Valuation allowances associated with deferred tax assets are another area that requires judgment. We record a valuation allowance to reduce deferred tax assets to the amount of future tax benefit that we believe is more likely than not to be realized. We consider recent earnings projections, allowable tax carryforward periods, tax planning strategies and historical earnings performance to determine the amount of the valuation allowance. Changes in these factors could cause us to adjust our valuation allowance, which would impact our income tax expense when we determine that these factors have changed.

At September 29, 2018, we had gross deferred tax assets of $187 million and deferred tax asset valuation allowances of $15 million. The deferred tax assets principally relate to benefit accruals, inventory obsolescence, tax benefit carryforwards and contract loss reserves. The deferred tax assets include $16 million related to tax benefit carryforwards associated with net operating losses and tax credits, for which $15 million of deferred tax asset valuation allowances are recorded.

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CONSOLIDATED RESULTS OF OPERATIONS

(dollars and shares in millions, except per share data)	2018	2017	2016	2018 vs. 2017 $ Variance	2018 vs. 2017 % Variance	2017 vs. 2016 $ Variance	2017 vs. 2016 % Variance
Net sales	**$2,709**	$2,498	$2,412	$212	8 %	$86	4 %
Gross margin	***28.5 %***	*29.3 %*	*29.5 %*				
Research and development expenses	**$130**	$145	$147	$(14)	(10 %)	$(3)	(2 %)
Selling, general and administrative expenses as a percentage of sales	***14.5 %***	*14.3 %*	*14.1 %*				
Interest expense	**$36**	$35	$35	$2	5 %	$—	— %
Restructuring expense	**$29**	$—	$15	$29	— %	$(15)	(100 %)
Goodwill impairment	**$—**	$—	$5	$—	— %	$(5)	(100 %)
Other	**$—**	$14	$(3)	$(14)	(99 %)	$18	n/a
Effective tax rate	***47.4 %***	*22.7 %*	*28.5 %*				
Net earnings attributable to Moog and noncontrolling interest	**$97**	$140	$124	$(44)	(31 %)	$17	14 %
Diluted average common shares outstanding	**36**	36	37	—	— %	—	(1 %)
Diluted earnings per share attributable to Moog	**$2.68**	$3.90	$3.47	$(1.22)	(31 %)	$0.43	12 %

Net sales increased across all of our segments in 2018 compared to 2017. Our recent acquisitions in Industrial Systems and Space and Defense Controls contributed an incremental $32 million and $7 million of sales, respectively. Additionally in 2018, stronger foreign currencies relative to the U.S. dollar, in particular the Euro, increased sales $27 million. Also in 2018, Space and Defense Controls was impacted by the absence of $18

Net sales in 2017 compared to 2016 increased in Aircraft Controls and Space and Defense Controls, while net sales decreased in Industrial Systems. Weaker foreign currencies relative to the U.S. dollar, in particular the British pound, decreased sales $19 million.

Gross margin decreased in 2018 compared to 2017 due primarily to the $12 million inventory write-down associated with our exit of the wind pitch control business. Gross margin excluding the inventory write-down decreased slightly. A negative sales mix in Aircraft Controls was mostly offset by incremental profit from higher sales in Industrial Systems and Space and Defense Controls.

Gross margin decreased in 2017 compared to 2016. Negative sales mix in Aircraft Controls, driven by lower foreign military sales, as well as lower military aftermarket sales, reduced gross margin. Partly offsetting the decline were favorable sales mixes in Industrial Systems and in Space and Defense Controls.

Research and development expenses in 2018 decreased compared to 2017. Within Aircraft Controls, research and development expenses decreased $19 million, as we had lower activity across all of our major commercial development programs. The reduced spend was partially offset by increases in research and development activities across our other two segments.

Research and development expenses in 2017 decreased compared to 2016. Within Aircraft Controls, research and development expenses decreased $13 million, as development activities declined on the Embraer E-2 and the Airbus A350 programs. The reduced spend in Aircraft Controls was mostly offset by increases in research and development activities in our other two segments.

Selling, general and administrative expenses as a percentage of sales increased in 2018 compared to 2017. The increase is due to higher planned selling expense in select growth markets, primarily in Industrial Systems, acquisition-related expenses and higher healthcare costs. Selling, general and administrative expenses as a percentage of sales also increased in 2017 compared to 2016. Within Space and Defense Controls, we had higher selling activities.

Interest expense in 2017 was comparable to interest expense in 2016. In 2017, higher interest rates increased expense $4 million; however, lower levels of debt decreased expense $4 million.

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In the second quarter of 2018, we decided to phase out our participation in the wind pitch control business over the remainder of our fiscal year. During 2018, we incurred $39 million of restructuring expense in Industrial Systems specific to this decision. Of the related restructuring expense, there was $30 million for non-cash charges, $6 million for severance and $3 million for other costs.
In 2016, we incurred restructuring expenses in response to business conditions, primarily in Aircraft Controls and Industrial Systems, with approximately 40% in cost of sales and 60% in selling, general and administrative expenses.
In 2016, we recorded a $5 million goodwill impairment charge in Space and Defense Controls related to our additive manufacturing acquisition.
Other expense in 2017 includes $13 million of losses associated with the sale of non-core businesses in Space and Defense Controls.
The effective tax rate in 2018 was significantly impacted by the enactment of the Tax Cuts and Jobs Act of 2017, as well as limited tax benefits associated with the restructuring charges taken in foreign jurisdictions of our Industrial Systems segment. Excluding the one-time special impacts due to the Act and the restructuring charges, the effective tax rate for 2018 was 25.1%.
Our effective tax rate in 2017 includes the benefits associated with divesting non-core businesses in Space and Defense Controls and the recognition and timing of U.S. tax incentives. In 2016, our effective tax rate included the beneficial timing of the enactment of the U.S. research and development tax credit.
Other comprehensive income in 2018 includes $27 million of retirement liability adjustments and $16 million of negative foreign currency translation adjustments. Other comprehensive income in 2017 includes $69 million of income from retirement liability adjustments and $27 million of positive foreign currency translation adjustments. Other comprehensive loss in 2016 included $54 million of losses from retirement liability adjustments and $38 million of foreign currency translation losses. In 2018 compared to 2017, the change in retirement liability was primarily due to differences in actual versus expected return on assets, partially offset by changes in discount rates. In 2017 compared to 2016, the retirement liability gain was primarily due to changes in discount rates and return on assets. Also in 2017 compared to 2016, the change in foreign currency translation adjustments was primarily driven by positive impacts of the British pound and the Euro.

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SEGMENT RESULTS OF OPERATIONS

Operating profit, as presented below, is net sales less cost of sales and other operating expenses, excluding interest expense, equity-based compensation expense and other corporate expenses. Cost of sales and other operating expenses are directly identifiable to the respective segment or allocated on the basis of sales, manpower or profit. Operating profit is reconciled to earnings before income taxes in Note 19 of Item 8, Financial Statements and Supplementary Data of this report.

Aircraft Controls

				2018 vs. 2017		2017 vs. 2016	
(dollars in millions)	**2018**	2017	2016	$ Variance	% Variance	$ Variance	% Variance
Net sales - military aircraft	**$572**	$522	$512	$50	10 %	$10	2 %
Net sales - commercial aircraft	**622**	603	551	19	3 %	51	9 %
	$1,194	$1,125	$1,064	$69	6 %	$61	6 %
Operating profit	**$129**	$114	$99	$15	13 %	$16	16 %
Operating margin	***10.8 %***	*10.1 %*	*9.3 %*				
Backlog	**$755**	$571	$632	$184	32 %	$(61)	(10 %)

Aircraft Controls' net sales growth was driven by military OEM programs and by commercial aftermarket programs in 2018 compared to 2017. Net sales growth was primarily driven by commercial programs in 2017 compared to 2016.

In 2018 compared to 2017, military OEM sales increased $43 million and military aftermarket sales increased $7 million. Within OEM programs, higher production levels on the F-35 and the KC-46 Tanker increased sales $22 million and $6 million, respectively. In addition, contract awards for navigational aides products increased sales $6 million and higher orders for foreign military programs increased sales $5 million. Within aftermarket programs, higher spare purchases for multiple programs offset the lower amount of prior year's activity associated with the B-2 program. Also in 2018, commercial aftermarket sales increased $33 million driven by higher initial provisioning orders for the Airbus A350 program and recapture activities on legacy Boeing programs. Partially offsetting these increases was a $14 million decline in commercial OEM sales, as declining volumes on legacy Boeing and Airbus programs surpassed volume increases on newer programs.

In 2017 compared to 2016, commercial OEM and aftermarket sales increased $46 million and $5 million, respectively. OEM sales for the Airbus A350 increased $40 million due to the program's production ramp up. The increase in commercial aftermarket sales was due to higher repair activity on legacy Boeing programs. In addition, military OEM sales increased $26 million in 2017 compared to 2016. While classified military OEM development jobs increased $23 million and higher production volume on the F-35 program increased sales $17 million, lower foreign military sales decreased $19 million. Also, military aftermarket sales decreased $16 million in 2017 due to lower repair activity for the B1-B and C-5 programs.

Operating margin in 2018 increased compared to the operating margin in 2017. Research and development expenses decreased $19 million due to lower activity on our major commercial development programs. However, we had an unfavorable mix due to lower amounts of mature commercial OEM sales as well as increased costs on a new commercial OEM program, partially offset by higher amounts of commercial aftermarket sales. Also, higher operating expenses, including new business capture activities, reduced operating profit.

Operating margin increased in 2017 compared to 2016. Research and development expenses decreased $13 million due to lower development activities on the Embraer E-2 and the Airbus A350 programs. Operating margin also benefited $7 million due to the absence of the prior year's restructuring expense and an incremental $4 million of associated restructuring benefits. Partly offsetting these benefits was $10 million of higher additions to contract loss reserves in 2017 compared to 2016.

The twelve-month backlog for Aircraft Controls at September 29, 2018 increased compared to September 30, 2017 due to the timing and volume of military orders, especially for the F-35 program. The twelve-month backlog for Aircraft Controls at September 30, 2017 declined compared to October 1, 2016. Half of the decline was in military aircraft, driven primarily due to order timing on the F-35 program. The remaining reduction was due to declining production rates on legacy commercial programs.

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Space and Defense Controls

(dollars in millions)	2018	2017	2016	2018 vs. 2017 $ Variance	2018 vs. 2017 % Variance	2017 vs. 2016 $ Variance	2017 vs. 2016 % Variance
Net sales	**$581**	$529	$499	$52	10 %	$ 30	6 %
Operating profit	**$67**	$49	$54	$18	38 %	$ (5)	(10 %)
Operating margin	***11.5 %***	*9.2 %*	*10.8 %*				
Backlog	**$454**	$385	$351	$69	18 %	$ 34	10 %

compared to 2016.

$18

$24

In 2017 compared to 2016, sales in our defense market increased $28 million due to higher sales of controls for domestic and European defense vehicles, as well as higher naval sales. Additionally in our space market in 2017, higher orders for satellite avionics and controls were offset by contracts continuing to wind down on launch vehicles and lost sales associated with the divestitures in the first half of 2017.

Operating margin increased in 2018 compared to 2017 due to the absence of last year's losses associated with selling our non-core businesses. Operating margin excluding the losses would have been 11.7% in 2017. The slight decline in 2018 operating margin compared to an adjusted 2017 operating margin was driven by higher research and development expenses.

Operating margin excluding the losses in 2017 increased compared to 2016 due primarily to a favorable sales mix in our defense markets.

Twelve-month backlog for Space and Defense Controls at September 29, 2018 compared to September 30, 2017 increased due to higher orders for our defense programs. Twelve-month backlog for Space and Defense Controls at September 30, 2017 increased compared to October 1, 2016 due to order growth in satellite avionics, launch vehicles and multiple defense products.

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Industrial Systems

(dollars in millions)	**2018**	2017	2016	2018 vs. 2017 $ Variance	2018 vs. 2017 % Variance	2017 vs. 2016 $ Variance	2017 vs. 2016 % Variance
Net sales	**$935**	$843	$849	$92	11 %	$(5)	(1 %)
Operating profit	**$62**	$88	$86	$(25)	(29 %)	$2	2 %
Operating margin	***6.7 %***	*10.4 %*	*10.1 %*				
Backlog	**$272**	$256	$230	$16	6 %	$25	11 %

In 2018 compared to 2017, approximately half of Industrial Systems' net sales growth was driven by organic growth within all our markets, and the remaining growth was split between the impacts of acquisitions and foreign currencies. In 2017, Industrial Systems' net sales decreased compared 2016 as weaker foreign currencies relative to the U.S. dollar, in particular the British pound, decreased sales $5 million.

Excluding the currency effects on sales in 2018 compared to 2017, sales increased $41 million in our industrial automation market. The increases were primarily driven by our acquisitions, as well as stronger macro economic growth. Sales also increased $17 million in our medical market driven by higher orders for our components and devices. In addition, sales increased $14 million in our energy market driven by increased shipments for energy generation and exploration products. Also in 2018 compared to 2017, the recent acquisitions of Vues Brno s.r.o and Rotary Transfer Systems increased sales, primarily in our industrial automation market, $32 million, and stronger foreign currencies, primarily the Euro relative to the U.S. dollar, increased sales $19 million.

due to lost sales to a key customer in Brazil who was acquired and by lower sales from additional wind customers. Also, sales decreased slightly for our simulation and test products by $3 million. Partly offsetting the decreases in 2017 compared to 2016 were higher sales in our medical market and in our industrial automation market. Sales increased $15 million in our medical market due primarily to higher sales volumes on our sets and pumps. Additionally, sales in our industrial automation market increased $11 million due primarily to the Rotary Transfer Systems acquisition, as well as increased demand across our industrial markets.

In the second quarter of 2018, we decided to phase out our participation in the wind pitch control business over the remainder of our fiscal year. During 2018, we incurred $39 million of restructuring expense in Industrial Systems as described in the Consolidated Results of Operations.

Operating margin decreased in 2018 compared to 2017 due to charges associated with exiting the wind pitch control business. Excluding the effect of this expense, operating margin would have been 10.6% in 2018. The increase in an adjusted 2018 operating margin compared to 2017 operating margin was driven by incremental profit from higher sales across all of our markets, but partially offset by higher operating expenses.

Operating margin increased in 2017 compared to 2016, driven primarily by the absence of the prior year's restructuring expense and the incremental associated benefits.

The increased level of twelve-month backlog in Industrial Systems at September 29, 2018 compared to September 30, 2017 is due to higher orders from our recent acquisitions within our industrial automation market and for our industrial components products. The twelve-month backlog at September 30, 2017 increased compared to the twelve-month backlog at October 1, 2016 in part due to higher orders for non-renewable energy customers, as well as higher test and simulation orders.

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SEGMENT OUTLOOK

(dollars in millions)	2019	2018	2019 vs. 2018 $ Variance	% Variance
Net sales:				
Aircraft Controls	$1,265	$1,194	$71	6 %
Space and Defense Controls	681	581	100	17 %
Industrial Systems	931	935	(4)	— %
	$2,877	$2,709	$167	6 %
Operating profit:				
Aircraft Controls	$144	$129	$15	12 %
Space and Defense Controls	81	67	14	21 %
Industrial Systems	112	62	49	79 %
	$336	$258	$78	30 %
Operating margin:				
Aircraft Controls	11.4 %	10.8 %		
Space and Defense Controls	11.8 %	11.5 %		
Industrial Systems	12.0 %	6.7 %		
	11.7 %	9.5 %		

2019 Outlook – We expect higher amounts of defense sales within Space and Defense Controls as well as Aircraft Controls to drive the increase in 2019 sales. We also expect commercial aircraft sales growth driven by major OEM program ramp-ups, and we expect Industrial Systems organic growth will offset the lost sales associated with our wind pitch control business. We expect 2019 operating margin will increase due to the absence of 2018's charges associated with exiting the wind pitch control business, as well as incremental margin from higher sales. We expect net earnings attributable to common shareholders to increase 92% in 2019 to $185 million, as the unusually high effective tax rate in 2018 due to the Tax Cuts and Jobs Act does not repeat. Excluding the impacts from the wind charge and the special impacts from the Tax Act, we expect net earnings attributable to common shareholders to increase 17% from an adjusted net earnings in 2018 of $165 million. We expect diluted earnings per share will range between $5.05 and $5.45, with a midpoint of $5.25.

2019 Outlook for Aircraft Controls **–** We expect 2019 sales in Aircraft Controls will increase primarily due to the continued ramp ups of the Airbus A350, the F-35 and the Boeing 787 programs. Partially offsetting the increases is an expected sales decline of commercial aftermarket programs as the favorable order timing in 2018 does not repeat in 2019. We expect 2019 operating margin will increase compared to 2018 due to a more favorable sales mix from higher military aftermarket sales, as well as improving costs on newer commercial programs.

2019 Outlook for Space and Defense Controls – We expect 2019 sales in Space and Defense Controls will increase due to new product offerings and higher sales volumes on existing defense controls and missile programs. We expect 2019 operating margin will increase slightly due to incremental margin from the higher sales volume.

2019 Outlook for Industrial Systems **–** We expect 2019 sales in Industrial Systems to increase across our major markets, offsetting the lost sales associated with our wind pitch control business which we exited in 2018. We expect 2019 operating margin will increase due to the absence of 2018's charges associated with exiting the wind pitch control business. Excluding the impact of these charges, 2019 operating margin will increase from an adjusted operating margin of 10.6%, reflecting incremental margin on the higher sales as well as higher operational efficiency.

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FINANCIAL CONDITION AND LIQUIDITY

(dollars in millions)	**2018**	2017	2016	2018 vs. 2017 $ Variance	2018 vs. 2017 % Variance	2017 vs. 2016 $ Variance	2017 vs. 2016 % Variance
Net cash provided (used) by:							
Operating activities	**$102**	$218	$216	$(115)	(53 %)	$2	1 %
Investing activities	**(142)**	(110)	(79)	(32)	29 %	(30)	38 %
Financing activities	**(222)**	(76)	(120)	(146)	193 %	44	(37 %)

Our available borrowing capacity and our cash flow from operations provide us with the financial resources needed to run our operations, reinvest in our business and make strategic acquisitions.

At September 29, 2018, our cash, cash equivalents and restricted cash balance was $128 million, which is primarily held outside of the U.S. Cash flow from our U.S. operations, together with borrowings on our credit facility, fund on-going activities, debt service requirements and future growth investments. Due to provisions in the Tax Cuts and Jobs Act, we plan to continue to repatriate substantial amounts of our existing offshore cash and future earnings back to the U.S. Throughout 2018, we have repatriated approximately $230 million.

Operating activities

Net cash provided by operating activities decreased in 2018 compared to 2017. Cash used by pension and retirement liabilities increased $94 million due to incremental pension contributions in 2018. Also, cash used by inventory increased $26 million, as higher volumes on new programs in Aircraft Controls and delays on shipments in Space and Defense Controls resulted in more inventory.

Net cash provided by operating activities in 2017 was comparable to 2016, as net earnings increased $17 million, but was offset by lower cash provided by working capital accounts. Unfavorable timing of receivables and increases in inventory across all of our segments used $65 million more of cash compared to 2016. Also, customer advances used $10 million more of cash due to milestones met primarily in Space and Defense Controls. Partially offsetting the decline was $48 million of cash provided by accounts payable due to favorable timing and $18 million of cash provided by accrued expenses.

Investing activities

Net cash used by investing activities in 2018 included $95 million for capital expenditures and $48 million for the acquisitions in our Industrial Systems and Space and Defense segments.

Net cash used by investing activities in 2017 included $76 million for capital expenditures and $41 million for the acquisition in Industrial Systems.

Net cash used by investing activities in 2016 included $67 million for capital expenditures and $11 million for the 70% ownership for the Linear Mold and Engineering acquisition.

We expect our 2019 capital expenditures to be approximately $95 million, due to facilities investments supporting the increased production of the F-35 program, as well as space engine propulsion testing.

Financing activities

Net cash used by financing activities in 2018 includes $100 million of net payments on our credit facilities. Net cash used by financing activities in 2018 also includes $76 million related to repurchasing approximately 1 million shares, at $75.74 per share, from the defined benefit pension plan. Additionally, we paid $21 million to extinguish the debt of our Industrial Systems' acquisition, and we paid $18 million of cash dividends in 2018.

Net cash used by financing activities in 2017 included

Net cash used by financing activities in 2016 included $39 million to fund our stock repurchase program. We repurchased approximately 850,000 shares, averaging $46 per share, and used our credit facility for funding.

CAPITAL STRUCTURE AND RESOURCES

We maintain bank credit facilities to fund our short and long-term capital requirements, including acquisitions. From time to time, we also sell debt and equity securities to fund acquisitions or take advantage of favorable market conditions.

Our U.S. revolving credit facility matures on June 28, 2021. The U.S. revolving credit facility has a capacity of $1.1 billion and also provides an expansion option, which permits us to request an increase of up to $200 million to the credit facility upon satisfaction of certain conditions. The U.S. revolving credit facility had an outstanding balance of $430 million at September 29, 2018. The weighted-average interest rate on primarily all of the outstanding credit facility borrowings is 3.80% and is based on LIBOR plus the applicable margin, which was 1.63% at September 29, 2018. The credit facility is secured by substantially all of our U.S. assets.

The U.S. revolving credit facility contains various covenants. The covenant for minimum interest coverage ratio, defined as the ratio of EBITDA to interest expense for the most recent four quarters, is 3.0. The covenant for the maximum leverage ratio, defined as the ratio of net debt, including letters of credit, to EBITDA for the most recent four quarters, is 3.5. We are in compliance with all covenants. EBITDA is defined in the loan agreement as (i) the sum of net income, interest expense, income taxes, depreciation expense, amortization expense, other non-cash items reducing consolidated net income and non-cash equity-based compensation expenses minus (ii) other non-cash items increasing consolidated net income.

We are generally not required to obtain the consent of lenders of the U.S. revolving credit facility before raising significant additional debt financing; however, certain limitations and conditions may apply that would require consent to be obtained. In recent years, we have demonstrated our ability to secure consents to access debt markets. We have also been successful in accessing equity markets from time to time. We believe that we will be able to obtain additional debt or equity financing as needed.

At September 29, 2018, we had $638 million of unused capacity, including $626 million from the U.S. revolving credit facility after considering standby letters of credit. However, our leverage ratio covenant limits our total borrowing capacity to $440 million as of September 29, 2018.

On July 26, 2018, the SECT entered into a revolving credit facility with a borrowing capacity of $35 million, maturing on July 26, 2020. Interest for the revolving credit facility is based on LIBOR plus a margin of 2.13%. As of September 29, 2018, there were no outstanding borrowings.

We have $300 million principal amount of 5.25% senior notes due December 1, 2022 with interest paid semiannually on June 1 and December 1 of each year. The senior notes are unsecured obligations, guaranteed on a senior unsecured basis by certain subsidiaries and contain normal incurrence-based covenants and limitations such as the ability to incur additional indebtedness, pay dividends, make other restricted payments and investments, create liens and certain corporate acts such as mergers and consolidations. The effective interest rate for these notes after considering the amortization of deferred debt issuance costs is 5.73%.

We have a trade receivables securitization facility (the "Securitization Program"), which matures on October 23, 2019. The Securitization Program provides up to $130 million of borrowing capacity and lowers our cost to borrow funds as compared to the U.S. revolving credit facility. Under the Securitization Program, we sell certain trade receivables and related rights to an affiliate, which in turn sells an undivided variable percentage ownership interest in the trade receivables to a financial institution, while maintaining a subordinated interest in a portion of the pool of trade receivables. We had an outstanding balance of $130 million at September 29, 2018. The Securitization Program has a minimum borrowing requirement, which was $104 million at September 29, 2018. Interest on the secured borrowings under the Securitization Program was 3.07% at September 29, 2018 and is based on 30-day LIBOR plus an applicable margin.

Net debt to capitalization was 38% at September 29, 2018 and 33% at September 30, 2017. The increase in net debt to capitalization is due to the share repurchases from our defined benefit plan and the use of cash for incremental pension contributions to fund our primary U.S. defined benefit pension plan and acquisitions, partially offset by our net earnings.

We believe that our cash on hand, cash flows from operations and available borrowings under short and long-term arrangements will continue to be sufficient to meet our operating needs.

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The Board of Directors authorized a share repurchase program. This program has been amended from time to time to authorize additional repurchases that includes both Class A and Class B common stock, and allows us to buy up to an aggregate 13 million common shares. Under this program, we have purchased approximately 9.7 million shares for $650 million as of September 29, 2018.

Off Balance Sheet Arrangements

We do not have any material off balance sheet arrangements that have or are reasonably likely to have a material future effect on our financial condition, results of operations or cash flows.

Contractual Obligations and Commercial Commitments

Our significant contractual obligations and commercial commitments at September 29, 2018 are as follows:

(dollars in millions)	Payments due by period				
Contractual Obligations	Total	2019	2020-2021	2022-2023	After 2023
Long-term debt	$861	$—	$560	$300	$—
Interest on long-term debt	65	16	32	17	—
Operating leases	112	21	33	21	37
Purchase obligations	649	462	165	7	15
Total contractual obligations	$1,687	$500	$790	$345	$52

The obligations in the table above exclude unrecognized tax benefits, which are not material. We are unable to determine if and when any of those amounts will be settled, nor can we estimate any potential changes to the unrecognized tax benefits.

The table above excludes interest on variable-rate debt from our U.S. revolving credit facility, other revolving credit facilities and the Securitization Program, as we are unable to determine the rate and average balance outstanding for the periods presented in the above table. Interest on variable-rate long-term debt, assuming the rate and outstanding balances do not change from those at September 29, 2018, would be approximately $22 million annually.

Total contractual obligations exclude pension obligations. In 2019, we have no minimum funding requirements. However, we anticipate making contributions to defined benefit pension plans of $12 million, of which approximately $5 million is for a non-qualified U.S. plan. We are unable to determine minimum funding requirements beyond 2019.

We have made discretionary incremental contributions to our defined benefit plans in excess of minimum funding requirements in 2018. These additional contributions were primarily made to fully fund our qualified U.S. defined benefit pension plan. We do not plan to make additional contributions to this plan for the foreseeable future.

(dollars in millions)	Commitments expiring by period				
Other Commercial Commitments	Total	2019	2020-2021	2022-2023	After 2023
Standby letters of credit	$44	$16	$4	$24	$ —

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ECONOMIC CONDITIONS AND MARKET TRENDS

We operate within the aerospace and defense and industrial markets. Our aerospace and defense markets are affected by market conditions and program funding levels, while our industrial markets are influenced by general capital investment trends and economic conditions. A common factor throughout our markets is the continuing demand for technologically advanced products.

Aerospace and Defense

Approximately two-thirds of our 2018 sales were generated in aerospace and defense markets. Within aerospace and defense, we serve three end markets: defense, commercial aircraft and space.

The defense market is dependent on military spending for development and production programs. Aircraft production programs are typically long-term in nature, offering predictability as to capacity needs and future revenues. We maintain positions on numerous high priority programs, including the Lockheed Martin F-35 Joint Strike Fighter, FA-18E/F Super Hornet and V-22 Osprey. The large installed base of our products leads to attractive aftermarket sales and service opportunities. The tactical and strategic missile, missile defense and defense controls markets are dependent on many of the same market conditions as military aircraft, including overall military spending and program funding levels. Our security and surveillance product line is dependent on government funding at federal and local levels, as well as private sector demand.

The 2011 Budget Control Act reduced the Department of Defense spending (or sequestration) by approximately $500 billion. The Bipartisan Budget Act of 2013 and the Bipartisan Budget Act of 2015 provided stability and modest growth in the Department of Defense spending through 2017. After operating under continuing resolutions, which restrict new program starts, the U.S. Government signed the 2019 defense appropriations budget in September 2018, with moderate growth in defense spending. However, future budgeted levels of defense spending beyond 2019 are uncertain and subject to debate. Currently, we expect approximately $850 million of U.S. defense sales in 2019.

The commercial aircraft market is dependent on a number of factors, including global demand for air travel, which generally follows underlying economic growth. As such, the commercial aircraft market has historically exhibited cyclical swings which tend to track the overall economy. In recent years, the development of new, more fuel-efficient commercial air transports has helped drive increased demand in the commercial aircraft market, as airlines replace older, less fuel-efficient aircraft with newer models in an effort to reduce operating costs. The aftermarket is driven by usage of the existing aircraft fleet and the age of the installed fleet, and is impacted by fleet re-sizing programs for passenger and cargo aircraft. Changes in aircraft utilization rates affect the need for maintenance and spare parts impacting aftermarket sales. Boeing and Airbus have historically adjusted production in line with air traffic volume. Demand for our commercial aircraft products is in large part dependent on new aircraft production, which is increasing as Boeing and Airbus work to fulfill large backlogs of unfilled orders.

The commercial space market is comprised of large satellite customers, traditionally communications companies. Trends for this market, as well as for commercial launch vehicles, follow demand for increased capacity. This, in turn tends to track with underlying demand for increased consumption of telecommunication services, satellite replacement and global navigation needs. The space market is also partially dependent on the governmental-authorized levels of funding for satellite communications, as well as investment for commercial and exploration activities.

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Industrial

Approximately one-third of our 2018 sales were generated in industrial markets. Within industrial, we serve three end markets: industrial automation, energy and medical.

The industrial automation market we serve is influenced by several factors including capital investment, product innovation, economic growth, cost-reduction efforts and technology upgrades. We experience challenges from the need to react to the demands of our customers, who are in large part sensitive to international and domestic economic conditions.

The energy market we serve is affected by changing oil and natural gas prices, global urbanization, the resulting change in supply and demand for global energy and the political climate and corresponding public support for investments in renewable energy generation capacity. Historically, drivers for global growth include investments in power generation infrastructure, including renewable energy, and exploration in search of new oil and gas resources. However, after the significant decline in the price of crude oil from 2014 through 2016, investments in exploration activities have been reduced.

The medical market we serve is influenced by economic conditions, regulatory environments, hospital and outpatient clinic spending on equipment, population demographics, medical advances, patient demands and the need for precision control components and systems. Advances in medical technology and medical treatments have had the effect of extending average life spans, in turn resulting in greater need for medical services. These same technology and treatment advances also drive increased demand from the general population as a means to improve quality of life. Access to medical insurance, whether through government funded health care plans or private insurance, also affects the demand for medical services.

Foreign Currencies

We are affected by the movement of foreign currencies compared to the U.S. dollar, particularly in Aircraft Controls and Industrial Systems. About one-fifth of our 2018 sales were denominated in foreign currencies. During 2018, average foreign currency rates generally strengthened against the U.S. dollar compared to 2017. The translation of the results of our foreign subsidiaries into U.S. dollars increased sales by $27 million compared to one year ago. During 2017, average foreign currency rates generally weakened against the U.S. dollar compared to 2016. The translation of the results of our foreign subsidiaries into U.S. dollars decreased 2017 sales by $19 million compared to 2016.

RECENT ACCOUNTING PRONOUNCEMENTS

See Note 1 of the Consolidated Financial Statements included in Item 8, Financial Statements and Supplementary Data of this report for further information regarding Financial Accounting Standards Board issued Accounting Standards Updates ("ASU").

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

In the normal course of business, we are exposed to interest rate risk from our long-term debt and foreign exchange rate risk related to our foreign operations and foreign currency transactions. To manage these risks, we may enter into derivative instruments such as interest rate swaps and foreign currency contracts. We do not hold or issue financial instruments for trading purposes. In 2018, our derivative instruments consisted of interest rate swaps designated as cash flow hedges, foreign currency contracts and net investment hedges.

At September 29, 2018, we had $560 million of borrowings subject to variable interest rates. At September 29, 2018, we had interest rate swaps with notional amounts totaling $150 million. The interest rate swaps effectively convert this amount of variable-rate debt to fixed-rate debt at 2.87%, including the applicable margin of 1.63% as of September 29, 2018. The interest will revert back to variable rates based on LIBOR plus the applicable margin upon the maturity of the interest rate swaps. These interest rate swaps mature at various times through June 23, 2020. During 2018, our average borrowings subject to variable interest rates, after adjusting for interest rate swaps, were $476 million and, therefore, if interest rates had been one percentage point higher during 2018, our interest expense would have been $5 million higher.

We also enter into forward contracts to reduce fluctuations in foreign currency cash flows related to third party purchases, intercompany product shipments and to reduce exposure on intercompany balances that are denominated in foreign currencies. We have foreign currency contracts with notional amounts of $145 million outstanding at September 29, 2018 that mature at various times through May 29, 2020. These include notional amounts of $115 million outstanding where the U.S. dollar is one side of the trade. The net fair value of all of our foreign currency contracts involving the U.S. dollar was a $2 million net liability at September 29, 2018. A hypothetical 10 percent increase in the value of the U.S. dollar against all currencies would decrease the fair value of our foreign currency contracts at September 29, 2018 by approximately $8 million, while a hypothetical 10 percent decrease in the value of the U.S. dollar against all currencies would increase the fair value of our foreign currency contracts at September 29, 2018 by approximately $10 million. It is important to note that gains and losses indicated in the sensitivity analysis would often be offset by gains and losses on the underlying receivables and payables.

Although the majority of our sales, expenses and cash flows are transacted in U.S. dollars, we have exposure to changes in foreign currency exchange rates such as the Euro, British pound and Japanese yen. If average annual foreign exchange rates collectively weakened or strengthened against the U.S. dollar by 10%, our net earnings in 2018 would have decreased or increased by $4 million from foreign currency translation. This sensitivity analysis assumed that each exchange rate would change in the same direction relative to the U.S. dollar and excludes the potential effects that changes in foreign currency exchange rates may have on actual transactions.

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Item 8. Financial Statements and Supplementary Data.
Consolidated Statements of Earnings

(dollars in thousands, except share and per share data)	Fiscal Years Ended **September 29, 2018**	September 30, 2017	October 1, 2016
Net sales	**$2,709,468**	$ 2,497,524	$2,411,937
Cost of sales	**1,924,283**	1,766,002	1,700,354
Inventory write-down - restructuring	**12,198**	—	—
Gross profit	**772,987**	731,522	711,583
Research and development	**130,186**	144,646	147,336
Selling, general and administrative	**393,759**	356,141	339,961
Interest	**36,238**	34,551	34,605
Restructuring	**28,794**	—	15,393
Goodwill impairment	**—**	—	4,800
Other	**173**	14,473	(3,372)
Earnings before income taxes	**183,837**	181,711	172,860
Income taxes	**87,209**	41,301	49,227
Net earnings attributable to Moog and noncontrolling interest	**$96,628**	$ 140,410	$123,633
Net earnings (loss) attributable to noncontrolling interest	**121**	(870)	(3,112)
Net earnings attributable to Moog	**$96,507**	$ 141,280	$126,745
Net earnings per share attributable to Moog			
Basic	**$2.71**	$ 3.94	$3.49
Diluted	**$2.68**	$ 3.90	$3.47
Dividends declared per share	**$0.50**	$ —	$—
Average common shares outstanding			
Basic	**35,661,638**	35,852,448	36,277,445
Diluted	**36,052,307**	36,230,043	36,529,344

See accompanying Notes to Consolidated Financial Statements.

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Consolidated Statements of Comprehensive Income (Loss)

(dollars in thousands)	Fiscal Years Ended **September 29, 2018**	September 30, 2017	October 1, 2016
Net earnings attributable to Moog and noncontrolling interest	**$ 96,628**	$ 140,410	$ 123,633
Other comprehensive income (loss), net of tax:			
Foreign currency translation adjustment	**(16,279)**	27,460	(37,838)
Retirement liability adjustment	**26,757**	69,229	(54,184)
Change in accumulated income (loss) on derivatives	**(121)**	2,881	(1,304)
Other comprehensive income (loss), net of tax	**10,357**	99,570	(93,326)
Tax Cuts and Jobs Act, reclassification from AOCIL to retained earnings	**(47,077)**	—	—
Comprehensive income (loss)	**59,908**	239,980	30,307
Comprehensive income (loss) attributable to noncontrolling interest	**91**	(870)	(3,112)
Comprehensive income (loss) attributable to Moog	**$ 59,817**	$ 240,850	$ 33,419

See accompanying Notes to Consolidated Financial Statements.

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Consolidated Balance Sheets

(dollars in thousands, except per share data)	**September 29, 2018**	September 30, 2017
ASSETS		
Current assets		
Cash and cash equivalents	**$ 125,584**	$ 368,073
Receivables	**793,911**	727,740
Inventories	**512,522**	489,127
Prepaid expenses and other current assets	**44,404**	41,499
Total current assets	**1,476,421**	1,626,439
Property, plant and equipment, net	**552,865**	522,991
Goodwill	**797,217**	774,268
Intangible assets, net	**95,537**	108,818
Deferred income taxes	**17,328**	26,558
Other assets	**24,680**	31,518
Total assets	**$ 2,964,048**	$ 3,090,592
LIABILITIES AND SHAREHOLDERS' EQUITY		
Current liabilities		
Short-term borrowings	**$ 3,623**	$ 89
Current installments of long-term debt	**365**	295
Accounts payable	**213,982**	170,878
Accrued compensation	**147,765**	148,406
Customer advances	**151,687**	159,274
Contract loss reserves	**42,258**	43,214
Other accrued liabilities	**120,944**	107,278
Total current liabilities	**680,624**	629,434
Long-term debt, excluding current installments	**858,836**	956,653
Long-term pension and retirement obligations	**117,471**	271,272
Deferred income taxes	**46,477**	13,320
Other long-term liabilities	**35,654**	5,609
Total liabilities	**1,739,062**	1,876,288
Commitments and contingencies (Note 21)	**—**	—
Shareholders' equity		
Common stock - par value $1.00		
Class A - Authorized 100,000,000 shares	**43,785**	43,704
Issued 43,784,489 and outstanding 32,486,766 shares at September 29, 2018		
Issued 43,704,286 and outstanding 32,346,135 shares at September 30, 2017		
Class B - Authorized 20,000,000 shares. Convertible to Class A on a one-for-one basis	**7,495**	7,576
Issued 7,495,224 and outstanding 2,311,286 shares at September 29, 2018		
Issued 7,575,427 and outstanding 3,436,747 shares at September 30, 2017		
Additional paid-in capital	**502,257**	492,246
Retained earnings	**1,973,514**	1,847,819
Treasury shares	**(738,494)**	(739,157)
Stock Employee Compensation Trust	**(118,449)**	(89,919)
Supplemental Retirement Plan Trust	**(72,941)**	(12,474)
Accumulated other comprehensive loss	**(372,181)**	(335,491)
Total shareholders' equity	**1,224,986**	1,214,304
Total liabilities and shareholders' equity	**$ 2,964,048**	$ 3,090,592

See accompanying Notes to Consolidated Financial Statements.

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Consolidated Statements of Shareholders' Equity

(dollars in thousands)	Fiscal Years Ended **September 29, 2018**	September 30, 2017	October 1, 2016
COMMON STOCK			
Beginning and end of year	**$51,280**	$ 51,280	$51,280
ADDITIONAL PAID-IN CAPITAL			
Beginning of year	**492,246**	465,762	456,512
Issuance of treasury shares	**(4,321)**	(7,390)	(429)
Equity-based compensation expense	**5,804**	4,582	3,271
Redemption of noncontrolling interest	**175**	3,125	—
Adjustment to market - SECT, SERP and other	**8,353**	26,167	6,408
End of year	**502,257**	492,246	465,762
RETAINED EARNINGS			
Beginning of year	**1,847,819**	1,706,539	1,579,794
Net earnings attributable to Moog	**96,507**	141,280	126,745
Dividends	**(17,889)**	—	—
Tax Cuts and Jobs Act, reclassification from AOCIL to retained earnings	**47,077**	—	—
End of year	**1,973,514**	1,847,819	1,706,539
TREASURY SHARES AT COST			
Beginning of year	**(739,157)**	(741,700)	(701,771)
Class A and B shares issued related to equity compensation	**8,881**	11,186	5,003
Class A and B shares purchased	**(8,218)**	(8,643)	(44,932)
End of year	**(738,494)**	(739,157)	(741,700)
STOCK EMPLOYEE COMPENSATION TRUST (SECT)			
Beginning of year	**(89,919)**	(49,463)	(44,211)
Issuance of shares	**4,714**	867	28,048
Purchase of shares	**(30,358)**	(18,685)	(28,799)
Adjustment to market	**(2,886)**	(22,638)	(4,501)
End of year	**(118,449)**	(89,919)	(49,463)
SUPPLEMENTAL RETIREMENT PLAN (SERP) TRUST			
Beginning of year	**(12,474)**	(8,946)	(5,337)
Purchase of shares	**(55,000)**	—	(2,300)
Adjustment to market	**(5,467)**	(3,528)	(1,309)
End of year	**(72,941)**	(12,474)	(8,946)
ACCUMULATED OTHER COMPREHENSIVE LOSS			
Beginning of year	**(335,491)**	(435,061)	(341,735)
Other comprehensive income (loss)	**10,387**	99,570	(93,326)
Tax Cuts and Jobs Act, reclassification from AOCIL to retained earnings	**(47,077)**	—	—
End of year	**(372,181)**	(335,491)	(435,061)
TOTAL MOOG SHAREHOLDERS' EQUITY	**1,224,986**	1,214,304	988,411
NONCONTROLLING INTEREST			
Beginning of year	**—**	—	—
Noncontrolling interest of acquired entity	**1,927**	—	—
Net earnings attributable to noncontrolling interest	**121**	—	—
Foreign currency translation adjustment	**(30)**	—	—
Acquisition of noncontrolling interest	**(2,018)**	—	—
End of year	**—**	—	—
TOTAL SHAREHOLDERS' EQUITY	**$1,224,986**	$ 1,214,304	$988,411

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Consolidated Statements of Shareholders' Equity, continued

	Fiscal Years Ended		
	September 29, 2018	September 30, 2017	October 1, 2016
REDEEMABLE NONCONTROLLING INTEREST			
Beginning of year	**$—**	$ 5,651	$ —
Redeemable noncontrolling interest of acquired entity	**—**	—	8,763
Net loss attributable to redeemable noncontrolling interest	**—**	(870)	(3,112)
Acquisition of noncontrolling interest	**—**	(4,781)	—
End of year	**$—**	$ —	$ 5,651

Consolidated Statements of Shareholders' Equity, Shares

	Fiscal Years Ended		
(share data)	**September 29, 2018**	September 30, 2017	October 1, 2016
COMMON STOCK - CLASS A			
Beginning of year	**43,704,286**	43,666,801	43,638,618
Conversion of Class B to Class A	**80,203**	37,485	28,183
End of year	**43,784,489**	43,704,286	43,666,801
COMMON STOCK - CLASS B			
Beginning of year	**7,575,427**	7,612,912	7,641,095
Conversion of Class B to Class A	**(80,203)**	(37,485)	(28,183)
End of year	**7,495,224**	7,575,427	7,612,912
TREASURY SHARES - CLASS A COMMON STOCK			
Beginning of year	**(10,933,003)**	(11,110,087)	(10,318,431)
Class A shares issued related to equity awards	**104,842**	284,048	152,099
Class A shares purchased	**(44,414)**	(106,964)	(943,755)
End of year	**(10,872,575)**	(10,933,003)	(11,110,087)
TREASURY SHARES - CLASS B COMMON STOCK			
Beginning of year	**(3,333,927)**	(3,323,926)	(3,323,926)
Class B shares issued related to equity awards	**64,664**	7,380	—
Class B shares purchased	**(54,733)**	(17,381)	—
End of year	**(3,323,996)**	(3,333,927)	(3,323,926)
SECT SHARES - CLASS A COMMON STOCK			
Beginning of year	**(425,148)**	(425,148)	—
Purchase of shares	**—**	—	(425,148)
End of year	**(425,148)**	(425,148)	(425,148)
SECT SHARES - CLASS B COMMON STOCK			
Beginning of year	**(654,753)**	(404,919)	(828,381)
Issuance of shares	**57,277**	15,000	487,678
Purchase of shares	**(386,296)**	(264,834)	(64,216)
End of year	**(983,772)**	(654,753)	(404,919)
SERP TRUST SHARES - CLASS B COMMON STOCK			
Beginning of year	**(150,000)**	(150,000)	(100,000)
Purchase of shares	**(726,170)**	—	(50,000)
End of year	**(876,170)**	(150,000)	(150,000)

See accompanying Notes to Consolidated Financial Statements.

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Consolidated Statements of Cash Flows

	Fiscal Years Ended		
(dollars in thousands)	**September 29, 2018**	September 30, 2017	October 1, 2016
CASH FLOWS FROM OPERATING ACTIVITIES			
Net earnings attributable to Moog and noncontrolling interest	**$96,628**	$ 140,410	$123,633
Adjustments to reconcile net earnings to net cash provided (used) by operating activities:			
Depreciation	**71,231**	71,363	77,407
Amortization	**17,341**	18,804	21,325
Deferred income taxes	**30,613**	10,758	4,248
Equity-based compensation expense	**5,804**	4,582	3,271
Other	**34,455**	17,898	13,440
Changes in assets and liabilities providing (using) cash:			
Receivables	**(67,621)**	(44,558)	1,672
Inventories	**(32,451)**	(5,999)	12,644
Accounts payable	**39,440**	25,740	(21,821)
Customer advances	**(10,998)**	(7,054)	2,903
Accrued expenses	**11,466**	16,901	(727)
Accrued income taxes	**4,227**	(4,686)	4,481
Net pension and post retirement liabilities	**(123,500)**	(29,029)	(29,708)
Other assets and liabilities	**25,772**	2,650	3,086
Net cash provided by operating activities	**102,407**	217,780	215,854
CASH FLOWS FROM INVESTING ACTIVITIES			
Acquisitions of businesses, net of cash acquired	**(48,382)**	(40,545)	(11,016)
Purchase of property, plant and equipment	**(94,517)**	(75,798)	(67,208)
Other investing transactions	**1,257**	6,820	(994)
Net cash (used) by investing activities	**(141,642)**	(109,523)	(79,218)
CASH FLOWS FROM FINANCING ACTIVITIES			
Net short-term borrowings (repayments)	**3,618**	(1,280)	—
Proceeds from revolving lines of credit	**568,550**	255,622	324,670
Payments on revolving lines of credit	**(678,660)**	(305,512)	(409,670)
Proceeds from long-term debt	**15,000**	—	20,000
Payments on long-term debt	**(25,922)**	(168)	(10,098)
Payment of dividends	**(17,889)**	—	—
Proceeds from sale of treasury stock	**4,560**	3,797	4,574
Purchase of outstanding shares for treasury	**(8,218)**	(8,643)	(44,933)
Proceeds from sale of stock held by SECT	**4,714**	867	28,048
Purchase of stock held by SECT	**(30,358)**	(18,685)	(28,799)
Purchase of stock held by SERP Trust	**(55,000)**	—	(2,300)
Excess tax benefits from equity-based payment arrangements	**—**	—	598
Other financing transactions	**(1,964)**	(1,656)	(1,950)
Net cash (used) by financing activities	**(221,569)**	(75,658)	(119,860)
Effect of exchange rate changes on cash	**1,541**	10,433	(3,751)
Increase (decrease) in cash, cash equivalents and restricted cash	**(259,263)**	43,032	13,025
Cash, cash equivalents and restricted cash at beginning of year	**386,969**	343,937	330,912
Cash, cash equivalents and restricted cash at end of year	**$127,706**	$ 386,969	$343,937
SUPPLEMENTAL CASH FLOW INFORMATION			
Interest paid	**$36,689**	$ 33,801	$34,150
Income taxes paid, net of refunds	**34,214**	44,205	41,517

Unsecured notes issued for acquisitions	—	—	1,280

See accompanying Notes to Consolidated Financial Statements.

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Notes to Consolidated Financial Statements
(dollars in thousands, except per share data)

Note 1 - Summary of Significant Accounting Policies

Consolidation: The consolidated financial statements include the accounts of Moog Inc. and all of our U.S. and foreign subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

Fiscal Year: Our fiscal year ends on the Saturday that is closest to September 30. The consolidated financial statements include 52 weeks for the years ended September 29, 2018, September 30, 2017 and October 1, 2016.

Operating Cycle: Consistent with industry practice, aerospace and defense related inventories, unbilled recoverable costs and profits on long-term contract receivables, customer advances, warranties and contract loss reserves include amounts relating to contracts having long production and procurement cycles, portions of which are not expected to be realized or settled within one year.

Foreign Currency Translation: Assets and liabilities of subsidiaries that prepare financial statements in currencies other than the U.S. dollar are translated using rates of exchange as of the balance sheet date and the statements of earnings are translated at the average rates of exchange for each reporting period.

Use of Estimates: The preparation of financial statements in conformity with U.S. generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates and assumptions.

Revenue Recognition: We recognize revenue using either the percentage of completion method for contracts or as units are delivered or services are performed.

Percentage of completion method for contracts: Revenue representing 39%, 38% and 34% of 2018, 2017 and 2016 sales, respectively, was accounted for using the percentage of completion, cost-to-cost method of accounting. This method of revenue recognition is predominantly used within the Aircraft Controls and Space and Defense Controls segments due to the contractual nature of the business activities, with the exception of their respective aftermarket activities. The contractual arrangements are either firm fixed-price or cost-plus contracts and are primarily with the U.S. Government or its prime subcontractors, foreign governments or commercial aircraft manufacturers, including Boeing and Airbus. The nature of the contractual arrangements includes customers' requirements for delivery of hardware as well as funded nonrecurring development work in anticipation of follow-on production orders.

Revenue on contracts using the percentage of completion, cost-to-cost method of accounting is recognized as work progresses toward completion as determined by the ratio of cumulative costs incurred to date to estimated total contract costs at completion, multiplied by the total estimated contract revenue, less cumulative revenue recognized in prior periods. Changes in estimates affecting sales, costs and profits are recognized in the period in which the change becomes known using the cumulative catch-up method of accounting, resulting in the cumulative effect of changes reflected in the period. Estimates are reviewed and updated quarterly for substantially all contracts. A significant change in an estimate on one or more contracts could have a material effect on our results of operations.

Occasionally, it is appropriate to combine or segment contracts. Contracts are combined in those limited circumstances when they are negotiated as a package in the same economic environment with an overall profit margin objective and constitute, in essence, an agreement to do a single project. In such cases, revenue and costs are recognized over the performance period of the combined contracts as if they were one. Contracts are segmented in limited circumstances if the customer had the right to accept separate elements of the contract and the total amount of the proposals on the separate components approximated the amount of the proposal on the entire project. For segmented contracts, revenue and costs are recognized as if they were separate contracts over the performance periods of the individual elements or phases.

Contract costs include only allocable, allowable and reasonable costs, as determined in accordance with the Federal Acquisition Regulations and the related Cost Accounting Standards for applicable U.S. Government contracts, and are included in cost of sales when incurred. The nature of these costs includes development engineering costs and product manufacturing costs including direct material, direct labor, other direct costs and indirect overhead costs. Contract profit is recorded as a result of the revenue recognized less costs incurred in any reporting period. Amounts representing performance incentives, penalties, contract claims or change orders are considered in estimating revenues, costs and profits when they can be reliably estimated and realization is considered probable. Revenue recognized on contracts for unresolved claims or unapproved contract change orders was not material for 2018, 2017 or 2016.

For contracts with anticipated losses at completion, a provision for the entire amount of the estimated remaining loss is charged against income in the period in which the loss becomes known. Contract losses are determined considering all direct and indirect contract costs, exclusive of any selling, general or administrative cost allocations that are treated as period expenses. Loss reserves are more common on firm fixed-price contracts that involve, to varying degrees, the design and development of new and unique controls or control systems to meet the customers' specifications. Contract-related loss reserves are recorded for the additional work needed on completed and delivered products in order to meet contract specifications.

As units are delivered or services are performed: Revenue representing 61%, 62% and 66% of 2018, 2017 and 2016 sales, respectively, were recognized as units were delivered or as service obligations were satisfied. Revenue is recognized when the risks and rewards of ownership and title to the product are transferred to the customer. When engineering or similar services are performed, revenue is recognized upon completion of the obligation including any delivery of engineering drawings or technical data. This method of revenue recognition is predominantly used within the Industrial Systems segment, as well as with aftermarket activity. Profits are recorded as costs are relieved from inventory and charged to cost of sales and as revenue is recognized. Inventory costs include all product manufacturing costs such as direct material, direct labor, other direct costs and indirect overhead cost allocations.

Shipping and Handling Costs: Shipping and handling costs are included in cost of sales.

Research and Development: Research and development costs are expensed as incurred and include salaries, benefits, consulting, material costs and depreciation.

Bid and Proposal Costs: Bid and proposal costs are expensed as incurred and classified as selling, general and administrative expenses.

Equity-Based Compensation: Our equity-based compensation plans allow for various types of equity-based incentive awards. The types and mix of these incentive awards are evaluated on an on-going basis and may vary based on our overall strategy regarding compensation. Equity-based compensation expense is based on awards that are ultimately expected to vest over the requisite services periods and are based on the fair value of the award measured on the grant date. Vesting requirements vary for directors, officers and key employees. In general, awards granted to officers and key employees principally vest over three years, in equal annual installments for time-based awards and in three years cliff vest for performance-based awards. Equity-based compensation expense is included in selling, general and administrative expenses.

Cash and Cash Equivalents: All highly liquid investments with an original maturity of three months or less are considered cash equivalents.

Restricted Cash: Restricted cash of $2,122 and $18,896 at September 29, 2018 and September 30, 2017 is included in Other assets on the Consolidated Balance Sheets and represents funds held to satisfy long term supplemental retirement obligations.

Allowance for Doubtful Accounts: The allowance for doubtful accounts is based on our assessment of the collectibility of customer accounts. The allowance is determined by considering factors such as historical experience, credit quality, age of the accounts receivable balances and current economic conditions that may affect a customer's ability to pay.

Inventories: Inventories are stated at the lower-of-cost-or-market with cost determined primarily on the first-in, first-out (FIFO) method of valuation.

Property, Plant and Equipment: Property, plant and equipment are stated at cost. Plant and equipment are depreciated principally using the straight-line method over the estimated useful lives of the assets, generally ranging from 15 to 40 years for buildings and improvements, 5 to 15 years for machinery and equipment and 3 to 7 years for computer equipment and software. Leasehold improvements are amortized on a straight-line basis over the term of the lease or the estimated useful life of the asset, whichever is shorter.

Goodwill: We test goodwill for impairment at the reporting unit level on an annual basis or more frequently if an event occurs or circumstances change that indicate that the fair value of a reporting unit is likely to be below its carrying amount. We also test goodwill for impairment when there is a change in reporting units. We may elect to perform a qualitative assessment that considers economic, industry and company-specific factors for all or selected reporting units. If, after completing this assessment, it is determined that it is more likely than not that the fair value of a reporting unit is less than its carrying value, we proceed to a quantitative test. We may also elect to perform a quantitative test instead of a qualitative test for any or all of our reporting units.

Quantitative testing requires a comparison of the fair value of each reporting unit to its carrying value. We typically use the discounted cash flow method to estimate the fair value of our reporting units. The discounted cash flow method incorporates various assumptions, the most significant being projected revenue growth rates, operating margins and cash flows, the terminal growth rate and the weighted-average cost of capital. If the carrying value of the reporting unit exceeds its fair value, goodwill is considered impaired and any loss must be measured. To determine the amount of the impairment loss, the implied fair value of goodwill is determined by assigning a fair value to all of the reporting unit's assets and liabilities, including any unrecognized intangible assets, as if the reporting unit had been acquired in a business combination at fair value. If the carrying amount of the reporting unit goodwill exceeds the implied fair value of that goodwill, an impairment loss would be recognized in an amount equal to that excess.

We recorded a $4,800 goodwill impairment charge in 2016 in the additive manufacturing reporting unit within our Space and Defense Controls segment. There were no impairment charges recorded in 2018 or 2017.

Acquired Intangible Assets: Acquired identifiable intangible assets are recorded at cost and are amortized over their estimated useful lives.

Impairment of Long-Lived Assets: Long-lived assets, including acquired identifiable intangible assets, are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of those assets may not be recoverable. We use undiscounted cash flows to determine whether impairment exists and measure any impairment loss using discounted cash flows.

In 2018, we recorded $14,382 of impairment charges in our Industrial Systems segment. These charges relate to intangible assets and equipment that will no longer be used as a result of restructuring actions taken for the wind pitch control business we are exiting. These charges are included in restructuring in the consolidated statements of earnings.

In 2017, we recorded $1,378 of impairment charges in our Space and Defense Controls segment. These charges relate to a write down on the value of equipment that no longer meets production requirements and is held for sale. These charges are included as other expense in the consolidated statements of earnings.

In 2016, we recorded $4,913 of impairment charges in our Aircraft Controls segment. These charges primarily related to intangible assets as a result of restructuring actions taken for a product line we are no longer pursuing. These charges are included in restructuring in the consolidated statements of earnings.

Financial Instruments: Our financial instruments consist primarily of cash and cash equivalents, receivables, notes payable, accounts payable, long-term debt, interest rate swaps and foreign currency contracts. The carrying values for our financial instruments approximate fair value with the exception at times of long-term debt. We do not hold or issue financial instruments for trading purposes.

We carry derivative instruments on the consolidated balance sheets at fair value, determined by reference to quoted market prices. The accounting for changes in the fair value of a derivative instrument depends on whether it has been designated and qualifies as part of a hedging relationship and, if so, the reason for holding it. Our use of derivative instruments is generally limited to cash flow hedges of certain interest rate risks and minimizing foreign currency exposure on foreign currency transactions, which are typically designated in hedging relationships, and intercompany balances, which are not designated as hedging instruments. Cash flows resulting from forward contracts are accounted for as hedges of identifiable transactions or events and classified in the same category as the cash flows from the items being hedged.

Reclassifications: Certain prior year amounts have been reclassified to conform to current year's presentation. Effective October 1, 2017, we made changes to our segment reporting structure that resulted in three reporting segments. Our former Components segment has been separated and merged into Space and Defense Controls and Industrial Systems. The Goodwill, Restructuring and Segment footnotes have been restated to reflect these changes. The Consolidated Statements of Cash Flows has been restated for the classification of restricted cash invested for long term supplemental retirement obligations. This resulted in an increase to net cash from investing activities of $87 in 2017 and a decrease in net cash from investing activities of $2,250 in 2016, which management does not consider to be material.

Refer to the following table for a summary of ASUs we adopted during 2018 and the related financial statement impact. The Statement of Comprehensive Income, Statement of Shareholder's Equity and Income Taxes and AOCIL footnotes have been restated to reflect these changes.

Recent Accounting Pronouncements:

Recent Accounting Pronouncements Adopted

Standard	Description	Financial Statement Effect or Other Significant Matters
ASU no. 2018-02 Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income	The standard amends existing guidance and allows a reclassification from accumulated other comprehensive income (loss) to retained earnings for stranded deferred tax effects resulting from the Tax Cuts and Jobs Act. The standard requires certain disclosures about stranded deferred tax effects. The provisions of the standard are effective for fiscal years beginning after December 15, 2018, and interim periods within those fiscal years. Early adoption is permitted.	We adopted this standard recording the related stranded deferred tax effects in the period of adoption, resulting in $47,077 being reclassified from accumulated other comprehensive income (loss) to retained earnings as of March 31, 2018. Date early adopted: Q2 2018

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Recent Accounting Pronouncements Not Yet Adopted

Standard	Description	Financial Statement Effect or Other Significant Matters
ASU no. 2014-09 *Revenue from Contracts with Customers (And All Related ASUs)*	The standard requires revenue recognition to depict the transfer of goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. The standard also requires additional disclosures about the nature, amount, timing and uncertainty of revenue and cash flows arising from customer contracts. The provisions of the standard, as well as all subsequently issued clarifications to the standard, are effective for fiscal years beginning after December 15, 2017 and interim periods within those fiscal years. The standard can be adopted using either a full retrospective or modified retrospective approach.	We will adopt the standard using the modified retrospective method, under which prior years' results are not restated, but supplemental information will be provided in our disclosures that will present fiscal 2019 results before adoption of the standard. In addition, a cumulative adjustment will be necessary to Shareholders' Equity at the beginning of 2019. We have implemented changes to our financial policies, information technology systems and internal controls and we are prepared to present our financial statements and the related disclosures in compliance with the standard. We have identified four revenue streams - commercial contracts, United States government contracts, repair and overhaul arrangements and foreign government and other contracts. The impact of this standard is significant on our United States government and repair and overhaul revenue streams, but will not significantly impact our commercial or foreign government and other revenue streams. For the revenue streams significantly impacted, more revenue will be recognized over time when compared to prior years, as we are creating or enhancing assets that the customer controls as the assets are being created or enhanced. We estimate the adoption of this standard to result in a cumulative adjustment of approximately \$16,000, which will be an increase to Shareholders’ Equity. Planned date of adoption: Q1 2019
ASU no. 2016-02 *Leases (And All Related ASUs)*	The standard requires most lease arrangements to be recognized in the balance sheet as lease assets and lease liabilities. The standard also requires additional disclosures about the leasing arrangements. The provisions of the standard are effective for fiscal years beginning after December 15, 2018 and interim periods within those years. Early adoption is permitted.	We are currently evaluating the effect on our financial statements and related disclosures. Planned date of adoption: Q1 2020
ASU no. 2017-07 *Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost*	The standard amends existing guidance on the presentation of net periodic benefit cost in the income statement and what qualifies for capitalization on the balance sheet. The provisions of the standard are effective for fiscal years beginning after December 15, 2017 and interim periods within those fiscal years. Early adoption is permitted as of the beginning of an annual period. The amendment requires income statement presentation provisions to be applied retrospectively and capitalization in assets provisions to be applied prospectively.	We anticipate the adoption of this standard will decrease operating expenses (Cost of sales, Research and development and Selling, general and administrative) and increase Other expense by \$6,778 for the year ended September 29, 2018 and \$12,595 for the year ended September 30, 2017. The adoption of this standard will not have a material impact on our Consolidated Balance Sheets, Consolidated Statements of Cash Flows and Notes to Consolidated Financial Statements. Planned date of adoption: Q1 2019
ASU no. 2017-12 *Targeted Improvements to Accounting for Hedging Activities*	The standard expands the hedging strategies eligible for hedge accounting, while simplifying presentation and disclosure by eliminating separate measurement and reporting of hedge ineffectiveness. The provisions of the standard are effective for fiscal years beginning after December 15, 2018 and interim periods within those fiscal years.	We are currently evaluating the effect on our financial statements and related disclosures. Planned date of adoption: Q1 2020

Early adoption is permitted.

ASU no. 2018-15 *Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That Is a Service Contract*	The standard amends ASC 350 to include in its scope implementation costs of a Cloud Computing Arrangement (CCA) that is a service contract and clarifies that a customer should apply ASC 350-40 to determine which implementation costs should be capitalized in a CCA that is considered a service contract. The ASU is effective for fiscal years beginning after December 15, 2019 and interim periods within those fiscal years. Early adoption is permitted. The amendments should be applied either retrospectively or prospectively to all implementation costs incurred after the date of adoption.	We are currently evaluating the effect on our financial statements and related disclosures. Planned date of adoption: Q1 2021

We consider the applicability and impact of all ASUs. ASUs not listed above were assessed and determined to be either not applicable, or had or are expected to have minimal impact on our financial statements and related disclosures.

Note 2 - Acquisitions, Divestitures and Equity Method Investments

On April 30, 2018, we acquired Electro-Optical Imaging, a designer and manufacturer of video trackers and imaging products, located in Florida, for a purchase price net of acquired cash of $5,442. This operation is included in our Space and Defense Controls segment. The purchase price allocation is subject to adjustments as we obtain additional information for our estimates during the measurement period.

On March 29, 2018, we acquired a 100% ownership interest in VUES Brno s.r.o located in the Czech Republic, which includes a 74% ownership interest in a subsidiary located in Germany. The purchase price, net of acquired cash, was $64,140, consisting of $42,961 in cash and $21,179 of assumed debt. VUES designs and manufactures customized electric motors, generators and solutions. This operation is included in our Industrial Systems segment. The purchase price allocation is subject to adjustments as we obtain additional information for our estimates during the measurement period. On September 6, 2018, we acquired the remaining 26% noncontrolling interest for $1,843 in cash. The difference between the cash paid and the adjustment to the noncontrolling interest is reflected in additional paid-in capital.

On October 3, 2017, we, in collaboration with SIA Engineering Company, announced the joint venture company, Moog Aircraft Services Asia ("MASA"), in Singapore, of which we currently hold a 51% ownership. MASA is intended to provide maintenance, repair and overhaul services for our manufactured flight control systems. As we hold a majority ownership in MASA, but share voting control, we are accounting for this investment using the equity method. As of September 29, 2018, we have made total contributions of $5,100. This operation is included in our Aircraft Controls segment.

In 2018, we sold a non-core business of our Space and Defense Controls segment for $5,486 in cash, plus a $584 note receivable and recorded losses in other expense of $1,792.

On April 2, 2017, we acquired Rotary Transfer Systems, a manufacturer of electromechanical systems, located in Germany and France for a purchase price, net of acquired cash, of $42,593, consisting of $40,545 in cash and $2,048 in assumed pension obligations. This operation is included in our Industrial Systems segment.

In 2017, we sold non-core businesses of our Space and Defense Controls segment for $7,210 in cash and recorded losses in other expense of $13,119 related to the sales.

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Note 3 - Receivables

Receivables consist of:

	September 29, 2018	September 30, 2017
Accounts receivable	**$ 295,180**	$ 286,773
Long-term contract receivables:		
Amounts billed	**156,414**	148,087
Unbilled recoverable costs and accrued profits	**316,489**	282,154
Total long-term contract receivables	**472,903**	430,241
Other	**30,787**	15,077
Less allowance for doubtful accounts	**(4,959)**	(4,351)
Receivables	**$ 793,911**	$ 727,740

Under our trade receivables securitization facility (the "Securitization Program"), we securitize certain trade receivables in transactions that are accounted for as secured borrowings. We maintain a subordinated interest in a portion of the pool of trade receivables that are securitized. The retained interest, which is included in receivables in the consolidated balance sheets, is recorded at fair value, which approximates the total amount of the designated pool of accounts receivable. See Note 7, Indebtedness, for additional disclosures related to the Securitization Program.

Long-term contract receivables are primarily associated with prime contractors and subcontractors in connection with U.S. Government contracts, as well as commercial aircraft and satellite manufacturers. Amounts billed under long-term contracts to the U.S. Government were $6,106 at September 29, 2018 and $2,966 at September 30, 2017. Unbilled recoverable costs and accrued profits under long-term contracts to be billed to the U.S. Government were $25,915 at September 29, 2018 and $16,720 at September 30, 2017. Unbilled recoverable costs and accrued profits principally represent revenues recognized on contracts that were not billable on the balance sheet date. These amounts will be billed in accordance with contract terms, generally as certain milestones are reached or upon shipment. Approximately 99% of unbilled amounts are expected to be collected within one year. In situations where billings exceed revenues recognized, the excess is included in customer advances.

There are no material amounts of claims or unapproved change orders included in the consolidated balance sheets. There are no material balances billed but not paid by customers under retainage provisions.

Concentrations of credit risk on receivables are limited to those from significant customers who are believed to be financially sound. Receivables from Boeing were $178,798 at September 29, 2018 and $142,876 at September 30, 2017. We perform periodic credit evaluations of our customers' financial condition and generally do not require collateral.

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Note 4 - Inventories

Inventories, net of reserves, consist of:

	September 29, 2018	September 30, 2017
Raw materials and purchased parts	**$ 197,071**	$ 189,517
Work in progress	**240,885**	229,202
Finished goods	**74,566**	70,408
Inventories	**$ 512,522**	$ 489,127

There are no material inventoried costs relating to long-term contracts where revenue is accounted for using the percentage of completion, cost-to-cost method of accounting as of September 29, 2018 and September 30, 2017.

Note 5 - Property, Plant and Equipment

Property, plant and equipment consists of:

	September 29, 2018	September 30, 2017
Land	**$ 33,788**	$ 29,191
Buildings and improvements	**446,709**	421,879
Machinery and equipment	**743,388**	709,382
Computer equipment and software	**145,817**	133,699
Property, plant and equipment, at cost	**1,369,702**	1,294,151
Less accumulated depreciation and amortization	**(816,837)**	(771,160)
Property, plant and equipment, net	**$ 552,865**	$ 522,991

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Note 6 - Goodwill and Intangible Assets

The changes in the carrying amount of goodwill are as follows:

	Aircraft Controls	Space and Defense Controls	Industrial Systems	Total
Balance at October 3, 2015	$188,525	$245,323	$303,364	$737,212
Acquisition	—	21,076	—	21,076
Impairment	—	(4,800)	—	(4,800)
Foreign currency translation	(8,831)	(117)	(4,378)	(13,326)
Balance at October 1, 2016	179,694	261,482	298,986	740,162
Acquisition	—	—	26,566	26,566
Divestitures	—	(1,804)	—	(1,804)
Foreign currency translation	1,681	273	7,390	9,344
Balance at September 30, 2017	181,375	259,951	332,942	774,268
Acquisitions	—	3,769	27,329	31,098
Divestitures	—	(1,836)	—	(1,836)
Foreign currency translation	(1,468)	(152)	(4,693)	(6,313)
Balance at September 29, 2018	**$179,907**	**$261,732**	**$355,578**	**$797,217**

In 2018, we changed our segment reporting structure as our former Components segment was separated and merged into Space and Defense Controls and Industrial Systems. As a result, all prior period balances for those segments were restated to reflect this change. The goodwill balance at October 3, 2015 for Space and Defense Controls and Industrial Systems increased by $87,110 and $192,521, respectively, over amounts previously reported.

Goodwill in our Space and Defense Controls segment is net of a $4,800 accumulated impairment loss at September 29, 2018.

Goodwill in our Medical Devices reporting unit, included in our Industrial Systems segment, is net of a $38,200 accumulated impairment loss at September 29, 2018.

The gross carrying amounts, accumulated amortization and amortization expense in the disclosures below reflect the full write off of intangible assets in relation to restructuring actions taken in our Industrial Systems segment. We recorded this charge during the second quarter of 2018 based on the expected cash flows over the remaining life of the assets. Refer to Note 11, Restructuring, for additional disclosures.

The components of intangible assets are as follows:

		September 29, 2018		September 30, 2017	
	Weighted-Average Life (years)	**Gross Carrying Amount**	**Accumulated Amortization**	Gross Carrying Amount	Accumulated Amortization
Customer-related	**11**	**$135,379**	**$ (96,090)**	$175,872	$ (128,019)
Technology-related	**9**	**69,393**	**(49,731)**	71,924	(55,069)
Program-related	**19**	**64,988**	**(33,740)**	66,458	(30,675)
Marketing-related	**8**	**23,489**	**(18,868)**	26,552	(19,251)
Other	**10**	**4,305**	**(3,588)**	4,379	(3,353)
Intangible assets	**12**	**$297,554**	**$ (202,017)**	$345,185	$ (236,367)

Substantially all acquired intangible assets other than goodwill are being amortized. Customer-related intangible assets primarily consist of customer relationships. Technology-related intangible assets primarily consist of technology, patents, intellectual property and software. Program-related intangible assets consist of long-term programs represented by current contracts and probable follow on work. Marketing-related intangible assets primarily consist of trademarks, trade names and non-compete agreements.

Amortization of acquired intangible assets was $17,037 in 2018, $18,518 in 2017 and $21,058 in 2016. Based on acquired intangible assets recorded at September 29, 2018, amortization is estimated to be approximately $13,400 in 2019, $11,800 in 2020, $9,700 in 2021, $8,200 in 2022 and $7,400 in 2023.

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Note 7 - Indebtedness