Mistras Group, Inc.
Form 10-K
March 18, 2019

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

Form 10-K

ý ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2018
o TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from ___ to ___

Commission File Number 001-34481

Mistras Group, Inc.
(Exact name of registrant as specified in its charter)

Delaware	22-3341267
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification Number)

195 Clarksville Road
Princeton Junction, New Jersey 08550
(Address of principal executive office)
(609) 716-4000
(Registrant's telephone number, including area code)

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

Title of each class	Name of each exchange on which registered
Common Stock, par value $.01 par value	New York Stock Exchange

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

Indicate by check mark whether the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act of 1933. Yes o No ý

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Securities Exchange Act of 1934 (the “Exchange Act”). Yes o 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 Exchange Act 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 o

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

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 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. o

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

Large accelerated filer o	Accelerated filer x
Non-accelerated filer o	Smaller reporting company o
	Emerging growth company o

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

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

The aggregate market value of the voting and non-voting common stock held by non-affiliates of the registrant, based on the closing price on June 29, 2018, the last business day of the registrant's most recently completed second fiscal quarter, as reported on the New York Stock Exchange, was approximately $327.2 million.

As of March 12, 2019, the Registrant had 28,562,708 shares of common stock outstanding

DOCUMENTS INCORPORATED BY REFERENCE

Information required by Part III (Items 10, 11, 12, 13 and 14) is incorporated by reference to portions of the registrant’s definitive proxy statement for its 2019 annual meeting of shareholders (the “Proxy Statement”), which is expected to be filed not later than 120 days after the registrant’s fiscal year ended December 31, 2018. Except as expressly incorporated by reference, the Proxy Statement shall not be deemed to be a part of this report on Form 10-K.

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ITEM 1. BUSINESS

FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K contains forward-looking statements regarding us and our business, financial condition, results of operations and prospects within the meaning of Section 27A of the Securities Act of 1933 (Securities Act), and Section 21E of the Securities Exchange Act of 1934 (Exchange Act). Such forward-looking statements include those that express plans, anticipation, intent, contingency, goals, targets or future development and/or otherwise are not statements of historical fact. These forward-looking statements are based on our current expectations and projections about future events and they are subject to risks and uncertainties known and unknown that could cause actual results and developments to differ materially from those expressed or implied in such statements.

In some cases, you can identify forward-looking statements by terminology, such as “goals,” “expects,” “anticipates,” “intends,” “plans,” “believes,” “seeks,” “estimates,” “may,” “could,” “should,” “would,” “predicts,” “appears,” “projects,” or t such terms or other similar expressions. Factors that could cause or contribute to differences in results and outcomes from those in our forward-looking statements include, without limitation, those discussed elsewhere in this Report in Part I, Item 1A. “Risk Factors,” Part 2, Item 7, “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and in this Item 1, as well as those discussed in our other Securities and Exchange Commission (SEC) filings. We undertake no obligation to (and expressly disclaim any obligation to) revise or update any forward-looking statements made herein whether as a result of new information, future events or otherwise. However, you should consult any further disclosures we may make on these or related topics in our reports on Form 8-K or Form 10-Q filed with the SEC.

The following discussions should be read in conjunction with the sections of this Report entitled “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and “Risk Factors.”

Transition Period

On January 3, 2017, the Company's Board of Directors approved a change in the Company's fiscal year end from May 31 to December 31, effective December 31, 2016. In connection with this change, we previously filed a Transition Report on Form 10-K to report the results of the seven-month transition period from June 1, 2016 to December 31, 2016. In this Annual Report, the periods presented are the years ended December 31, 2018 and 2017, the seven-month transition period from June 1, 2016 to December 31, 2016 (which we sometimes refer to as the "transition period ended December 31, 2016") and the year ended May 31, 2016 (which we sometimes refer to as "fiscal 2016"). For comparison purposes, we have also included unaudited data for the year ended December 31, 2016 and for the seven months ended December 31, 2015.

OUR BUSINESS

Asset Protection Industry Overview

We offer our customers “OneSource for Asset Protection Solutions®” and are a leading global provider of technology-enabled asset protection solutions used to evaluate the safety, structural integrity and reliability of critical energy, industrial and public infrastructure.

Our asset protections are intended to help maximize safety and uptime of our customers' assets and facilities. These mission critical solutions enhance our customers’ ability to comply with governmental safety and environmental regulations, extend the useful life of their assets, increase productivity, minimize repair costs, manage risk and avoid catastrophic disasters.

We deliver value through a comprehensive “OneSource” portfolio of customized solutions, utilizing a proven systematic method that creates a closed-loop lifecycle for addressing continuous asset protection and improvement.

Our specialized asset protection solutions include:

- Field Inspections
- Consulting
- Maintenance
- Data Management
- Access
- Monitoring
- Laboratory Quality Assurance/Control (QA/QC)

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- Equipment

Our OneSource model emphasizes the integration of these solutions to service our clients throughout their assets' lifetimes. Under this business model, many customers outsource their inspection and other asset protection needs to us on a "run-and-maintain" basis to ensure the continued safety and structural and operational integrity of their assets. We have established long-term relationships as a critical solutions provider to many of the leading companies with asset-intensive infrastructure in our target markets. These markets include:

- Oil & Gas (Downstream, Midstream, Upstream and Petrochemical)
- Aerospace & Defense
- Industrial
- Power Generation and Transmission
- Public Infrastructure, Research and Engineering
- Process Industries

Most of our revenues are generated by deploying technicians at our customers' locations. However, the majority of our revenues from aerospace and certain manufacturing clients are generated by performing inspections and testing at our various in-house laboratories.

We generated revenues of $742.4 million, $701.0 million and $404.2 million, for the years ended December 31, 2018 and 2017 and the transition period ended December 31, 2016, respectively, and net income of $6.8 million for the year ended December 31, 2018, net loss of $2.2 million for the year ended December 31, 2017 and net income of $9.6 million for the transition period ended December 31, 2016. We generated revenues of $719.2 million and net income of $24.7 million for fiscal 2016. For the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016, and fiscal 2016, we generated approximately 77%, 78%, 73% and 77%, respectively, of our revenues from our Services segment. Our revenues are diversified, with our top ten customers accounting for approximately 34%, 38%, 37% and 36% of our revenues during the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and fiscal 2016, respectively.

OUR SPECIALIZED SOLUTIONS

As a OneSource provider of asset protection solutions, MISTRAS combines our industry-leading services, products and technologies to provide a unique, custom-tailored solution for each customer's individual asset protection need, ranging from routine inspections to complex, plant-wide asset integrity management.

Field Inspections

Our field inspections portfolio includes traditional and advanced Non-Destructive Testing (NDT) techniques, along with predictive maintenance (PdM) assessments of fixed and rotating assets. We offer these solutions on an individual basis, or as parts of plant-wide inspection and testing programs.

NDT is the examination of an asset without materially impacting its integrity. The ability to inspect infrastructure assets and not interfere with their operating performance makes NDT a highly-attractive alternative to many traditional techniques, which may require shutting down an asset or entire facility. Typical issues that MISTRAS technicians inspect for include corrosion, cracking, leaking, faults and flaws in piping, storage tanks, pressure vessels and a wide range of other industrial assets.

Field inspection services lend themselves to integration with our other offerings, and as such have often served as the initial entry point to more advanced customer engagements that require additional solutions. After an initial field inspection is performed, MISTRAS is able to provide multiple supplemental solutions that further serve to solidify our relationships with our clients and drive additional revenue.

Consulting

We provide a broad range of engineering consulting services, primarily for process equipment, technologies and facilities. Our engineering consultations include plant operations and management support, turnaround/shutdown planning, profit improvement, facilities planning studies, engineering design, process safety reviews, energy optimization evaluations, benchmarking/key performance indicator (KPI) development and technical training.

Our Asset Integrity Management/Mechanical Integrity (AIMS/MI) services help improve asset reliability and regulatory compliance through a systematic, engineering-based approach to ensure the ongoing integrity and safety of equipment and industrial facilities. AIMS/MI services can include conducting an inventory of infrastructure assets; developing, implementing and training personnel in executing inspection and maintenance procedures; and managing MI programs. We help to identify

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gaps between existing and desired practices and establish quality assurance standards for fabrication, engineering and installation of infrastructure assets.

Maintenance

We perform maintenance and light mechanical services to prepare assets for inspection and to return them to working condition post inspection. These services include corrosion removal, mitigation and prevention; insulation installation and removal; electrical services; heat tracing, industrial cleaning; pipefitting; and welding. Our light mechanical services are often offered as complementary, value-added solutions to inspections, such as removing insulation in order to inspect piping, then re-installing insulation.

Our multi-disciplined technicians offer maintenance and light mechanical services in hard-to-access areas, in combination with rope access or diving strategies.

Mechanical services are still a small part of our business, and we carefully try to avoid providing any such services that conflict with our inspection services.

Data Management

Our world-class enterprise inspection database management software (IDMS) - Plant Condition Management Software (PCMS®) - was developed specifically for process industries and equipment, and enables the storage, organization and analysis of inspection data.

PCMS offers wide-ranging support for mechanical integrity programs, including:

- Comprehensive inspection tracking, scheduling and analysis
- Corrosion analysis & trending
- Integrated risk-based inspection (RBI) calculators
- Safety relief valve management

PCMS compares data to prior operations, similar assets, industrial standards and specific risk conditions, such as use with highly-flammable or corrosive materials. It also develops asset integrity management plans based on RBI calculations that specify an optimal schedule for the testing, maintenance and retirement of assets.

In many instances, customers of our field inspections and consulting services also have licensed PCMS for storage and analysis of collected inspection and MI data.

We believe PCMS is one of the most widely used plant condition management software systems in North American refineries. We estimate it is currently used by approximately 50% of the U.S. refining capacity, as well as by leading midstream pipeline energy companies and major energy companies in Canada and Europe. This provides us with recurring maintenance and support fees and additional marketing opportunities for additional software and solutions.

MISTRAS also digitizes the transfer of field inspections to inspection data management systems (IDMS). MISTRAS Digital™ is an electronic platform that digitally delivers field inspection assignments and related data, captures inspection results, and delivers electronic reporting and productivity tracking via Key Performance Indicators (KPIs). MISTRAS Digital integrates with MISTRAS' PCMS and other inspection data management systems to provide additional productivity improvements.

Access

Much of our work is conducted in hard-to-access locations, including those in at-height, subsea and confined locations. We utilize scaffolding and rope access to access at-height and confined assets; certified divers for subsea inspection and maintenance; and unmanned aerial, land-based and subsea systems for a wide range of inspection applications, with an emphasis on minimizing at-height access and confined space entry (CSE).

Monitoring

Our online condition-monitoring solutions provide real-time reports and analysis of infrastructure to alert facility personnel to damages before critical failures occur. These monitoring solutions are often installed in hazardous or hard-to-reach locations, helping to enhance safety by reducing the need to send technicians into unsafe locations. We offer monitoring solutions for a wide range of assets and applications, including:

- Bridge Structural Health Monitoring (SHM)

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- Power Transformer Health & Reliability
- Stator Vane Cracking
- Through-Valve Leaking
- Tube Leaking
- Wall Thickness Tracking

We offer a variety of secure, web-based solutions that monitor structural integrity and analyze conditions against our library of historical inspection data, allowing users to stay aware of potential concerns and prioritize future inspections and maintenance. We also offer custom-developed software that integrates into onsite IDMSs, stores and trends monitoring data and provides immediate automated data analysis.

We provide continuous, periodic and conditional monitoring, depending on the type of asset and its operating condition. Continuous monitoring is applied on critical assets to observe the earliest onset of a defect to predict its progress and to track its progression to avoid catastrophic failure. Periodic monitoring, or “walk around” monitoring, is a preventative maintenance technique to observe changes in an asset's condition over a specified period of time. Conditional monitoring solutions are typically used when there is a known defect that needs to be monitored until the asset is repaired or replaced.

Laboratory Quality Assurance/Control (QA/QC)

Our network of in-house laboratories located across North America and Europe offer quality assurance and quality control (QA/QC) solutions for new and existing metal and alloy components, materials and composites.

Our in-house labs work with our clients throughout their components’ lifetimes, from preparation and production to post-processing and in-service component monitoring. MISTRAS’ laboratory QA/QC solutions help to meet customer needs throughout their manufacturing cycles, with a focus on optimizing production logistics. Our in-house lab solutions include:

- Non-destructive testing (NDT)
- Destructive testing (DT)
- Metallurgical testing
- Chemical analysis testing
- Mechanical services
- Pre-machining
- Finishing services

We often inspect and test components prior to assembly to screen for defects and discontinuities introduced in the manufacturing process. We also inspect existing components to ensure they remain fit-for-purpose.

Our labs hold a wide variety of certifications that allow them to perform inspections to meet or exceed stringent regulatory requirements, such as: Nadcap (formerly NADCAP, the National Aerospace and Defense Contractors Accreditation Program), AS9100/ISO-9001, Federal Aviation Administration (FAA) Repair Station, the International Traffice in Arms Regulations/Export Administration Regulations (ITAR/EAR) and manufacturers' requirements. With these certifications comes a comprehensive range of approvals from prime contractors of major projects, militaries, and internationally-renowned original equipment manufacturers (OEMs) from many of our key markets, including the oil and gas, aerospace and defense, power generation, and industrial markets.

Equipment

We design and manufacture portable, handheld, wireless and turnkey NDT equipment, along with corresponding data acquisition sensors and software, for spot inspections and long-term, unattended monitoring applications.

We sell these solutions as individual components, or as complete systems, which include a combination of sensors, an amplifier, signal processing electronics, knowledge-based software and decision and feedback electronics. We also sell integrated service-and-system technology packages, in which our field technicians utilize our proprietary and specialized testing procedures and hardware, advanced pattern recognition, neural network software and databases to compare test results against our prior testing data or industry standards.

In addition to other NDT and vibration equipment, we provide a range of acoustic emission (AE) products and are a leader in the design and manufacture of AE sensors, instruments and turnkey systems used for monitoring and testing materials, pressure components, processes and structures.

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Most of our hardware products are fabricated, assembled and tested in our ISO-9001-certified facility in Princeton Junction, New Jersey. We also design and manufacture automated ultrasonic systems and scanners in France.

Centers of Excellence

Another differentiator in our business model are our Centers of Excellence (COEs), which offer support for asset, technology, or industry-specific solutions. Our subject matter experts engage in strategic sales opportunities to offer customers value-added solutions using advanced technologies and methods. The COEs help to standardize our approach to common problems in our key market segments. Our COEs include:

- Acoustic Emission
- Aerospace
- American Petroleum Institute (API) Turnarounds
- AIMS/MI/Engineering
- Automated Ultrasonics
- Fossil Power
- Guided Wave Ultrasonics
- Infrastructure
- PCMS Software & Services
- Mechanical Services
- Nuclear Power
- Offshore
- Phased Array
- Pipeline
- Power Generation
- Predictive Maintenance
- Refractory Inspection
- Rope Access/Wind
- Substation Reliability
- Tank Inspection
- Transportation
- Tube Inspection
- Unmanned Systems

ASSET PROTECTION INDUSTRY OVERVIEW

Asset protection plays a crucial role in assuring the integrity and reliability of critical infrastructure. As an asset protection solutions provider, MISTRAS seeks to maximize the uptime and safety of critical infrastructure, by helping clients to detect, locate, mitigate and prevent damages such as corrosion, cracks, leaks, manufacturing flaws and other concerns to operating and structural integrity. In addition to these core utilities, the storage and analysis of collected inspection and mechanical integrity data is also a key aspect of asset protection.

NDT has historically been a prominent solution in the asset protection industry due to its capacity to detect defects without compromising the integrity of the tested materials or equipment. The supply of NDT inspection services has traditionally come from many small vendors, who provide services to a small geographic region. A trend has emerged, however, for customers to engage a select few vendors capable of providing a wider spectrum of asset protection solutions for global infrastructure, in addition to an increased demand for advanced non-destructive testing (ANDT) solutions and data acquisition software, both of which require a highly-trained workforce.

Due to these trends, those vendors offering integrated solutions, scalable operations skilled personnel and a global footprint will have a distinct competitive advantage. Moreover, we believe that vendors that are able to effectively deliver both advanced solutions and data analytics, by virtue of their access to customers' data, create a significant barrier to entry for competitors, leading to the opportunity to further create significant recurring revenues.

Key Dynamics of the Asset Protection Industry

We believe the following represent key dynamics of the asset protection industry, and that the market available to us will continue to grow as these macro-market trends continue to develop:

Extending the Useful Life of Aging Infrastructure While Increasing Utilization. Due to the prohibitive costs and challenges of building new infrastructure, many companies have chosen to extend the useful life of existing assets through enhancements,

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rather than replacing these assets. This has resulted in the significant aging and increased utilization of existing infrastructure in our target markets. Increasing demand for refined petroleum products, combined with high plant-utilization rates, is driving refineries to upgrade facilities to make them more efficient and expand capacities. Because aging infrastructure requires more frequent inspection and maintenance in comparison to new infrastructure, companies and public authorities continue to spend on asset protection to ensure their aging infrastructure assets continue to operate effectively.

Outsourcing of Non-Core Activities and Technical Resource Constraints. Due to the increasing sophistication and automation of NDT programs, a decreasing supply of skilled professionals and increasing governmental regulations, companies are increasingly outsourcing NDT to third-party providers with advanced solution portfolios, engineering expertise and trained workforces.

Increasing Corrosion from Low-Quality Inputs. The increased availability and low cost of crude oil from areas such as shale plays and oil sands resources have led to the use of lower-grade raw materials and feedstock. This leads to higher rates of corrosion, especially in refining processes involving petroleum with higher sulfur content. This increases the need for asset protection solutions to detect and/or proactively prevent corrosion-related issues.

Increasing Use of Advanced Materials. Customers in various of our target markets - particularly aerospace and defense - are increasingly utilizing advanced materials, such as composites and other unique technologies in their assets. These materials often cannot be tested using traditional NDT techniques. We believe that demand for more advanced testing and assessment solutions will increase along with the demand for these advanced materials during the design, manufacturing, operating and quality control phases.

Meeting Safety Regulations. Owners and operators of refineries, pipelines and petrochemical and chemical plants increasingly face strict government regulations and more stringent process safety enforcement standards. This includes the continued implementation of the Occupational Safety and Health Administration’s (OSHA) National Emphasis Program (NEP). Failure to meet these standards can result in significant financial liabilities, increased scrutiny by government and industry regulators, higher insurance premiums and tarnished corporate brand value. As a result, these owners and operators are seeking highly-reliable asset protection suppliers with a track record of assisting organizations in meeting increasingly stringent regulations. Our clients benefit from MISTRAS’ extensive engineering consulting base that supports them in devising mechanical integrity programs that both meet regulatory compliance standards and enable enhanced safety and uptime at their facilities.

Expanding Addressable End-Markets. The continued emergence of and advances in asset protection technologies and software-based systems are increasing the demand for asset protection solutions in applications where existing techniques were previously ineffective.

Expanding Aerospace Industry. We believe that increased demand will continue to come from the aerospace industry due to the approximately decade-long backlog for next-generation commercial aircraft to be built, driving the need for advanced solutions that drive cost and quality efficiencies.

Crude Oil Prices. Throughout most of 2018, crude oil prices have continued to rebound, although during the last two months of 2018, they declined. They have already started to rebound in early 2019, and we believe that spending on maintenance shutdowns in 2019 should remain steady with 2018 levels. This demand will be balanced against the continued focus on process efficiencies and cost savings initiatives.

Our Competitive Strengths

We believe the following competitive strengths contribute to our being a leading provider of asset protection solutions and will allow us to further capitalize on growth opportunities in our industry:

One Source Provider for Asset Protection Solutions®. We believe we have one of the most comprehensive portfolios of integrated asset protection solutions worldwide, which positions us to be the leading single-source provider for our customers’ asset protection requirements. This is particularly a competitive strength in regards to turnarounds and shutdowns - during which facilities temporarily cease operations in order to perform plant-wide inspections, maintenance and repairs - as these work stoppages make up significant portions of refinery, process and power plant maintenance budgets. Demand for our solutions increases during these outages, as facilities seek third-party providers to perform a wide spectrum of asset protection operations while the plant is offline. In addition, as companies are increasingly outsourcing their NDT needs to third-party providers, we believe that the ability to offer a comprehensive

package of solutions provides us with a competitive advantage.

Long-Standing Trusted Provider to a Diversified and Growing Customer Base. We have become a trusted partner to a large and growing customer base across numerous global markets through our proven, decades-long track record of successful operations. Our customers include some of the largest and most well-recognized firms in the oil and gas, chemicals, power generation and aerospace and defense industries, as well as public authorities.

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Repository of Customer-Specific Inspection Data. Through our enterprise data management and analysis software, PCMS, we have accumulated extensive, proprietary process data that allows us to provide our customers with value-added services, such as benchmarking, risk-based inspection (RBI) and reliability-centered maintenance (RCM).
Proprietary Products, Software and Technology Packages. Our deep knowledge base in asset protection services and equipment enable us to offer technology packages, in which our field technicians utilize our proprietary and specialized testing procedures and hardware, advanced pattern recognition, neural network software and databases to compare test results against our prior testing data or national and international structural integrity standards.
Deep Domain Knowledge and Extensive Industry Experience. We have extensive asset protection experience and data, dating back several decades of operations. We have gained this through our industry leadership in developing advanced asset protection solutions, including research and development of advanced NDT technologies and applications; process engineering technologies; online plant asset integrity management with sensor fusion; and enterprise software solutions for plant-wide and fleet-wide inspection data archiving and management.
Technological Research and Development. The NDT industry continues to move towards more advanced, automated solutions, requiring service providers to find safer and more cost-efficient inspection techniques. We believe that we remain ahead of the technological curve by backing our extensive industry expertise with the investment of resources in research and development (R&D). Some of the advanced inspection technologies developed by our internal R&D teams include an automated radiographic testing (aRT) crawler for corrosion under insulation (CUI) inspections in aboveground pipelines; our Large Structure Inspection (LSI) scanner; and our real-time radiography (RTR) crawler for 360° inspections of pipeline girth welds.
Collaborating with Our Customers. We have historically expanded our asset protection solution portfolio in response to our customers’ unique performance specifications. Our technology packages have often been developed in close cooperation and partnership with key customers and industry organizations.
Experienced Management Team. Our management team has a track record of asset protection organizational leadership. These individuals also have successfully driven operational growth organically and through acquisitions, which we believe is important to facilitate future growth in the asset protection industry.

Our Growth Strategy

Our growth strategy emphasizes the following key elements:
Expand Our Focus in the Aerospace Industry. We believe that the introduction of next-generation airframes and aircraft engines has created an inherent demand for inspection, testing, machining and mechanical services required for the production of parts. The recent interest in the use of additive manufacturing techniques to create components also necessitates advanced inspection and testing solutions. The Company consummated two acquisitions of aerospace inspection companies in 2017 and won a key European contract in 2016. These recent actions are driven by our increased focus to provide solutions to our clients throughout their manufacturing value chains in this growing area.
Expand Our Focus in the Pipeline Integrity Industry. MISTRAS intends to continue broadening our solutions for the pipeline market. Recent industry regulations significantly expanded pipeline integrity management regulations, requiring pipeline owner/operators to inspect, document, and assess the risk of operating conditions for existing lines. This provide MISTRAS, with the opportunity to provide asset protection solutions for both the new construction and integrity phases. We acquired an inline inspection provider based in Canada in 2018 and have implemented our PCMS software for several pipeline operators to support their integrity data management.
Expanding our Mechanical Services Portfolio. We believe that performing mechanical services to complement inspections, such as removing and reapplying insulation or preparing surfaces for coating or painting, is an important market differentiator for us. This is particularly true when considering the cost-efficiencies our customers realize when our rope access technicians perform these services at height without the use of scaffolding. Many of our customers already require these services, but utilize multiple vendors to do so, creating an opportunity for us to provide greater value to a customer base that increasingly requires enhanced speed and efficiency.
Continue to Develop Technology-Enabled Asset Protection Solutions. We intend to maintain and enhance our technological leadership by continuing to invest in developing new technology, applications and data services. We intend to continue deepening synergies between our solutions to provide our customers with uniquely-integrated offerings, which we believe makes us a more attractive vendor for clients seeking to centralize their asset protection.

We also intend to continue to develop technologies that enhance the flow of data throughout multiple operational phases and facilities.

Expand our Solution Offerings to Existing Customers. We believe that branching into adjacent, complementary services, such as mechanical services, increases our value proposition and our ability to capture additional business. Many of our customers

are multinational corporations with asset protection requirements at multiple locations. We believe that expanding our solution offerings, combined with the trend of customers outsourcing asset protection to service providers with integrated offerings, provides opportunities for significant additional recurring revenues.

Continue to Expand Our Customer Base into New End Markets. We believe we have significant opportunities to expand our customer base in relatively new end markets, including wind and other alternative energy, natural gas transportation industries pipeline integrity and additive manufacturing. The expansion of our addressable markets is being driven by the increased recognition and adoption of advanced asset protection technologies that are supplanting traditional methods.

Continue to Capitalize on Acquisitions. We intend to continue employing a disciplined acquisition strategy to supplement and enhance our solutions, add new customers, expand our sales channels and accelerate our growth. We believe the market contains many potential acquisition opportunities, enhanced by an increasing desire on the part of customers for a single source provider of solutions.

Our Segments

The Company has three operating segments:

Services. This segment provides asset protection solutions predominantly in North America, with the largest concentration in the United States, consisting primarily of non-destructive testing, inspection, mechanical and engineering services that are used to evaluate the structural integrity and reliability of critical energy, industrial and public infrastructure.

International. This segment offers services, products and systems similar to those of our Services and Products and Systems segments to select markets within Europe, the Middle East, Africa, Asia and South America, but not to customers in China and South Korea, which are served by our Products and Systems segment.

Products and Systems. This segment designs, manufactures, sells, installs and services our asset protection products and systems, including equipment and instrumentation, predominantly in the United States.

For a discussion of segment revenues, operating results and other financial information, including geographic areas in which we generated revenues, see “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in Item 7, as well as Note 19 - Segment Disclosure in the notes to consolidated financial statements in Item 8 of this Annual Report.

Our Target Markets

Overview

Mistras operates in a highly competitive, but fragmented market. Domestically, the market is serviced by several national competitors, and many regional and/or local companies. Internationally, our primary competitors are divisions of large companies, with additional competition from small independent local companies which may be limited to a specific product, service or technology and focused on a niche market or geographic region. We focus our strategic sales, marketing and product development efforts on a range of infrastructure-intensive based industries and governmental authorities. We view energy-related infrastructure and commercial aerospace as the Company's largest market opportunities. We perform inspection and mechanical services for customers in both industries.

In the energy market there are various economic indicators that drive our business, especially in the U.S. domestic markets. These factors are excerpted below from various Energy Information Administration (EIA) outlook reports;

The continued decline in natural gas prices and increasing penetration of renewable electricity generation have resulted in lower wholesale electricity prices and operating losses for coal and nuclear generators. In addition, environmental concerns continue to negatively affect coal as a viable source of electricity generation. The use of natural gas as an energy source is projected to grow the most on an absolute basis. Per the Energy Information Agency's (EIA) December 14, 2018, crude oil output was 11.6 million barrels per day (bpd) and increased to 11.7 bpd by the end of the year, the highest level for any year on record in the United States. In addition, the EIA estimates that production of U.S. crude oil and natural gas plant liquids continues its growth through 2025, with oil production

records predicted through 2027 that top 14 million bpd through 2040. Crude pricing remains highly uncertain due to international market conditions. However, U.S. refinery utilization peaks in 2020 at approximately 96%.

There are a number of economic factors which drive the aerospace market, including:

- The approximately decade-long backlog for next generation commercial aircraft to be built, including several large and mid-sized aircraft built by Boeing, Airbus, Bombardier and Embraer, among other manufacturers;

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- The backlog of next generation aircraft engines which operate with greater fuel efficiency, including the LEAP engine and the geared-turbo fan engine;
- The continuing regulatory scrutiny to ensure public safety associated with these new technologically advanced aircraft, which serves to ensure the continued need for inspection and mechanical services to be performed, as well as to limit the number of participants who can meet the demanding requirements associated with performing these services.

Revenue by Target Market

The following chart represents the percentage of consolidated revenues we generated from our various markets for the year ended December 31, 2018:

Mistras Revenues by Target Market
(Year ended December 31, 2018)

Oil and Gas
MISTRAS supplies oil and gas asset protection solutions to downstream (refining), midstream (transportation and storage), upstream (exploration and production) and petrochemical operations.
We use our vast solutions portfolio to help identify current and future asset performance, and actively prevent, mitigate or otherwise address potential issues, including corrosion, cracking, leaking and other damages that may lead to safety, productivity or environmental concerns. Our solutions help identify conditions that could lead to potential catastrophic failures in tanks, vessels, valves, buried and above ground pipelines, pumps, motors, compressors and other critical assets found throughout the oil & gas production and delivery supply chain.
We actively seek to evolve our solutions through technological enhancements and R&D to discover new applications. Online monitoring and permanently-mounted sensors, as well as the use of drones and other alternative delivery devices, are all being considered as oil and gas infrastructure owners look to “smart” technologies that reduce human intervention while delivering highly-accurate inspection & integrity data. We also have actively sought to further enhance our integrated approach to asset protection, through the development of our complementary mechanical service portfolio.
In general, the energy market is poised to leverage digital solutions to facilitate process improvements as well as increase plant reliability and improve process and personnel safety. This provides an opportunity for the Company to synergistically leverage our asset protection solutions into our new MISTRAS Digital platform. Digital transmission of data in various industry sectors, with built-in analytic functions, shall allow our clients to better leverage inspection data that is being generated in the field.

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While we expect off-stream inspection of critical assets to remain a routine practice, we anticipate an increase in the demand for non-invasive, or on-stream inspections. Non-invasive inspections enable companies to minimize the costs associated with shutting down equipment during testing, while enabling the economic and safety advantages of advanced planning and/or predictive maintenance.

Aerospace and Defense

The aerospace industry is undergoing unprecedented growth with many original equipment manufacturers (OEMs) reporting record-high backlogs of up to ten years. We serve this rapidly-growing target market by providing a full range of inspection, testing, machining, mechanical, finishing, additive manufacturing and equipment solutions, which we are Nadcap certified. Our state-of-the-art in-house labs maintain numerous accreditations from industry organizations, including Nadcap and some of the largest prime manufacturers in the world, such as Boeing, Safran, Airbus, Bombardier and Embraer.

Advanced composite materials found in new classes of aircraft require advanced asset protection solutions, including x-ray of critical engine components, ultrasonic fatigue testing of complete aircraft structures and corrosion detection and other critical components. Many OEMs are shifting towards condition-based maintenance utilizing embedded monitoring sensors to track component structural and operational integrity over time as opposed to performing maintenance on time-based intervals. We expect demand for our solutions to increase with the adoption of these new-age materials and distributed online sensor networks. We also expect demand for asset protection solutions to increase with the continued adoption of additive manufacturing techniques.

Industrial

The quality control requirements driven by the need for zero-to-low-defect component tolerance within automated, robotic-intensive industries such as automotive, consumer electronics and medical industries serve as key drivers for increased demand in asset protection, particularly for in-house inspection and testing. We expect that increasingly stringent quality-control requirements and competitive forces will drive the demand for more-costly finishing and polishing which, in turn, creates opportunities for integrated partnerships between MISTRAS and our clients throughout the production lifecycle.

Power Generation and Transmission

MISTRAS provides asset protection solutions for clients in the combined cycle, fossil, nuclear, transmission & distribution and wind/alternative energy industries. We believe that in recent years, acceptance of asset protection solutions has grown in this industry due to the aging of critical power generation and transmission infrastructure.

The growing availability of cheap natural gas, along with environmental concerns with coal, has stimulated the construction of new natural gas-fired power plants across North America, creating opportunities for MISTRAS to provide specialized solutions in multiple phases. These include facility design consultations, NDT services during construction and plant operations and long-term condition monitoring. We anticipate sharp growth in the plants as natural gas pricing remains low, and the environmental impacts of coal remain unattractive to the public.

Process Industries

Our asset protection solutions are crucial for process industries, or industries in which raw materials are treated or prepared in a series of stages, including chemicals, pharmaceuticals, food processing, pulp and paper and metals and mining. As the process facilities are increasingly facing aging infrastructure, high utilization, growing capacity constraints and increasing capital costs, we believe asset protection solutions will continue to grow in importance in maintenance planning, quality and cost control and prevention of catastrophic failure.

Public Infrastructure, Research and Engineering

We believe that high-profile infrastructure catastrophes have caused public authorities to more actively seek ways to prevent similar events from occurring. Public authorities tasked with new construction and maintenance of existing public infrastructure increasingly use asset protection solutions to inspect these assets, including the use of embedded sensors to enable online monitoring throughout the life of the asset.

We have provided testing and structural health monitoring (SHM) solutions on bridges and structures worldwide, including some of the largest and most well-known bridges in the United States and United Kingdom. Our sensors continuously monitor these assets, alerting owner/operators when defects are detected. Our monitoring teams also provide regular reports that include early warnings of suspect areas before an alarm is generated.

Customers

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We provide our asset protection solutions to a global customer base of diverse companies primarily in our target markets. No customer accounted for more than 10% of our revenues in 2018. One customer, BP plc., accounted for approximately 11%, 12% and 10% of our total revenues for the year ended December 31, 2017, the transition period ended December 31, 2016 and fiscal 2016, respectively.

Geographic Areas

We have operations in 10 countries and occasionally conduct business in a few other countries. Most of our revenues are derived from our U.S., Canadian and European operations. See Note 19 — Segment Disclosure to the consolidated financial statements in this Annual Report for further disclosure of our revenues, long-lived assets and other financial information regarding our international operations.

Sales and Marketing

We sell our asset protection solutions through our direct sales and marketing teams within all of our offices worldwide. In addition, our project and laboratory managers as well as our management are trained on our solutions and often are the source of sales leads and customer contacts. Our direct sales and marketing teams work closely with our customers' research and design personnel, reliability engineers and facilities maintenance engineers to demonstrate the benefits and capabilities of our asset protection solutions, refine our asset protection solutions based on changing market and customer needs and identify potential sales opportunities. We divide our sales and marketing efforts into services sales, products and systems sales and marketing and utilize customer relationship management (CRM) systems to collect, manage and collaborate customer information with our teams globally. Our CRM's also provide critical data to provide accurate forecasting and reporting.

Manufacturing

Most of our hardware products are manufactured in our Princeton Junction, New Jersey facility. Our Princeton Junction facility includes the capabilities and personnel to fully produce all of our AE products and NDT Automation Ultrasonic equipment. We also design and manufacture automated ultrasonic systems and scanners in France.

Employees

Providing our asset protection solutions requires a highly-skilled and technically proficient employee base. As of December 31, 2018, we had approximately 5,700 employees worldwide, of which approximately 61% were based in the United States. Less than 1% of our employees in the United States are unionized. We believe that we have good relations with our employees.

Seasonality

Our business is seasonal. This seasonality relates primarily to our oil and gas business. U.S. refineries' non-peak periods are generally in the fall, when they are retooling to produce more heating oil for winter, and in the spring, when they are retooling to produce more gasoline for summer. The peak periods for these customers are the summer and winter months, when they run at peak capacity and are not retooling or performing turnarounds or shut downs. As a result, our revenues in the summer and winter months are typically lower than our revenues in the fall and spring because demand for our asset protection solutions from the oil and gas as well as the fossil and nuclear power industries increases during their non-peak production periods. Because we are increasing our work in the fall and spring, our cash flows are lower in those quarters than in the summer and winter, as collections of receivables lag behind revenues. We expect that this seasonality will continue.

Competition

We operate in a highly competitive, but fragmented, market. Our primary competitors are divisions of large companies and various small companies which generally are limited to a specific product or technology and focused on a niche market or geographic region. We believe that few, if any, of our competitors currently provide the full range of asset protection and NDT products, enterprise software (PCMS) and the traditional and advanced services solutions that we offer. Our competition with respect to NDT services include the Acuren division of Rockwood Service Corporation, SGS Group, the Team Qualspec division of Team, Inc. and APPLUS RTD. Our competition with respect to our PCMS software includes UltraPIPE, Lloyd's Register Capstone, Inc. and Meridium Systems. In the traditional NDT market, we believe the principal competitive factors include project management, availability of qualified personnel, execution, price, reputation and quality; whereas in the advanced NDT market, reputation, quality and size tend to be the most significant competitive factors. We believe that the NDT market has significant barriers to entry which would make it difficult for new competitors to enter the market. These barriers include: (1) having to acquire or develop advanced NDT services, products and systems technologies, which in our case

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occurred over many years of customer engagements and at significant internal research and development expense, (2) complex regulations and safety codes that require significant industry experience, (3) license requirements and evolved quality and safety programs, (4) costly and time-consuming certification processes, (5) capital requirements and (6) emphasis by large customers on size and critical mass, length of relationship and past service record.

Research and Development

Our research and development is principally conducted by engineers and scientists at our Princeton Junction, New Jersey headquarters, and supplemented by other employees in the United States and throughout the world, including France, Greece the United Kingdom, Brazil and the Netherlands. Our total professional staff includes employees who hold Ph.D.'s and engineers and employees who hold Level III certification, the highest level of certification from the American Society of Non-Destructive Testing (ASNT).
MISTRAS makes strategic R&D investments in technologies that support integration with our other solution offerings to enhance cost- and time-efficiencies, maximize uptime and safety and improve the flow of data from field technicians to inspection databases. We are investing resources in the development of MISTRAS Digital, an electronic platform that will digitally deliver field inspection assignments and related data, capture inspection results, and provide electronic reporting and productivity tracking. MISTRAS also invested significant R&D in pre-machining and advanced testing technologies in a purpose-built facility for an aerospace customer, with the goal of reducing the customer's production cycle logistics and costs.
We also work with customers to develop new products or applications for our technology, including:

- Testing of new composites
- Detecting crack propagation
- Wireless and communications technologies
- Development of permanently embedded inspection systems to provide continuous, online, in-service monitoring of critical structural components

Research and development expenses are reflected on our consolidated statements of income as research and engineering expenses. Our company-sponsored research and engineering expenses were approximately $3.3 million, $2.3 million, $1.6 million and $2.5 million for the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and fiscal 2016, respectively. While we have historically funded most of our research and development expenditures, from time to time we also receive customer-sponsored research and development funding. Most of the projects are in our target markets; however, a few of the projects could lead to other future market opportunities.

Intellectual Property
Our success depends, in part, on our ability to maintain and protect our proprietary technology and to conduct our business without infringing on the proprietary rights of others. We utilize a combination of intellectual property safeguards, including patents, copyrights, trademarks and trade secrets, as well as employee and third-party confidentiality agreements, to protect our intellectual property.
As of December 31, 2018, we held 4 U.S. patents (by direct ownership or exclusive licensing) which will expire at various times between 2021 and 2026 and 2 patents pending in the U.S. for applications filed in 2018, and license certain other patents. However, we do not principally rely on these patents or licenses to provide our proprietary asset protection solutions. Our trademarks and service marks provide us and our solutions with a certain amount of brand recognition in our markets. We do not consider any single patent, trademark or service mark material to our financial condition or results of operations.
As of December 31, 2018, the primary trademarks and service marks that we held in the United States included MISTRAS® and our stylized globe design. Other trademarks or service marks that we utilize in localized markets or product advertising include:

- One Source for Asset Protection Solutions®

- PCMS®
- Physical Acoustics and the PAC logo
- Streamview™
- Ropeworks®
- Sensor Highway™
- Streamview
- TankPAC®
- CALIPERAY™
- VPAC

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- Transformer Clinic™

Many elements of our asset protection solutions involve proprietary know-how, technology or data that are not covered by patents or patent applications because they are not patentable or would be difficult to enforce, including technical processes, equipment designs, algorithms and procedures. We believe that this proprietary know-how, technology and data is the most important component of our intellectual property used in our asset protection solutions, and is a primary differentiator of our solutions from those of our competitors. We rely on various trade secret protection techniques and agreements with our customers, service providers and vendors to protect these assets. All of our employees are subject to confidentiality requirements through our employee handbook. In addition, many of our employees have entered into confidentiality and proprietary information agreements with us. Our employee handbook and these agreements require our employees not to use or disclose our confidential information, to assign to us all of the inventions, designs and technologies they develop during the course of employment with us and to otherwise address intellectual property protection issues. We also seek confidentiality agreements from our customers and business partners before we disclose any sensitive aspects of our technologies or business strategies. We are not currently involved in any material intellectual property claims.

Environmental Matters

We are subject to numerous environmental, legal and regulatory requirements related to our operations worldwide. In the United States, these laws and regulations include, among others: the Comprehensive Environmental Response, Compensation, and Liability Act, the Resources Conservation and Recovery Act, the Clean Air Act, the Federal Water Pollution Control Act, the Toxic Substances Control Act, the Atomic Energy Act, the Energy Reorganization Act of 1974, and applicable regulations. In addition to the federal laws and regulations, states and other countries where we do business often have numerous environmental, legal and regulatory requirements by which we must abide. We evaluate and address the environmental impact of our operations by assessing properties in order to avoid future liabilities and comply with environmental, legal and regulatory requirements.

We received a notice in May 2015 that the U.S. Environmental Protection Agency ("EPA") performed a preliminary assessment of a leased facility we operate in Cudahy, California. Based upon the preliminary assessment, the EPA conducted an investigation of the site. The purpose of the investigation is to determine whether any hazardous materials were released from the facility. We were informed that certain hazardous materials and pollutants have been found in the ground water in the general vicinity of the site and the EPA is attempting to ascertain the origination or source of these materials and pollutants. Given the historic industrial use of the site, the EPA determined that the site of our Cudahy facility should be examined along with numerous other sites in the vicinity. In addition, the California Department of Toxic Substances Control recently notified the owner of the property that it may perform additional investigation of the property. At this time, we are not able to determine whether we have any liability in connection with this matter and if so, the amount or range of any such liability.

Executive Officers

The following are our executive officers and other key employees as of December 31, 2018 and their background and experience:

Name	Age	Position
Sotirios J. Vahaviolos	72	Executive Chairman and Director
Dennis Bertolotti	59	President, Chief Executive Officer and Director
Edward J. Prajzner	52	Senior Vice President, Chief Financial Officer and Treasurer
Michael C. Keefe	62	Executive Vice President, General Counsel and Secretary
Michael J. Lange	58	

		Vice Chairman, Senior Executive Vice President of Global Business Development, Marketing & Strategic Planning, and Director
Jonathan H. Wolk	57	Senior Executive Vice President and Chief Operating Officer

Sotirios J. Vahaviolos has been Executive Chairman since August 10, 2017. Prior to being named Executive Chairman, Dr. Vahaviolos had been our Chairman and Chief Executive Officer since he founded Mistras in 1978 under the name Physical Acoustics Corporation and was also our President until June 1, 2016. Prior to joining Mistras, Dr. Vahaviolos worked at AT&T Bell Laboratories. Dr. Vahaviolos received a B.S. in Electrical Engineering and graduated first in his engineering class from Fairleigh Dickinson University and received Masters Degrees in Electrical Engineering and Philosophy and a Ph.D. (EE) from the Columbia University School of Engineering. During Dr. Vahaviolos' career in non-destructive testing, he has been elected

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Fellow of The Institute of Electrical and Electronics Engineers, a member of The American Society for Nondestructive Testing (ASNT) where he served as its President from 1992-1993 and its Chairman from 1993-1994, a member of Acoustic Emission Working Group (AEWG) and an honorary life member of the International Committee for Nondestructive Testing. Additionally, he was the recipient of ASNT's Gold Medal in 2001 and AEWG's Gold Medal in 2005. He was also one of the six founders of NDT Academia International in 2008 headquartered in Brescia, Italy.

Dennis Bertolotti joined Mistras when Conam Inspection Services was acquired in 2003, where Mr. Bertolotti was a Vice President at the time of the acquisition. Since then, Mr. Bertolotti has had increasing levels of responsibility with Mistras, and became our President and Chief Executive Officer and Director, effective August 10, 2017. From June 1, 2016 to August 9, 2017, Mr. Bertolotti was our President and Chief Operating Officer. Mr. Bertolotti has been in the NDT business for over 30 years, and previously held ASNT Level III certifications and various American Petroleum Institute, or API, certifications, and received his Associate of Science degree in NDT from Moraine Valley Community College in 1983. Mr. Bertolotti has also received a Bachelor of Science and MBA from Otterbein College.

Edward J. Prajzner joined Mistras in January 2018. Prior to joining Mistras, Mr. Prajzner worked at CECO Environmental Corp., a global service provider to environmental, energy and filtration industries, and served as Chief Financial Officer and Secretary from 2014 to 2017, Vice President of Finance and Chief Accounting Officer from 2013 until his appointment as CFO in 2014, and Corporate Controller and Chief Accounting Officer from 2012 to 2013. Mr. Prajzner also served in senior finance roles at CDI Corporation (now AE Industrial Partners), and American Infrastructure (now Allan Myers). Mr. Prajzner began his career in public accounting at Ernst & Young, received his B.S. in accountancy from Villanova University, his MBA in finance from Temple University and is a certified public accountant.

Michael C. Keefe joined Mistras in December 2009. Prior to joining Mistras, Mr. Keefe worked at International Fight League, a publicly-traded sports promotion company, from 2007 until 2009, in various executive positions. From 1990 until 2006, Mr. Keefe served in various legal roles with Lucent Technologies and AT&T, the last four years as Vice President, Corporate and Securities Law and Assistant Secretary. Mr. Keefe received a BS in Business Administration (Accounting) from Seton Hall University and a J.D. from Seton Hall University School of Law.

Michael J. Lange joined Mistras when we acquired Quality Services Laboratories in November 2000, and was elected a Director in 2003. Mr. Lange has held various executive level positions with Mistras, becoming Vice Chairman in July 2015 and Senior Executive Vice President, effective June 1, 2016. Mr. Lange is a well-recognized authority in Radiography and has held an ASNT Level III Certificate for almost 20 years. Mr. Lange received an Associate of Science degree in NDT from the Spartan School of Aeronautics.

Jonathan H. Wolk joined Mistras in November 2013 and served as Executive Vice President, Chief Financial Officer and Treasurer until August 10, 2017, when Mr. Wolk became Senior Executive Vice President and Chief Operating Officer. Mr. Wolk was also acting Chief Financial Officer from August 10, 2017 until the appointment of Mr. Prajzner on January 5, 2018. Prior to joining Mistras, Mr. Wolk served as Senior Vice President, Chief Financial Officer and Secretary of American Woodmark Corporation from 2004 until August 2013. Prior to American Woodmark, he served as the Chief Financial Officer and Treasurer of Tradecard, Inc., from 2000 to 2004, and was the global controller of GE Capital Real Estate from 1998 to 2000. Mr. Wolk started his career in public accounting at KPMG, received his B.S. in accounting from State University of New York-Albany and is a certified public accountant.

Our executive officers are elected by, and serve at the discretion of, our board of directors. There are no family relationships among any of our directors or executive officers.

Our Website and Available Information

Our website address is www.mistrasgroup.com. We file reports with the SEC, including Quarterly Reports on Form 10-Q, Annual Reports on Form 10-K, Current Reports on Form 8-K and Proxy Statements. All of the materials we file with or furnish to the SEC are available free of charge on our website at http://investors.mistrasgroup.com/sec.cfm, as soon as reasonably practicable after having been electronically submitted to the SEC. Information contained on or connected to our website is not incorporated by reference into this Annual Report on Form 10-K and should not be considered part of this report or any other filing with the SEC. All of our SEC filings are also available at the SEC's website at www.sec.gov. In addition, materials we file with the SEC may be read and copied at the SEC's Public Reference Room at 100 F Street, NE, Washington, DC 20549. The public may obtain information on the operation of the Public Reference Room by calling the SEC at 1-800-SEC-0330.

ITEM 1A. RISK FACTORS

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This section describes the major risks to us, our business and our common stock. You should carefully read and consider the risks described below, together with the other information contained in this Annual Report, including our financial statements and the notes thereto and “Management’s Discussion and Analysis of Financial Condition and Results of Operations”(MD&A) before making an investment decision. The statements contained in this section constitute cautionary statements under the Private Securities Litigation Reform Act of 1995. If any of these risks occur, our business, financial condition, results of operations and future growth prospects may be adversely affected. As a result, the trading price of our common stock would likely decline, and you may lose all or part of your investment. You should understand that it is not possible to predict or identify all risk factors that could impact us. Accordingly, you should not consider the following to be a complete discussion of all risks and uncertainties pertaining to us and our common stock.

Risks Related to Our Business

Our growth strategy includes acquisitions. We may not be able to identify suitable acquisition candidates or integrate acquired businesses successfully, which may adversely impact our results. Furthermore, acquisitions that we do complete could expose us to a number of unanticipated operational and financial risks.

A significant factor in our growth has been and will continue to be based upon our ability to make acquisitions and successfully integrate these 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. This strategy has provided us with many benefits and has helped fuel our growth, but also carries with it many risks. Some of the risks associated with our acquisition strategy include:

- whether we successfully identify suitable acquisition candidates, negotiate appropriate acquisition terms, and complete proposed acquisitions;
- whether we can successfully integrate acquired businesses into our current operations, including our accounting, internal control and information technology systems, marketing and other key infrastructure;
- whether we can adequately capture opportunities that an acquired business may offer, including the expansion into new markets in which we have little to no experience or presence;
- whether we value an acquired business properly when determining the purchase price and terms, and whether we are able to achieve the returns on the investment we expect;
- whether an acquired business can achieve levels of revenues, profitability, productivity or cost savings we expect;
- whether an acquired business is compatible with our culture and philosophy of doing business;
- the unexpected loss of key personnel and customers of an acquired business;
- the assumption of liabilities and risks (including environmental-related costs) of an acquired business, some of which may not be anticipated;
- the potential disruption of our ongoing business and distraction of management and other personnel of us and the acquired business resulting from the efforts to acquire, then integrate, an acquired business;
- the potential for greater exposure to risks associated with international operations; and

- the amount and cost of funding (including borrowings under our credit agreement) to acquire and integrate other businesses (some of which may require substantial funding) and the impact of the acquisition and borrowing on our continued compliance with covenants in our credit agreement.

Our ability to undertake acquisitions is limited by our financial resources, including available cash and borrowing capacity. Future acquisitions could result in potentially dilutive issuances of equity securities, the incurrence of substantial additional indebtedness and other expenses, any of which could adversely impact our financial condition and results of operations. Although management intends to: (i) evaluate the risks inherent in any particular transaction, (ii) assume only risks management believes to be acceptable, and (iii) develop plans to mitigate such risks, there are no assurances that we will properly ascertain or accurately assess the extent of all such risks. Difficulties encountered with acquisitions may adversely impact our business, financial condition and results of operations.

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In addition, we have a significant amount of goodwill and other intangible assets on our balance sheet from our acquisitions. This will increase as we complete more acquisitions. If our acquisitions do not perform as planned and we do not realize the benefits and profitability we expect, we could incur significant write-downs and impairment charges to our earnings due to the impairment of the goodwill and other intangible assets we have acquired or acquire in the future.

Our international operations are subject to risks relating to non-U.S. operations.

For the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and fiscal 2016, we generated approximately 34%, 33%, 36% and 28% of our revenues outside the United States, respectively. In addition, our international operations as a percentage of our business may increase over time. Our primary operations outside the United States are in Canada, Germany, France, the United Kingdom and Brazil. We also have operations in the Netherlands, Belgium, Greece and India. There are numerous risks inherent in doing business in international markets, including:

- fluctuations in currency exchange rates and interest rates;
- varying regional and geopolitical business and economic conditions and demands;
- compliance with applicable foreign regulations and licensing requirements, and U.S. laws and regulation with respect to our business in other countries, including export controls and anti-bribery laws;
- the cost and uncertainty of obtaining data and creating solutions that are relevant to particular geographic markets;
- the need to provide sufficient levels of technical support in different locations;
- the complexity of maintaining effective policies and procedures in locations around the world;
- political instability and civil unrest;
- restrictions or limitations on outsourcing contracts or services abroad;
- the impact of the United Kingdom exiting the European Union; the ultimate effects of Brexit on the Company are difficult to predict. The Company currently has subsidiaries that operate in the United Kingdom and Europe and our UK subsidiary and other European subsidiaries from time to time share employees and equipment. Brexit will make this sharing of employees and equipment more time consuming and expensive, which could cause disruptions and adversely affect the Company’s financial condition, operating results and cash flows.
- restrictions or limitations on the repatriation of funds, or tax consequences on the non-repatriation of overseas operationally generated funds; and
- other potentially adverse tax consequences.

Due to our dependency on customers in the oil and gas industry, we are susceptible to prolonged negative trends relating to this industry that could adversely affect our operating results.

Our customers in the oil and gas industry (including the petrochemical market) have accounted for a substantial portion of our historical revenues. Specifically, they accounted for approximately 56%, 58%, 55% and 56% of our revenues for the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and fiscal 2016, respectively. Although we have expanded our customer base into industries other than the oil and gas industry, we still receive approximately half of our revenues from this industry. Our services are vital to the operators of plants and refineries and we have expanded our services offerings, such as expanding our mechanical services capabilities. However, economic slowdowns or low oil prices have, and could continue to, result in cutbacks in contracts for our services. In addition, low oil prices could depress the level of new exploration and construction, which would adversely affect our market opportunities. If the oil and gas industry were to continue to operate in a market with low oil prices, our revenues, profits and cash flows may be reduced. While we continue to expand our market presence in the aerospace, power generation and transmission, and the chemical processing industries, among others, these markets are also cyclical in nature and as such, are subject to economic downturns.

We expect to continue expanding and our success depends on how effectively we manage our growth.

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We expect to continue experiencing growth, including through acquisitions, in the number of employees and the scope of our operations over the long-term. To effectively manage our anticipated future growth, we must continue to implement and improve our managerial, operational, compliance, financial and reporting systems and capabilities, expand our facilities and continue to recruit and train additional qualified personnel. We expect that all these measures will require significant expenditures and will demand the attention of management. Failure to manage our growth effectively could lead us to over or under-invest in technology and operations, result in weaknesses in our infrastructure, systems, compliance programs or controls, and give rise to operational mistakes, the loss of business opportunities, the loss of employees and reduced productivity among remaining employees. Our expected growth could require significant capital expenditures and may divert financial resources from other projects, such as the development of new solutions. If our management is unable to effectively manage our expected growth, our expenses may increase more than expected, our profit margins may suffer, our revenues could decline or may grow more slowly than expected and we may be unable to implement our business strategy as anticipated.

Our operating results could be adversely affected by a reduction in business with our significant customers.

We derive a significant amount of revenues from a few customers. Taken as a group, our top ten customers were responsible for approximately 34%, 38%, 37% and 36% of our revenues for the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and fiscal 2016, respectively. This concentration pertains almost exclusively to our Services segment, which accounted for more than 70% of our revenues for the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and fiscal 2016. These customers are primarily in the oil and gas sector. Generally, our customers do not have an obligation to make purchases from us and may stop ordering our products and services or may terminate existing orders or contracts at any time with little or no financial penalty. The loss of any of our significant customers, any substantial decline in sales to these customers or any significant change in the timing or volume of purchases by our customers could result in lower revenues and could harm our business, financial condition or results of operations.

An accident or incident involving our asset protection solutions could expose us to claims, harm our reputation and adversely affect our ability to compete for business and, as a result, harm our operating performance.

We could be exposed to liabilities arising out of the solutions we provide. For instance, we furnish the results of our testing and inspections for use by our customers in their assessment of their assets, facilities, plants and other structures. If such results were to be incorrect or incomplete, as a result of, for instance, poorly designed inspections, malfunctioning testing equipment or our employees’ failure to adequately test or properly record data, we could be subject to claims. Further, if an accident or incident involving a structure we tested occurs and causes personal injuries or property damage, such as the collapse of a bridge or an explosion in a facility, and particularly if these injuries or damages could have been prevented by our customers had we provided them with correct or complete results, we would likely face significant claims relating to personal injury, property damage or other losses. Even if our results are correct and complete, we may face claims for such injuries or damage simply because we tested the structure or facility in question. While we do have insurance, our insurance coverage may not be adequate to cover the damages from any such claims, forcing us to bear these uninsured damages directly, which could harm our operating results and may result in additional expenses and possible loss of revenues. An accident or incident for which we are found partially or fully responsible, even if fully insured, or even an incident at a customer or site for which we provide services although we were found not to be responsible, may also result in negative publicity, which would harm our reputation among our customers and the public, cause us to lose existing and future contracts or make it more difficult for us to compete effectively, thereby significantly harming our operating performance. In addition, the occurrence of an accident or incident might also make it more expensive or extremely difficult for us to insure against similar events in the future.

Many of the sites at which we work are inherently dangerous workplaces. If we fail to maintain a safe work environment, we may incur losses and lose business.

Many of our customers, particularly in the oil and gas and chemical industries, require their inspectors and other contractors working at their facilities to have good safety records because of the inherent danger at these sites. If our employees are injured at the work place, we will incur costs for the injuries and lost productivity. In addition, safety records are impacted by the number and amount of workplace incidents involving a contractor's employees. If our safety record is not within the levels required by our customers, or compares unfavorably to our competitors, we could lose business, be prevented from working at certain facilities or suffer other adverse consequences, all of which could negatively impact our business, revenues, reputation and profitability.

We may face risks regarding our information technology and security.

Significant disruptions of our information technology systems or breaches of information security could adversely affect our business. We rely upon information technology systems to operate many parts of our business. We routinely collect, store and

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transmit large amounts of sensitive or confidential information, including data from the results of our testing and inspections. We deploy and operate various technical and procedural controls to maintain the confidentiality and integrity of such sensitive or confidential information. In addition, we rely on third parties for significant elements of our information technology infrastructure and, as a result, we are managing many independent vendor relationships with third parties who may or could have access to our confidential information. The size and complexity of our information technology and information security systems, and those of our third-party vendors with whom we contract (and the large amounts of confidential information that is present on them), make such systems potentially vulnerable to service interruptions or to security breaches from inadvertent or intentional actions by our employees or vendors, or from attacks by malicious third parties. Such attacks are of ever-increasing levels of sophistication and expertise, including organized criminal groups, "hacktivists," and others. Due to the nature of some of these attacks, there is a risk that they may remain undetected for a period of time. While we have invested in the protection of data and information technology, there can be no assurance that our efforts will prevent service interruptions or security breaches. Any such interruption or breach of our systems could adversely affect our business operations and/or result in the loss of critical or sensitive confidential information, and could result in financial, legal, business and reputational harm to us. We maintain cyber liability insurance; however this insurance may not be sufficient to cover the financial, legal, business or reputational losses that may result from an interruption or breach of our systems. The occurrence or perception of security breaches in connection with our asset protection solutions or our customers' concerns about internet security or the security of our solutions, whether warranted or not, would likely harm our reputation and business, inhibit market acceptance of our asset protection solutions and cause us to lose customers, any of which would harm our financial condition and results of operations.

In addition, much of our computer and communications hardware is located at a single facility. We have a back-up data-center and storage in a different geographic area. Should a natural disaster or some other event occur that damages our primary data center or significantly disrupts its operation, such as human error, fire, flood, power loss, telecommunications failure, break-ins, terrorist attacks, acts of war and similar events, we could suffer temporary interruption of key functions and capabilities before the back-up facility is fully operational.

If we are unable to attract and retain a sufficient number of trained certified technicians, engineers and scientists at competitive wages, our operational performance may be harmed and our costs may increase.

We believe that our success depends, in part, upon our ability to attract, develop and retain a sufficient number of trained certified technicians, engineers and scientists at competitive wages. The demand for such employees fluctuates as the demand for NDT and inspection services fluctuates. When the demand for qualified technicians increases, we will often experience increased labor costs, which we may not recover in the amounts we can charge our customers. The markets for our products and services require us to use personnel trained and certified in accordance with standards set by domestic or international standard-setting bodies, such as the American Society of Non-Destructive Testing or the American Petroleum Institute. Because of the limited supply of these certified technicians, we expend substantial resources maintaining in-house training and certification programs. If we fail to attract sufficient new personnel or fail to motivate and retain our current personnel, our ability to perform under existing contracts and orders or to pursue new business may be harmed, preventing us from growing our business or causing us to lose customers and revenues, and the costs of performing such contracts and orders may increase, which would likely reduce our margins.

We operate in competitive markets and if we are unable to compete successfully, we could lose market share and revenues and our margins could decline.

We face strong competition from NDT and a variety of niche asset protection providers, both larger and smaller than we are. Some of our competitors have greater financial resources than we do and could focus their substantial financial resources to develop a competing business model or develop products or services that are more attractive to

potential customers than what we offer. Some of our competitors are business units of companies substantially larger than us and could attempt to combine asset protection solutions into an integrated offering to customers who already purchase other types of products or services from them. Our competitors may offer asset protection solutions at lower prices than ours in order to attempt to gain market share. Smaller niche competitors with small customer bases could be aggressive in their pricing in order to retain customers. These competitive factors could reduce our market share, revenues and profits.

Due to the participation in multi-employer pension plans by our subsidiaries, these subsidiaries may face withdrawal liability.

Some of our workforce is unionized and the terms of employment for these workers are governed by collective bargaining agreements, or CBAs. Under these CBAs, we are required to contribute to the national pension funds for the unions representing these employees, which are multi-employer pension plans. Significant reductions in contributions to these pension plans, or events that result in our subsidiaries no longer contributing to these pension plans, can result in a complete or partial

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withdrawal liability under ERISA, which can be significant and adversely impact our earnings and cash flow. We incurred a $5.9 million charge in 2018 because of such a potential liability.

Events such as natural disasters, industrial accidents, epidemics, war and acts of terrorism, and adverse weather conditions could disrupt our business or the business of our customers, which could significantly harm our operations, financial results and cash flow.

Our operations and those of our customers are susceptible to the occurrence of catastrophic events outside our control, ranging from severe weather conditions to acts of war and terrorism. Any such events could cause a serious business disruption that reduces our customers' need or interest in purchasing our asset protection solutions. In the past, such events have resulted in order cancellations and delays because customer equipment, facilities or operations have been damaged, or are not then operational or available. A large portion of our customer base has operations in the Gulf of Mexico, which is subject to hurricanes and tropical storms. Hurricane-related disruptions to our customers' operations have adversely affected our revenues in the past. Such events in the future may result in substantial delays in the provision of solutions to our customers and the loss of valuable equipment. In addition, our results can be adversely impacted by severe winter weather conditions, which can result in lost work days and temporary closures of customer facilities or outdoor projects. Any cancellations, delays or losses due to such events may significantly reduce our revenues and harm our operating performance.

If we lose key members of our senior management team upon whom we are dependent, we may be less effective in managing our operations and may have more difficulty achieving our strategic objectives.

Our future success depends to a considerable degree upon the availability, contributions, vision, skills, experience and effort of our senior management team. We have in place various compensation programs, such as an annual cash incentive program, equity incentive program and a severance policy, each designed to incentivize and retain our key senior managers. At this time, we do not have any reason to believe that we may lose the services of any of these key persons in the foreseeable future and we believe our compensation programs will help us retain these individuals. We believe we have sufficient depth in our executive management to continue our success if we were to lose the services of an executive. However, an unplanned loss or interruption of the service of numerous key members of our senior management team could harm our business, financial condition and results of operations and could significantly reduce our ability to manage our operations and implement our strategy.

We are subject to privacy and data security/protection laws in the jurisdictions in which we operate and may be exposed to substantial costs and liabilities associated with such laws and regulations.

The regulatory environment surrounding information security and privacy is increasingly demanding, with frequent imposition of new and changing requirements. The European Union's General Data Protection Regulation ("GDPR"), which became effective in May 2018, imposed significant new requirements on how companies process and transfer personal data, as well as significant fines for non-compliance. Compliance with changes in privacy and information security laws and standards may result in significant expense due to increased investment in technology and the development of new operational processes, which could have a material adverse effect on our financial condition and results of operations. In addition, the payment of potentially significant fines or penalties in the event of a breach of the GDRP or other privacy and information security laws, as well as the negative publicity associated with such a breach, could damage the Company's reputation and adversely impact product demand and customer relationships.

Deteriorations in economic conditions in certain markets or other factors may cause us to recognize impairment charges for our goodwill.

As of December 31, 2018, the carrying amount of our goodwill was approximately $279 million, of which approximately $36 million relates to our International segment. A significant portion of our International segment are concentrated in Europe and Brazil. Significant deterioration in industry or economic conditions in which we operate, disruptions to our business, not effectively integrating acquired businesses, or other factors, may cause impairment charges to goodwill in future periods.

The success of our businesses depends, in part, on our ability to develop new asset protection solutions, increase the functionality of our current offerings and meet the needs and demands of our customers.

The market for asset protection solutions is impacted by technological change, uncertain product lifecycles, shifts in customer demands and evolving industry standards and regulations. We may not be able to successfully develop and market new asset protection solutions that comply with present or emerging industry regulations and technology standards. Also, new regulations or technology standards could increase our cost of doing business.

From time to time, our customers have requested greater value and functionality in our solutions. As part of our strategy to enhance our asset protection solutions and grow our business, we continue to make investments in the research and development of new technologies, inspection tools and methodologies. We believe our future success will depend, in part, on our ability to continue to design new, competitive and broader asset protection solutions, enhance our current solutions and provide new, value-added services. Many traditional NDT and inspection services are subject to price competition by our customers. Accordingly, the need to demonstrate our value-added services is becoming more important. Developing new solutions will require continued investment, and we may experience unforeseen technological or operational challenges. In addition, our asset protection software is complex and can be expensive to develop, and new software and software enhancements can require long development and testing periods. If we are unable to develop new asset protection solutions or enhancements that meet market demands on a timely basis, we may experience a loss of customers or otherwise be likely to lose opportunities to earn revenues and to gain customers or access to markets, and our business and results of operations will be adversely affected.

Even if we develop new solutions, if our customers, or potential customers, do not see the value our solutions have over competing products and services, our operating results could be adversely impacted. In addition, because the asset protection solutions industry is rapidly evolving, we could lose insight into trends that may be emerging, which would further harm our competitive position by making it difficult to predict and respond to customer needs. If the market for our asset protection solutions does not continue to develop, our ability to grow our business would be limited and we might not be able to maintain profitability. If we cannot convince our customers of the advantages and value of our advanced NDT services, we could lose large contracts or suffer lower profit margin.

If our software or system produces inaccurate information or are incompatible with the systems used by our customers and make us unable to successfully provide our solutions, it could lead to a loss of revenues and customers.

Our software and systems are complex and, accordingly, may contain undetected errors or failures. Software or system defects or inaccurate data may cause incorrect recording, reporting or display of information related to our asset protection solutions. Any such failures, defects and inaccurate data may prevent us from successfully providing our asset protection solutions, which could result in lost revenues. Software or system defects or inaccurate data may lead to customer dissatisfaction and could cause our customers to seek to hold us liable for any damages incurred. As a result, we could lose customers, our reputation may be harmed and our financial condition and results of operations could be materially adversely affected.

We currently serve a commercial, industrial and governmental customer base that uses a wide variety of constantly changing hardware, software solutions and operating systems. Our asset protection solutions need to interface with these non-standard systems in order to gather and assess data. Our business depends on the following factors, among others:

- our ability to integrate our technology with new and existing hardware and software systems;

- our ability to anticipate and support new standards, especially internet-based standards; and

- our ability to integrate additional software modules under development with our existing technology and operational processes.

If we are unable to adequately address any of these factors, our results of operations and prospects for growth and profitability would be adversely impacted.

The seasonal nature of our business reduces our revenues and profitability in the winter and summer.

Our business is seasonal. The fall and spring revenues are typically higher than our revenues in the winter and summer because demand for our asset protection solutions from the oil and gas as well as the fossil and nuclear power industries increases during their non-peak production periods. For instance, U.S. refineries' non-peak periods are generally in the fall, when they are retooling to produce more heating oil for winter, and in the spring, when they are retooling to produce more gasoline for summer. As a result of these trends, we generally have reduced cash flows in the fall and spring, as collections of receivables lag behind revenues, possibly requiring us to borrow under our credit agreement. In addition, most of our operating expenses, such as employee compensation and property rental expense, are relatively fixed over the short term. Moreover, our spending levels are based in part on our expectations regarding future revenues. As a result, if revenues for a particular quarter are below expectations, we may not be able to proportionately reduce operating expenses for that quarter. We expect that the impact of seasonality will continue.

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Our business, and the industries we currently serve, are currently subject to governmental regulation, and may become subject to modified or new government regulation that may negatively impact our ability to market our asset protection solutions.

We incur substantial costs in complying with various government regulations and licensing requirements. For example, the transportation and overnight storage of radioactive materials used in providing certain of our asset protection solutions such as radiography are subject to regulation under federal and state laws and licensing requirements. Our Services segment is currently licensed to handle radioactive materials by the U.S. Nuclear Regulatory Commission (NRC), over 20 state regulatory agencies and the Canadian Nuclear Safety Commission. If we allegedly fail to comply with these regulations, we may be investigated and incur significant legal expenses associated with such investigations, and if we are found to have violated these regulations, we may be fined or lose one or more of our licenses or permits, which would prevent or restrict our ability to provide radiography services. In addition, while we are investigated, we may be required to suspend work on the projects associated with our alleged noncompliance, resulting in loss of profits or customers, and damage to our reputation. Many of our customers have strict requirements concerning safety or loss time occurrences and if we are unable to meet these requirements it could result in lost revenues. In the future, governmental agencies may seek to change current regulations or impose additional regulations on our business. Any modified or new government regulation applicable to our current or future asset protection solutions may negatively impact the marketing and provision of those solutions and increase our costs of providing these solutions and have a corresponding adverse effect on our margins.

Additionally, greenhouse gases that result from human activities, including burning of fossil fuels, have been the focus of increased scientific and political scrutiny and are being subjected to various legal requirements. International agreements, national laws, state laws and various regulatory schemes limit or otherwise regulate emissions of greenhouse gases, and additional restrictions are under consideration by different governmental entities. We derive a significant amount of revenues and profits from such industries, including oil and gas, power generation and transmission, and chemicals processing. Such regulations could negatively impact our customers, which could negatively impact the market for the services and products we provide. This could materially adversely affect our business, financial condition, results of operations and cash flows.

We rely on certification of our NDT solutions by industry standards-setting bodies. We and/or our subsidiaries currently have International Organization for Standardization (ISO) 9001:2008 certification, ISO 14001:2004 certification and OHSAS 18001:2007 certification. In addition, we currently have NADCAP (formerly National Aerospace and Defense Contractors Accreditation Program) and similar certifications for certain of our locations. We continually review our NDT solutions for compliance with the requirements of industry specification standards and the NADCAP special processes quality requirements. However, if we fail to maintain our ISO, Nadcap or other certifications, our business may be harmed because our customers generally require that we have these certifications before they purchase our NDT solutions.

Intellectual property may impact our business and results of operations.

Our ability to compete effectively depends in part upon the maintenance and protection of the intellectual property related to our asset protection solutions. Patent protection is unavailable for certain aspects of the technology and operational processes important to our business and any patent or patent applications, trademarks or copyrights held by us or to be issued to us, may not adequately protect us. Some of our trademarks that are not in use may become available to others. To date, we have relied principally on copyright, trademark and trade secrecy laws, as well as confidentiality agreements and licensing arrangements, to establish and protect our intellectual property. However, we have not obtained confidentiality agreements from all our customers and vendors. Although we obligate our employees to confidentiality, we cannot be certain that these obligations will be honored or enforceable.

We may require additional capital to support business growth, which might not be available.

We intend to continue making investments to support our business growth and may require additional funds to respond to business challenges or opportunities, including the need to develop new, or enhance our current, asset protection solutions, enhance our operating infrastructure or acquire businesses and technologies. Accordingly, we may need to engage in equity or debt financings to secure additional funds. If we raise additional funds through further issuances of equity or convertible debt securities, our current stockholders could suffer significant dilution, and any new equity securities we issue could have rights, preferences and privileges superior to those of holders of our common stock. While our current credit facility is meeting our current needs, any debt financing secured by us in the future could involve restrictive covenants relating to our capital-raising activities and other financial and operational matters, which may make it more difficult for us to obtain additional capital and to pursue business opportunities, including potential acquisitions. In addition, no assurance can be given that adequate or acceptable financing will be available to us, in which case we may not be able to grow our business, including through acquisitions, or respond to business challenges.

Our credit agreement contains financial and operating restrictions that may limit our access to credit. If we fail to comply with financial or other covenants in our credit agreement, we may be required to repay indebtedness to our existing lenders, which may harm our liquidity.

Our credit agreement contains financial covenants that require us to maintain compliance with specified financial ratios. If we fail to comply with these covenants, the lenders could prevent us from borrowing under our credit agreement, require us to pay all amounts outstanding, require that we cash collateralize letters of credit issued under the credit agreement and restrict us from making acquisitions. If the maturity of our indebtedness is accelerated, we then may not have sufficient funds available for repayment or the ability to borrow or obtain sufficient funds to replace the accelerated indebtedness on terms acceptable to us, or at all.

Our current credit agreement also imposes restrictions on our ability to engage in certain activities, such as creating liens, making certain investments, incurring more debt, disposing of certain property, paying dividends and making distributions and entering into a new line of business. While these restrictions have not impeded our business operations to date, if our plans change, these restrictions could be burdensome or require that we pay fees to have the restrictions waived.

Risks Related to Our Common Stock

Our stock price could fluctuate for numerous reasons, including variations in our results.

Our quarterly operating results have fluctuated in the past and may do so in the future. Accordingly, we believe that period-to-period comparisons of our results of operations may be the best indicators of our business. You should not rely upon the results of one quarter as an indication of future performance. Our revenues and operating results may fall below the expectations of securities analysts or investors in any future period. Our failure to meet these expectations may cause the market price of our common stock to decline, perhaps substantially. Our quarterly revenues and operating results may vary depending on a number of factors, including those listed previously under “Risks Related to Our Business.” In addition, the price of our common stock is subject to general economic, market, industry, and competitive conditions, the risk factors discussed below and numerous other conditions outside of our control.

A significant stockholder controls the direction of our business. The concentrated ownership of our common stock may prevent other stockholders from influencing significant corporate decisions.

Dr. Sotirios J. Vahaviolos, our founder and Executive Chairman, owns approximately 35% of our outstanding common stock. As a result, Dr. Vahaviolos has significant control over our Company and has the ability to exert substantial influence over all matters requiring approval by our shareholders, including the election and removal of directors, amendments to our certificate of incorporation, and any proposed merger, consolidation or sale of all or substantially all of our assets and other corporate transactions. This concentration of ownership could be disadvantageous to other shareholders with differing interests from Dr. Vahaviolos.

We currently have no plans to pay dividends on our common stock.

We have not declared or paid any cash dividends on our common stock to date, and we do not anticipate declaring or paying any dividends on our common stock in the foreseeable future. To the extent we do not pay dividends on our common stock, investors must look solely to stock appreciation for a return on their investment.

Shares eligible for future sale may cause the market price for our common stock to decline even if our business is doing well.

Future sales by us or by our existing shareholders of substantial amounts of our common stock in the public market, or the perception that these sales may occur, could cause the market price of our common stock to decline. This could also impair our ability to raise additional capital in the future through the sale of our equity securities. Under our certificate of incorporation, we are authorized to issue up to 200,000,000 shares of common stock, of which approximately 28,563,000 shares of common stock were outstanding as of March 12, 2019. In addition, we have approximately 3,023,000 shares of common stock reserved for issuance related to stock options and restricted stock units that were outstanding as of March 12, 2019. We cannot predict the size of future issuances of our common stock or the effect, if any, that future sales and issuances of shares of our common stock, or the perception of such sales or issuances, would have on the market price of our common stock.

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Provisions of our charter, bylaws and of Delaware law could discourage, delay or prevent a change of control of our company, which may adversely affect the market price of our common stock.

Certain provisions of our certificate of incorporation and bylaws could discourage, delay or prevent a merger, acquisition, or other change of control that stockholders may consider favorable, including transactions in which our stockholders might otherwise receive a premium for their shares. These provisions also could limit the price that investors might be willing to pay in the future for shares of our common stock, thereby depressing the market price of our common stock. Stockholders who wish to participate in these transactions may not have the opportunity to do so. Furthermore, these provisions could prevent or frustrate attempts by our stockholders to replace or remove our management. These provisions:

- allow the authorized number of directors to be changed only by resolution of our board of directors;
- require that vacancies on the board of directors, including newly created directorships, be filled only by a majority vote of directors then in office;
- authorize our board of directors to issue, without stockholder approval, preferred stock that, if issued, could operate as a “poison pill” to dilute the stock ownership of a potential hostile acquirer to prevent an acquisition that is not approved by our board of directors;
- require that stockholder actions must be effected at a duly called stockholder meeting by prohibiting stockholder action by written consent;
- prohibit cumulative voting in the election of directors, which may otherwise allow holders of less than a majority of stock to elect some directors; and
- establish advance notice requirements for stockholder nominations to our board of directors or for stockholder proposals that can be acted on at stockholder meetings and limit the right to call special meetings of stockholders to the Chairman of the Board, the Chief Executive Officer, the board of directors acting pursuant to a resolution adopted by a majority of directors or the Secretary upon the written request of stockholders entitled to cast not less than 35% of all the votes entitled to be cast at such meeting.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which may, unless certain criteria are met, prohibit large stockholders, in particular those owning 15% or more of our outstanding voting stock, from merging or combining with us for a prescribed period of time.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

As of December 31, 2018, we operated approximately 125 offices in 10 countries, with our corporate headquarters located in Princeton Junction, New Jersey. Our headquarters in Princeton Junction is our primary location, where most of our manufacturing and research and development is conducted. While we lease most of our facilities, as of December 31, 2018, we owned properties located in Monroe, North Carolina; Trainer, Pennsylvania; LaPorte, Texas; Burlington, Washington; Gillette, Wyoming; Evanston, Wyoming and Jonquiere, Quebec. Our Services segment utilizes approximately 85 offices throughout North America (including Canada). Our Products and Systems segment’s

primary location is in our Princeton Junction, NJ facility. Our International segment has approximately 40 offices including locations in Belgium, Brazil, France, Germany, Greece, India, the Netherlands, and the United Kingdom. We believe that all of our facilities are well maintained and are suitable and adequate for our current needs.

ITEM 3. LEGAL PROCEEDINGS

We are subject to periodic legal proceedings, investigations and claims that arise in the ordinary course of business. See “Litigation” in Note 18 — Commitments and Contingencies to our audited consolidated financial statements contained in Item

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8 of this Annual Report for a description of legal proceedings involving us and our business, which is incorporated herein by reference.

ITEM 4. MINE SAFETY DISCLOSURES

None.

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASE OF EQUITY SECURITIES

Market for Common Stock

Our common stock currently trades on the New York Stock Exchange (NYSE) under the ticker symbol "MG."

Holders of Record

As of March 12, 2019, there were 8 holders of record of our Common Stock. The number of record holders was determined from the records of our transfer agent and does not include beneficial owners of common stock whose shares are held in the names of various security brokers, dealers, and registered clearing agencies. The transfer agent of our common stock is American Stock Transfer & Trust Company, 6201 15th Avenue, Brooklyn, New York 11219.

Dividends

No cash dividends have been paid on our Common Stock to date. We currently intend to retain our future earnings, if any, to finance the expansion of our business and do not expect to pay any cash dividends in the foreseeable future.

Purchases of Equity Securities

The following sets forth the shares of our common stock we acquired during the fourth quarter of 2018 pursuant to the surrender of shares by employees to satisfy minimum tax withholding obligations in connection with the vesting of restricted stock units.

Month Ending	Total Number of Shares (or Units) Purchased	Average Price Paid per Share (or Unit)	Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs	Approximate dollar Value of Shares that May Yet Be Purchased Under the Plans or Programs (1)
October 31, 2018	33,585	$ 19.59	—	$25,081,657
November 30, 2018	5,067	$ 16.92	—	$25,081,657
December 31, 2018	2,730	$ 14.38	—	$25,081,657

(1) - On October 7, 2015, the Company announced that its Board of Directors approved a share repurchase plan, which authorizes the expenditure of up to $50.0 million for the purchase of the Company's common stock.

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ITEM 6. SELECTED FINANCIAL DATA

The following table presents selected financial data for the years ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and the fiscal years ended May 31, 2016, 2015 and 2014. This selected financial data should be read in conjunction with "Management's Discussion and Analysis of Financial Condition and Results of Operations" in Item 7 and the audited consolidated financial statements and the notes thereto in Item 8 in this Annual Report.

	For the year ended December 31,		For the Transition period ended December 31, 2016 (3)	For the year ended May 31,		
	2018 (1)	2017 (2)		2016 (4)	2015 (4)	2014 (4)
	($ in thousands, except per share data)					
Statement of Income Data:						
Revenues	$742,354	$700,970	$404,161	$719,181	$711,252	$623,447
Gross profit	207,874	187,712	117,004	203,008	184,733	172,943
Income from operations	22,221	4,160	17,533	43,177	30,353	38,295
Net income (loss) attributable to Mistras Group, Inc.	$6,836	$(2,175)	$9,568	$24,654	$16,081	$22,518
Per Share Information:						
Weighted average common shares outstanding:						
Basic	28,406	28,422	28,989	28,856	28,613	28,365
Diluted	29,427	28,422	30,125	29,891	29,590	29,324
Earnings (loss) per common share:						
Basic	$0.24	$(0.08)	$0.33	$0.85	$0.56	$0.79
Diluted	$0.23	$(0.08)	$0.32	$0.82	$0.54	$0.77
Balance Sheet Data:						
Cash and cash equivalents	$25,544	$27,541	$19,154	$21,188	$10,555	$10,020
Total assets	694,037	554,441	469,427	482,675	471,727	443,972
Total long-term debt and obligations under capital leases, including current portion	303,617	181,491	103,466	104,776	132,822	97,563
Total Mistras Group, Inc. stockholders' equity	$270,897	$270,619	$270,582	$276,163	$244,819	$242,104
Cash Flow Data:						
Net cash provided by operating activities	$41,664	$55,799	$30,259	$68,124	$49,840	$36,873
Net cash used in investing activities	(155,450)	(102,797)	(17,374)	(16,752)	(49,651)	(38,005)
Net cash (used in) provided by financing activities	113,969	53,045	(12,869)	(40,378)	2,066	3,262

1 - Includes pre-tax charges of $9.4 million relating to special items. See the Income from Operations table in Item 7 for a description of these items. The impact of these items, net of taxes, on net income and diluted earnings per share was $9.3 million and $0.32, respectively, including a $1.7 million tax charge related to the Tax Act.

2 - Includes pre-tax charges of $21.0 million relating to special items. The impact of these items, net of taxes, on net income and diluted earnings per share was $14.9 million and $0.51, respectively, including a $2.0 million tax charge

related to the Tax Act.

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3- Includes pre-tax charges of $2.2 million relating to special items. The impact of these items, net of taxes, on net income and diluted earnings per share was ($1.6) million and ($0.05), respectively.

4 - Includes pre-tax charges (benefits) of $6.0 million in fiscal 2016, $0.1 million in fiscal 2015 and $(2.4) million in fiscal 2014 relating to special items. Net income was (decreased) increased by these items, net of taxes, by ($3.2) million in fiscal 2016, $1.0 million in fiscal 2015 and $2.4 million in fiscal 2014, respectively. The (decrease) increase of these items on diluted earnings per share were ($0.11) in fiscal 2016, $0.03 in fiscal 2015 and $0.08 in fiscal 2014, respectively.

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ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATION

The following Management's Discussion and Analysis ("MD&A") provides a narrative of our results of operations for the years ended December 31, 2018, 2017 and 2016, the transition period ended December 31, 2016 and the comparable period ended December 31, 2015 (which is referred to as "transition period 2015") and our financial position as of December 31, 2018 and December 31, 2017. The MD&A should be read together with our consolidated financial statements and related notes included in Item 8 in this Annual Report on Form 10-K. Unless otherwise specified or the context otherwise requires, "Mistras," "the Company," "we," "us" and "our" refer to Mistras Group, Inc. and it consolidated subsidiaries. The MD&A includes the following sections:

- Forward-Looking Statements
- Overview
- Consolidated Results of Operations
- Liquidity and Capital Resources
- Critical Accounting Estimates
- Recent Accounting Pronouncements

Forward-Looking Statements

This Annual Report on Form 10-K contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 (Securities Act), and Section 21E of the Securities Exchange Act of 1934 (Exchange Act). Such forward-looking statements include those that express plans, anticipation, intent, contingency, goals, targets or future development and/or otherwise are not statements of historical fact. See "Forward-Looking Statements" at the beginning of Item 1 of this Annual Report.

Overview

We offer our customers "one source for asset protection solutions"® and are a leading global provider of technology-enabled asset protection solutions used to evaluate the structural integrity and reliability of critical energy, commercial aerospace and defense, industrial and public infrastructure. We combine industry-leading products and technologies, expertise in mechanical integrity (MI), Non-Destructive Testing (NDT), Destructive Testing (DT), mechanical and predictive maintenance (PdM) services, process and fixed asset engineering and consulting services, proprietary data analysis and our world class enterprise inspection database management and analysis software, PCMS, to deliver a comprehensive portfolio of customized solutions, ranging from routine inspections to complex, plant-wide asset integrity management and assessments. These mission critical solutions enhance our customers' ability to comply with governmental safety and environmental regulations, extend the useful life of their assets, increase productivity, minimize repair costs, manage risk and avoid catastrophic disasters. Our comprehensive "OneSource" portfolio of customized solutions, utilizing a proven systematic method that creates a closed-loop lifecycle for addressing continuous asset protection and improvement, helps us to deliver value to our customers.

Our operations consist of three reportable segments: Services, International and Products and Systems.

- Services provides asset protection solutions predominantly in North America, with the largest concentration in the United States, followed by Canada, consisting primarily of NDT, inspection, mechanical and engineering services that are used to evaluate the structural integrity and reliability of critical energy, industrial and public infrastructure.

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International offers services, products and systems similar to those of the other segments to select markets within Europe, the Middle East, Africa, Asia and South America, but not to customers in China and South Korea, which are served by the Products and Systems segment.

- Products and Systems designs, manufactures, sells, installs and services the Company’s asset protection products and systems, including equipment and instrumentation, predominantly in the United States.

Given the role our solutions play in enhancing the safe and efficient operation of infrastructure, we have historically provided a
majority of our solutions to our customers on a regular, recurring basis. We perform these services largely at our customers’ facilities, while primarily servicing our aerospace customers at our growing network of state-of-the-art, in-house laboratories. These solutions typically include NDT and inspection services, and can also include a wide range of mechanical services,

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including engineering assessments, heat tracing, pre-inspection insulation stripping, inspections, coating applications, reinsulation, and long-term condition-monitoring. Under this business model, many customers outsource their inspection to us on a “run and maintain” basis. We have established long-term relationships as a critical solutions provider to many of the leading companies with asset-intensive infrastructure in our target markets. These markets include oil and gas (downstream, midstream, upstream and petrochemical), commercial aerospace and defense, power generation (natural gas, fossil, nuclear, alternative, renewable, and transmission and distribution), public infrastructure, chemicals, transportation, primary metals and metalworking and research and engineering institutions.

We have focused on providing our advanced asset protection solutions to our customers using proprietary, technology-enabled software and testing instruments, including those developed by our Products and Systems segment. We have made numerous acquisitions in an effort to grow our base of experienced, certified personnel, expand our service lines and technical capabilities, increase our geographical reach and leverage our fixed costs. We have increased our capabilities and the size of our customer base through the development of applied technologies and managed support services, organic growth and the integration of acquired companies. These acquisitions have provided us with additional service lines, technologies, resources and customers that we believe will enhance our advantages over our competition.

In regards to the Onstream acquisition, completed in December 2018, it helps support many of our Corporate initiatives. Onstream's strong presence in inline inspection provides us with a strong foundation within the midstream Oil and Gas market, which is an important piece of our overall growth strategy. We expect to generate new business opportunities through introduction of our inline inspection capabilities to existing midstream customers. Onstream also provides us with an additional digital solution with their Streamview™ software, which is an innovative application of advanced digital technology.

Demand for outsourced asset protection solutions has generally increased over the last ten years, creating demand from which our entire industry has benefited. We believe continued growth can be realized in all of our target markets. During the first half of 2017, market conditions were soft, driven by lower oil prices which caused many of the Company’s oil and gas customers to curtail spending for our services and products. However, during the second half of 2017, market conditions strengthened and continued to improve throughout 2018, with oil and gas customer spending patterns rebounding from low prior year levels described above. These improved conditions led to a catch-up from the pent-up demand of deferred work during the Spring of 2018 as well as a healthier level of market activity for projects and turnarounds. Although oil prices decreased in the last two months of 2018, they have started to rebound during the early months of 2019. Subject to oil price fluctuations, we expect relatively stable oil and gas customer spending for inspection services throughout 2019. In addition, demand for our services in the aerospace industry are strong and we are focused on expanding our capabilities to service this market.

In addition, we have increased our capabilities and the size of our customer base through the development of applied technologies and managed support services, organic growth and the integration of acquired companies. These acquisitions have provided us with additional products, technologies, resources and customers that we believe will enhance our advantages over our competition.

Note about Non-GAAP Measures

In this MD&A under the heading "Income from Operations", the non-GAAP financial performance measure "Income (loss) before special items" is used for each of our three segments, the Corporate segment and the Total Company, with tables reconciling the measure to a financial measure under GAAP. This non-GAAP measure excludes from the GAAP measure "Income (loss) from Operations" (a) transaction expenses related to acquisitions, such as professional fees and due diligence costs, (b) the net changes in the fair value of acquisition-related contingent consideration liabilities, (c) impairment charges, (d) reorganization and other costs, which includes items such as severance, labor

relations matters and asset and lease termination costs and (e) other special items. These adjustments have been excluded from the GAAP measure because these expenses and credits are not related to the Company's or Segment's core business operations. The acquisition related costs and special items can be a net expense or credit in any given period.

We believe investors and other users of our financial statements benefit from the presentation of "Income (loss) before special items" for each of our three segments, the Corporate segment and the Total Company in evaluating our performance. Income (loss) before special items excludes the identified adjustments, which provides additional tools to compare our core business operating performance on a consistent basis and measure underlying trends and results in our business. Income (loss) before special items is not used to determine incentive compensation for executives or employees, nor is it a replacement for GAAP and/or necessarily comparable to other companies non-GAAP financial measures.

Consolidated Results of Operations

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On January 3, 2017, the Company's Board of Directors approved a change in the Company's fiscal year end from May 31 to December 31, effective December 31, 2016. In connection with this change, we previously filed a Transition Report on Form 10-K to report the results of the seven-month transition period from June 1, 2016 to December 31, 2016. In this Annual Report on Form 10-K, the periods presented are the years ended December 31, 2018 and 2017, the seven-month transition period from June 1, 2016 to December 31, 2016 and the year ended May 31, 2016. For comparison purposes, we have also included unaudited data for the year ended December 31, 2016 and for the seven months ended December 31, 2015.

Year ended December 31, 2018 vs. Year ended December 31, 2017

The following table summarizes our consolidated statements of operations for the years ended December 31, 2018 and 2017:

	For the year ended December 31,	
	2018	2017
	($ in thousands)	
Revenues	$742,354	$700,970
Gross profit	207,874	187,712
Gross profit as a % of Revenue	28 %	27 %
Total operating expenses	185,653	183,552
Operating expenses as a % of Revenue	25 %	26 %
Income from operations	22,221	4,160
Income from operations as a % of Revenue	3 %	1 %
Interest expense	7,950	4,386
Income (loss) before provision for income taxes	14,271	(226)
Provision for income taxes	7,426	1,942
Net income (loss)	6,845	(2,168)
Less: net income attributable to noncontrolling interests, net of taxes	9	7
Net income (loss) attributable to Mistras Group, Inc.	$6,836	$(2,175)

Revenues

Revenues by segment for the years ended December 31, 2018 and 2017 were as follows:

	For the year ended December 31,	
	2018	2017
	($ in thousands)	
Revenues		
Services	$574,619	$543,565
International	153,448	144,265
Products and Systems	23,426	23,297
Corporate and eliminations	(9,139)	(10,157)
	$742,354	$700,970

Revenue was $742.4 million for the year ended December 31, 2018, an increase of $41.4 million, or 6%, compared with the year ended December 31, 2017. The increase was driven by the Services segment, which increased by $31.1 million, or 6%, as well as an increase of $9.2 million, or 6% from the International segment. Revenue from the

Products and Systems segment was consistent over the respective periods. The Services segment increase was driven by mid-single digit acquisition growth. The International segment increase was driven by low-single digit organic growth as well as low-single digit favorable impact of foreign exchange rates.

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Revenues from oil and gas customers comprised 56% and 58% for the years ended December 31, 2018 and 2017, respectively. Revenues from aerospace and defense customers comprised 15% and 13% for the years ended December 31, 2018 and 2017, respectively.

Gross Profit

Gross profit by segment for the years ended December 31, 2018 and December 31, 2017 was as follows:

	For the year ended December 31,	
	2018	2017
	($ in thousands)	
Gross profit		
Services	$151,974	$139,160
% of segment revenue	26.4 %	25.6 %
International	45,464	38,974
% of segment revenue	29.6 %	27.0 %
Products and Systems	10,560	9,798
% of segment revenue	45.1 %	42.1 %
Corporate and eliminations	(124)	(220)
	$207,874	$187,712
% of total revenue	28.0 %	26.8 %

Gross profit increased $20.2 million, or 11%, for the year ended December 31, 2018 compared to the year ended December 31, 2017, with a sales increase of 6%. Gross profit margin was 28.0% and 26.8% for the years ended December 31, 2018 and 2017, respectively. Services segment gross profit margins had a year-on-year increase of 80 basis points to 26.4% for the year ended December 31, 2018, which primarily reflected an improved sales mix. International segment gross margins had a year-on-year increase of 260 basis points to 29.6% for the year ended December 31, 2018. This increase was primarily driven by higher utilization of technical labor and overhead, a more favorable sales mix and exiting a poor margin contract from the prior year. Products and Systems segment gross margins improved by 300 basis points for the year ended December 31, 2018 to 45.1%, driven by a more favorable sales mix.

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Income from Operations. The following table shows a reconciliation of segment income (loss) from operations to income (loss) before special items for the years ended December 31, 2018 and 2017:

	For the year ended December 31,	
	2018	2017
	($ in thousands)	
Services:		
Income from operations (GAAP)	$47,126	$46,677
Pension withdrawal expense	5,886	—
Bad debt provision for troubled customers	650	1,200
Reorganization and other costs	458	684
Acquisition-related expense, net	576	392
Income before special items (non-GAAP)	54,696	48,953
International:		
Income from operations (GAAP)	3,953	3,537
Reorganization and other costs	3,966	1,055
Acquisition-related (benefit), net	(409)	(501)
Income before special items (non-GAAP)	7,510	4,091
Products and Systems:		
Income (loss) from operations (GAAP)	2,368	(16,991)
Impairment charges	—	15,810
Gain on sale of subsidiary	(2,384)	—
Reorganization and other costs	29	18
Income (loss) before special items (non-GAAP)	13	(1,163)
Corporate and Eliminations:		
Loss from operations (GAAP)	(31,226)	(29,063)
Litigation charges	—	1,600
Reorganization and other costs	305	184
Acquisition-related expense, net	365	591
Loss before special items (non-GAAP)	(30,556)	(26,688)
Total Company:		
Income from operations (GAAP)	$22,221	$4,160
Litigation charges	—	1,600
Pension withdrawal expense	5,886	—
Gain on sale of subsidiary	(2,384)	—
Impairment charges	—	15,810
Bad debt provision for troubled customers	650	1,200
Reorganization and other costs	4,758	1,941
Acquisition-related expense, net	532	482
Income before special items (non-GAAP)	$31,663	$25,193

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Total Company income from operations (GAAP) increased by $18.1 million, or 434% compared to the year ended December 31, 2017. Total Company income before special items (non-GAAP) increased by $6.5 million or 26% compared with the year ended December 31, 2017. Income before special items improved by 70 basis points to 4.3% for the year ended December 31, 2018 from 3.6% for the year ended December 31, 2017.

Operating expenses (GAAP), as a percentage of revenue, decreased to 25% for the year ended December 31, 2018 compared to 26% for the year ended December 31, 2017. Operating expenses, excluding special items (non-GAAP), as a percentage of revenues, was 24% for the year ended December 31, 2018 compared to 23% for the year ended December 31, 2017. For the GAAP decrease, the chart above highlights the expense items that resulted in a lower operating expense percentage for 2018, in addition to the fact that revenues in 2018 were higher by $41 million. The non-GAAP increase was primarily driven by approximately $6.5 million of additional expenses in 2018 from 2017 acquisitions in our Services segment. In addition, there was approximately $4.0 million of additional Corporate expenses in 2018 compared to 2017 as a result of additional headcount and increase in professional fees. There was an increase of $1.1 million in research and engineering expenses, primarily from our Products segment. The Company incurred approximately $0.7 million more transactional foreign exchange expense as a result of a stronger U.S. dollar.

The workforce of certain of the Company’s subsidiaries is unionized and the terms of employment for these workers are governed by collective bargaining agreements, or CBAs. Under these CBAs, the Company’s subsidiaries are required to contribute to the national pension funds for the unions representing these employees, which are multi-employer pension plans. The Company was notified that a significant project was awarded to another contractor in January 2018, and as a result, one of the Company’s subsidiaries experienced a significant reduction in the number of its employees covered by one of the CBAs. Under certain circumstances, such a reduction in the number of employees participating in multi-employer pension plans pursuant to this CBA could result in a complete or partial withdrawal liability to these multi-employer pension plans under the Employee Retirement Income Security Act of 1974 ("ERISA"). Management has explored options to retain a level of union work that would avoid withdrawal liability to the pension plans, but concluded during the third quarter of 2018 that the subsidiaries probably would not obtain sufficient union work to avoid withdrawal liability. As of September 30, 2018, the Company determined that it is probable that its subsidiary will incur a withdrawal liability related to these multiemployer pension plans and estimated that the total amount of this potential liability is approximately $5.9 million. Accordingly, the Company recorded a charge of $5.9 million during the year ended December 31, 2018 for this potential withdrawal liability.

During the year ended December 31, 2018, the Company recorded approximately $1.2 million, in charges related to labor claims for its Brazilian subsidiary, which are included within Selling, General and Administrative expenses. These claims related to employees in a company acquired by the Brazilian subsidiary in a prior period. The Company believes it is entitled to indemnification from the sellers of the acquired company for most of these charges, but has not recorded the expected recovery of indemnification for these labor claims as the amount and timing of collection is uncertain as of December 31, 2018.

The Company’s German subsidiary provides employees to customers under temporary staff leasing arrangements. In April 2017, the German Labor Lease Act was passed in Germany limiting the duration of temporary workers to eighteen months, or longer as subsequently agreed with by a customer appropriate authority. Since the passing of the German Labor Lease Act, the Company explored selling its staff leasing services and concluded during the third quarter of 2018 that a sale would not be probable. As a result, the Company decided that it will not renew several of these leasing services contracts when they expire beginning in 2019. Due to the cap on the length of service allowed under the German Labor Lease Act, employees will have to be transitioned off the customer contracts. It is expected that the German subsidiary then will either terminate these employees, creating a severance obligation to the terminated employees, or transition them to the Company's other customers. As of December 31, 2018, the Company had over 200 employees under current staff leasing contracts, which expire through 2021. As of December 31, 2018, the Company estimated it would be required to pay approximately $1.6 million in severance for these employees not

otherwise transitioned, and accordingly recorded an accrual for this amount which is included within Selling, General and Administrative expenses for the year ended December 31, 2018.

Interest Expense

Interest expense was $8.0 million and $4.4 million for the years ended December 31, 2018 and December 31, 2017, respectively. The increase was primarily related to increased borrowings on the Company's credit agreement throughout the year, which were primarily attributable to acquisitions completed during 2017 and 2018, and to a lesser extent, from an increase in the base borrowing rate.

Income Taxes

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Our effective income tax rate was approximately 52.0% for the year ended December 31, 2018, compared to (857.9)% for the year ended December 31, 2017. The change in effective tax rate was primarily driven by tax reform in the United States.

On December 22, 2017, the United States enacted fundamental changes to federal tax law following the passage of the Tax Cuts and Jobs Act (the "Tax Act"). The Tax Act is complex and significantly changes the U.S. corporate tax system. Our financial statements for the year ended December 31, 2017 reflected certain effects of the Tax Act which includes a reduction in the corporate tax rate from 35% to 21%, imposition of a tax on unrepatriated foreign earnings ("the transition tax"), and a reduction to deferred tax assets attributable to changes made to executive compensation rules. As a result of the changes to tax laws and tax rates under the Tax Act, we incurred an increase in income tax expense of $1.9 million during the year ended December 31, 2017, which consisted primarily of a $2.3 million decrease in our net deferred tax liabilities due to the reduction in the federal corporate tax rate from 35% to 21%, an increase of $3.9 million in tax expense attributable to the transition tax, and a decrease in deferred tax assets of $0.3 million due to changes made to executive compensation rules. During the year ended December 31, 2018, the company completed the accounting for the effects of the Tax Act on the period ended December 31, 2017, which resulted in income tax expense of $1.7 million. This consisted primarily of an increase of $0.1 million in our net deferred tax liabilities due to the reduction in the federal corporate rate from 35% to 21%, an increase of $1.3 million in tax expense attributable to the transition tax, and a decrease in deferred tax assets of $0.4 million due to changes made to executive compensation. Additionally, as a result of the Tax Act, we incurred an income tax expense of $0.6 million during the year ended December 31, 2018 which consists primarily of an increase of $0.3 million in the tax expense attributable to the global intangible low-taxed income ("GILTI"), an increase of $0.2 million for non-deductible executive compensation, and an increase of $0.1 million for non-deductible fringe benefits.
Income tax expense varies as a function of pre-tax income and the level of non-deductible expenses, such as certain amounts of meals and entertainment expense, valuation allowances, and other permanent differences. It is also affected by discrete items that may occur in any given year, but are not consistent from year to year. Our effective income tax rate may fluctuate over the next few years due to many variables including the amount and future geographic distribution of our pre-tax income, changes resulting from our acquisition strategy, increases or decreases in our permanent differences, and the effects of the Tax Act.

Year ended December 31, 2017 vs. Year ended December 31, 2016

The following table summarizes our consolidated statements of operations for the years ended December 31, 2017 and 2016:

	For the year ended December 31,	
	2017	2016 (unaudited)
	($ in thousands)	
Revenues	$700,970	$684,762
Gross profit	187,712	194,134
Gross profit as a % of Revenue	27 %	28 %
Total operating expenses	183,552	168,588
Operating expenses as a % of Revenue	26 %	25 %
Income from operations	4,160	25,546
Income from operations as a % of Revenue	1 %	4 %
Interest expense	4,386	3,075
(Loss) income before provision for income taxes	(226)	22,471
Provision for income taxes	1,942	8,008

Net (loss) income	(2,168)	14,463
Less: net income attributable to noncontrolling interests, net of taxes	7	54
Net (loss) income attributable to Mistras Group, Inc.	$(2,175)	$14,409

Revenues

Revenues by segment for the years ended December 31, 2017 and 2016 were as follows:

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	For the year ended December 31,	
	2017	2016 (unaudited)
	($ in thousands)	
Revenues		
Services	$ 543,565	$ 519,378
International	144,265	148,761
Products and Systems	23,297	26,049
Corporate and eliminations	(10,157)	(9,426)
	$ 700,970	$ 684,762

Revenue was $701.0 million for the year ended December 31, 2017, an increase of $16.2 million, or 2%, compared with the year ended December 31, 2016. The increase was driven by the Services segment, which increased by $24.2 million, or 5%, partially offset by a decrease of $4.5 million, or 3% from the International segment and the Products and Systems segment, which decreased $2.8 million, or 11%. The Services segment increase was driven by mid-single digit acquisition growth. The International segment decrease was driven by a mid-single digit organic decline, offset by low single digit favorable impact of foreign exchange rates. The Products and Systems segment decrease was driven by lower sales volume.

Revenues from oil and gas customers comprised 58% for the year ended December 31, 2017, compared to 57% for the year ended December 31, 2016. Revenues from aerospace customers comprised 13% for the years ended December 31, 2017 and 2016.

Gross Profit

Gross profit by segment for the years ended December 31, 2017 and December 31, 2016 was as follows:

	For the year ended December 31,	
	2017	2016 (unaudited)
	($ in thousands)	
Gross profit		
Services	$ 139,160	$ 133,532
% of segment revenue	25.6 %	25.7 %
International	38,974	48,372
% of segment revenue	27.0 %	32.5 %
Products and Systems	9,798	11,956
% of segment revenue	42.1 %	45.9 %
Corporate and eliminations	(220)	274
	$ 187,712	$ 194,134
% of total revenue	26.8 %	28.4 %

Gross profit decreased $6.4 million, or 3%, for the year ended December 31, 2017 compared to the year ended December 31, 2016, despite a sales increase of 2%. Gross profit margin was 26.8% and 28.4% for the years ended December 31, 2017 and 2016, respectively. International segment gross margins had a year-on-year decline of 550 basis points to 27.0% for the year ended December 31, 2017. This decline was primarily driven by lower revenues in the Company's German subsidiary, as well as poor margins on a large contract and lower utilization of technical labor in the United Kingdom. Products and Systems segment gross margins declined by 380 basis points for the year ended

December 31, 2017 to 42.1%, driven by lower sales volumes and a less favorable sales mix. Services segment gross profit margins were consistent with the prior year.

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Income from Operations. The following table shows a reconciliation of segment income (loss) from operations to income (loss) before special items for the years ended December 31, 2017 and 2016:

	For the year ended December 31,	
	2017	2016 (unaudited)
	($ in thousands)	
Services:		
Income from operations (GAAP)	$46,677	$ 37,788
Litigation charges	—	6,320
Bad debt provision for a customer bankruptcy	1,200	—
Severance costs	684	77
Asset write-offs and lease terminations	—	—
Acquisition-related (benefit) expense, net	392	(232)
Income before special items (non-GAAP)	48,953	43,953
International:		
Income from operations (GAAP)	3,537	12,908
Severance costs	1,055	1,184
Asset write-offs and lease terminations	—	1,042
Acquisition-related (benefit) expense, net	(501)	(42)
Income before special items (non-GAAP)	4,091	15,092
Products and Systems:		
Loss from operations (GAAP)	(16,991)	(180)
Impairment charges	15,810	—
Severance costs	18	31
Loss before special items (non-GAAP)	(1,163)	(149)
Corporate and Eliminations:		
Loss from operations (GAAP)	(29,063)	(24,970)
Litigation charges	1,600	—
Severance costs	184	133
Acquisition-related expense (benefit), net	591	269
Loss before special items (non-GAAP)	(26,688)	(24,568)
Total Company:		
Income from operations (GAAP)	$4,160	$ 25,546
Litigation charges	1,600	6,320
Impairment charges	15,810	—
Bad debt provision for a customer bankruptcy	1,200	—
Severance costs	1,941	1,425
Asset write-offs and lease terminations	—	1,042
Acquisition-related (benefit) expense, net	482	(5)
Income before special items (non-GAAP)	$25,193	$ 34,328

Total Company income from operations (GAAP) decreased by $21.4 million, or 84% compared to the year ended December 31, 2016. Total Company income before special items (non-GAAP) decreased by $9.1 million or 27% compared with the year

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ended December 31, 2016. Income before special items declined by 140 basis points to 3.6% for the year ended December 31, 2017 from 5.0% for the year ended December 31, 2016.

Total operating expenses increased by $15.0 million, or 9% for the year ended December 31, 2017, driven primarily by the $15.8 million impairment charges for the Products and Systems segment (See Notes 8 and 9 in the notes to consolidated financial statements in Item 8 of this Annual Report).

Interest Expense

Interest expense was $4.4 million and $3.1 million for the years ended December 31, 2017 and December 31, 2016. The increase was primarily related to increased borrowings on the Company's revolving line of credit.

Income Taxes

Our effective income tax rate was approximately (858)% for the year ended December 31, 2017, compared to 36% for the year ended December 31, 2016. The change in effective tax rate was driven by tax reform in the United States.
On December 22, 2017, the United States enacted fundamental changes to federal tax law following the passage of the Tax Cuts and Jobs Act (the “Tax Act”). The Tax Act is complex and significantly changes the U.S. corporate tax system. Our financial statements for the year ended December 31, 2017 reflect certain effects of the Tax Act which includes a reduction in the corporate tax rate from 35% to 21%, imposition of a tax on unrepatriated foreign earnings (“the transition tax”), and a reduction to deferred tax assets attributable to changes made to executive compensation rules. As a result of the changes to tax laws and tax rates under the Tax Act, we incurred an increase in income tax expense of $1.9 million during the year ended December 31, 2017, which consisted primarily of a $2.3 million decrease in our net deferred tax liabilities due to the reduction in the federal corporate tax rate from 35% to 21%, an increase of $3.9 million in tax expense attributable to the transition tax, and a decrease in the realizability of deferred tax assets of $0.3 million due to changes made to executive compensation rules pursuant to the Tax Act.

Income tax expense varies as a function of pre-tax income and the level of non-deductible expenses, such as certain amounts of meals and entertainment expense, valuation allowances, and other permanent differences. It is also affected by discrete items that may occur in any given year, but are not consistent from year to year. Our effective income tax rate may fluctuate over the next few years due to many variables including the amount and future geographic distribution of our pre-tax income, changes resulting from our acquisition strategy, increases or decreases in our permanent differences, and the effects of the Tax Act.

Transition period ended December 31, 2016 vs. Transition period ended December 31, 2015

The following table summarizes our consolidated statements of operations for the transition periods ended December 31, 2016 and 2015:

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	For the Transition period ended December 31,	
	2016	2015 (unaudited)
	($ in thousands)	
Revenues	$404,161	$427,913
Gross profit	117,004	123,190
Gross profit as a % of Revenue	29 %	29 %
Total operating expenses	99,471	88,092
Operating expenses as a % of Revenue	25 %	21 %
Income from operations	17,533	35,098
Income from operations as a % of Revenue	4 %	8 %
Interest expense	2,052	3,672
Income before provision for income taxes	15,481	31,426
Provision for income taxes	5,870	11,627
Net income	9,611	19,799
Less: net income (loss) attributable to noncontrolling interests, net of taxes	43	(15)
Net income attributable to Mistras Group, Inc.	$9,568	$19,814

Revenues by segment for the transition periods ended December 31, 2016 and 2015 were as follows:

	For the Transition period ended December 31,	
	2016	2015 (unaudited)
	($ in thousands)	
Revenues		
Services	$293,218	$ 327,118
International	104,013	87,411
Products and Systems	14,541	18,786
Corporate and eliminations	(7,611)	(5,402)
	$404,161	$ 427,913

Revenue was $404.2 million for the transition period ended December 31, 2016, a decrease of $23.8 million, or 6% compared with the transition period ended December 31, 2015. The decrease was driven by the Services segment, which decreased by $33.9 million, or 10% and the Products and Systems segment, which decreased by $4.2 million, or 23%, partially offset by an increase of $16.6 million, or 19% from the International segment. The Services segment decrease was driven by low double digit organic decline, offset by a small amount of acquisition growth. The Products and Systems segment decrease was driven by lower sales volume. The International segment increase was driven by organic growth, offset partially by an unfavorable impact of foreign exchange rates.

Revenues from oil and gas customers comprised 55% for the transition period ended December 31, 2016.

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Gross profit by segment for the transition periods ended December 31, 2016 and December 31, 2015 was as follows:

	For the Transition period ended December 31,			
	2016		2015 (unaudited)	
	($ in thousands)			
Gross profit				
Services	$75,784		$ 87,514	
% of segment revenue	25.8	%	26.8	%
International	34,210		26,762	
% of segment revenue	32.9	%	30.6	%
Products and Systems	6,920		8,986	
% of segment revenue	47.6	%	47.8	%
Corporate and eliminations	90		(72	)
	$117,004		123,190	
% of total revenue	28.9	%	28.8	%

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Gross profit decreased $6.2 million, or 5% for the transition period ended December 31, 2016 compared to the transition period ended December 31, 2015. As a percentage of revenues, gross profit improved by 10 basis points compared with the prior year to 28.9%.

The decrease in gross profit was primarily attributable to revenue declines in the Services segment of $11.7 million or 13% and in the Products and Systems segment of $2.1 million or 23%, offset in part by the International segment's improvement of $7.4 million or 28%. International gross profit margins improved to 32.9% of revenues in the transition period ended December 31, 2016 compared with 30.6% of revenues in the transition period ended December 31, 2015. The 230 basis point increase was due to improvement across the Company's largest country locations, driven by organic growth, improvements in technical labor utilization, sales mix and overhead utilization. Services segment gross profit margins decreased to 25.8% of revenues in the transition period ended December 31, 2016 compared with 26.8% of revenues in the transition period ended December 31, 2015. The 100 basis point decrease was primarily driven by lower sales volume and a less favorable sales mix. Products and Systems segment gross margins decreased by 20 basis points to 47.6% of revenues.

Income from Operations. The following table shows a reconciliation of the segment income from operations to income before for the transition periods ended December 31, 2016 and 2015:

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	For the transition period ended December 31,	
	2016	2015 (unaudited)
	($ in thousands)	
Services:		
Income from operations (GAAP)	$22,411	$ 37,175
Severance costs	77	188
Acquisition-related expense (benefit), net	236	(593)
Income before special items (non-GAAP)	22,724	36,770
International:		
Income from operations (GAAP)	10,597	6,888
Severance costs	474	175
Asset write-offs and lease terminations	1,042	—
Acquisition-related expense (benefit), net	29	(457)
Income before special items (non-GAAP)	12,142	6,606
Products and Systems:		
(Loss) income from operations (GAAP)	(254)	2,613
Severance costs	14	17
(Loss) income before special items (non-GAAP)	(240)	2,630
Corporate and Eliminations:		
Loss from operations (GAAP)	(15,221)	(11,578)
Severance costs	133	—
Acquisition-related expense (benefit), net	231	91
Loss before special items (non-GAAP)	(14,857)	(11,487)
Total Company:		
Income from operations (GAAP)	$17,533	$ 35,098
Severance costs	698	380
Asset write-offs and lease terminations	1,042	—
Acquisition-related expense (benefit), net	496	(959)
Income before special items (non-GAAP)	$19,769	$ 34,519

Total Company income from operations (GAAP) decreased by $17.6 million, or 50% compared to the transition period ended December 31, 2015. Total Company income before special items (non-GAAP) decreased by $14.8 million or 43% compared with the transition period ended December 31, 2015. Income before special items declined by 320 basis points to 4.9% of revenues for the transition period ended December 31, 2016.

Total operating expenses increased by $11.4 million, or 13% in the transition period ended December 31, 2016 compared to the transition period ended December 31, 2015. The increase included approximately $5 million of expenses that were primarily associated with the acceleration of certain costs to align with our new fiscal year, and other charges which included severance and the write-off of an intangible asset.

Interest Expense

Interest expense was $2.1 million and $3.7 million for the transition periods ended December 31, 2016 and December 31, 2015, respectively. The decrease was primarily related to the repayment of seller notes related to acquisitions.

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Income Taxes

Our effective income tax rate was 38% for the transition period ended December 31, 2016 compared to 37% for the transition period ended December 31, 2015. The higher effective tax rate was driven by the impact of permanent items.

Liquidity and Capital Resources

Overview

The Company has funded its operations from cash provided from operations, bank borrowings and capital lease financings. Management believes that the Company's existing cash and cash equivalents, anticipated cash flows from operating activities, and available borrowings under our credit agreement will be more than sufficient to meet anticipated cash needs over the next 12 months. The Company generated operating cash flow of $41.7 million for the year ended December 31, 2018, $55.8 million for the year ended December 31, 2017, $63.2 million for the year ended December 31, 2016 and $30.3 million for the transition period ended December 31, 2016. The Company generated operating cash flow of $68.1 million in fiscal 2016. Capital expenditures for the purchase of property, plant and equipment and of intangible assets was $21.1 million, $20.6 million, $15.9 million, $9.8 million and $16.2 million for the years ended December 31, 2018, 2017 and 2016, the transition period ended December 31, 2016 and fiscal 2016, respectively.

Cash Flows Table

The following table summarizes our cash flows for the years ended December 31, 2018, 2017 and 2016, the transition period ended December 31, 2016 and fiscal 2016:

	For the year ended December 31,			For the Transition period ended December 31,	For the year ended May 31,
	2018	2017	2016	2016	2016
($ in thousands)			(unaudited)		
Net cash provided by (used in):					
Operating activities	$41,664	$55,799	$ 63,211	$ 30,259	$68,124
Investing activities	(155,450)	(102,797)	(22,408)	(17,374)	(16,752)
Financing activities	113,969	53,045	(30,031)	(12,869)	(40,378)
Effect of exchange rate changes on cash	(2,180)	2,340	(1,217)	(2,050)	(361)
Net change in cash and cash equivalents	$(1,997)	$8,387	$ 9,555	$ (2,034)	$10,633

Cash Flows from Operating Activities

Cash provided by operating activities for the year ended December 31, 2018 was $41.7 million, a decline of $14 million from the prior year. The decrease was primarily attributable to movements in working capital, including the timing of collections on accounts receivable.

Cash provided by operating activities for the year ended December 31, 2017 was $55.8 million, a decline of $8 million from the prior year. The decrease was primarily attributable to a lower level of net income, exclusive of the $15.8 million impairment charge during 2017.

Cash provided by operating activities for the transition period ended December 31, 2016 was $30.3 million.

Cash provided by operating activities in fiscal 2016 improved by $18 million or 37% over the prior fiscal year. This improvement was primarily driven by the Company's $16 million improvement in net income, as adjusted for working capital items and certain non-cash items, most notably the $6 million legal settlement, as well as from reducing Days Sales Outstanding by 2 days.

Cash Flows from Investing Activities

Net cash used in investing activities for the year ended December 31, 2018 was $155.5 million, principally due to $135.7 million of acquisitions, net of dispositions, and $21.1 million purchases of property, plant and equipment and intangible assets.

Net cash used in investing activities for the year ended December 31, 2017 was $102.8 million, principally due to $83.4 million of acquisitions and $20.6 million purchases of property, plant and equipment and intangible assets. Net cash used in investing activities for the year ended December 31, 2016 was $22.4 million, principally due to $15.9 million purchases of property, plant and equipment and intangible assets as well as $8.3 million of acquisitions.

Net cash used in investing activities for the transition period ended December 31, 2016 was $17.4 million, principally due to $9.8 million purchases of property, plant and equipment and intangible assets and $8.3 million of acquisitions.

Net cash used in investing activities was $16.8 million in fiscal 2016, principally due to $16.2 million purchases of property, plant and equipment and intangible assets.

Cash Flows from Financing Activities

Net cash provided by financing activities for the year ended December 31, 2018 was $114.0 million, derived from our net borrowings for the year of $125.2 million, which were primarily used to fund acquisitions, offset by $6.2 million of net repayments of other debt and capital lease obligations and $2.3 million of contingent consideration payments.

Net cash provided by financing activities for the year ended December 31, 2017 was $53.0 million, derived from our net borrowings for the year of $71.5 million, which were primarily used to fund acquisitions, offset principally by $15.9 million of treasury stock purchases. Net cash used in financing activities for the year ended December 31, 2016 was $30.0 million, driven primarily by $17.3 million of net repayments of debt and $9.0 million of treasury stock purchases.

Net cash used in financing activities for the transition period ended December 31, 2016 was $12.9 million, driven primarily by $9 million of treasury stock purchases and $2 million of net repayments of debt.

Net cash used in financing activities in fiscal 2016 of $40 million consisted primarily of net repayments of debt totaling $36 million.

Cash Balance and Credit Facility Borrowings

As of December 31, 2018, the Company had cash and cash equivalents totaling $25.5 million, of which $24.9 million is outside of the United States, and available borrowing capacity of up to $112.9 million under its credit agreement (as defined below). Borrowings of $281.7 million and letters of credit of $5.4 million were outstanding under the credit agreement at December 31, 2018. We finance our operations primarily through our existing cash balances, cash collected from operations, bank borrowings and capital lease financing. We believe these sources are sufficient to fund our operations for the foreseeable future.

On December 13, 2018, the Company entered into a Fifth Amended and Restated Credit Agreement (“Credit Agreement”). The Credit Agreement increased the Company’s revolving line of credit from $250 million to $300 million and provides that under certain circumstances the line of credit can be increased to $450 million. In addition, the Credit Agreement provided the Company with a $100 million senior secured term loan A facility. The Company

increased its borrowing capacity under the Credit Agreement primarily to fund an acquisition in December 2018. Both the revolving line of credit and the term loan A facility under the Credit Agreement have a maturity date of December 12, 2023. The Company may continue to borrow up to $100 million in non-U.S. Dollar currencies and use up to $20 million of the credit limit for the issuance of letters of credit.

Loans under the Credit Agreement bear interest at LIBOR plus an applicable LIBOR margin ranging from 1% to 2%, or a base rate less a margin of 1.25% to 0.375%, at the option of the Company, based upon the Company's Funded Debt Leverage Ratio. Funded Debt Leverage Ratio is generally the ratio of (1) all outstanding indebtedness for borrowed money and other interest-bearing indebtedness as of the date of determination to (2) EBITDA (which is (a) net income, less (b) income (or plus loss) from discontinued operations and extraordinary items, plus (c) income tax expenses, plus (d) interest expense, plus (e) depreciation, depletion, and amortization (including non-cash loss on retirement of assets), plus (f) stock compensation expense, less (g) cash expense related to stock compensation, plus (h) certain amounts of EBITDA of acquired business for the prior twelve months, plus (i) certain expenses related to the closing of the Credit Agreement, plus (j) non-cash expenses which do not (in the current or any future period) represent a cash item (excluding non-cash gains which increase net income), plus

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(k) non-recurring charges (not to exceed $10 million in the four consecutive quarters immediately preceding the date of determination) for items such as severance, lease termination charges, asset write-offs and litigation settlements paid, and multi-employer pension plan withdrawal liabilities, all determined for the period of four consecutive fiscal quarters immediately preceding the date of determination of EBITDA. The Company has the benefit of the lowest margin if its Funded Debt Leverage Ratio is equal to or less than 1.0 to 1, and the margin increases as the ratio increases, to the maximum margin if the ratio is greater than 3.25 to 1. The Company will also bear additional costs for market disruption, regulatory changes effecting the lenders' funding costs, and default pricing of an additional 2% interest rate margin on any amounts not paid when due. Amounts borrowed under the Credit Agreement are secured by liens on substantially all of the assets of the Company and is guaranteed by some of our subsidiaries.

The Credit Agreement contains financial covenants requiring that the Company maintain a Funded Debt Leverage Ratio of no greater than 4.25 to 1 through December 31, 2018, reducing to a maximum permitted ratio of 3.50 to 1 as of March 31, 2020 and all quarterly periods thereafter, and a Fixed Charge Coverage Ratio of at least 1.25 to 1. Fixed Charge Coverage Ratio means the ratio, as of any date of determination, of (a) (i) EBITDA for the 12 month period immediately preceding the date of determination, taken together as one accounting period, less (ii) the aggregate amount of all capital expenditures made during the period, less (iii) taxes paid in cash during the period, less (iv) Restricted Payments paid in cash during the period, -to- (b) the sum of (i) all interest, premium payments, debt discount, fees, charges and related expenses of us and our subsidiaries in connection with borrowed money (including capitalized interest) or in connection with the deferred purchase price of assets, in each case, to the extent treated as interest in accordance with U.S. generally accepted accounting principles ("GAAP") and to the extent paid in cash during the period, (ii) the aggregate principal amount of all redemptions or similar acquisitions for value of outstanding debt for borrowed money or regularly scheduled principal payments made during the period, but excluding any such payments to the extent refinanced through the incurrence of additional Indebtedness otherwise expressly permitted under the Credit Agreement, and (iii) payments made during the period under all leases that have been or should be, in accordance with GAAP as in effect for our 2017 audited financial statement, recorded as capitalized leases. Beginning in 2020, the Company can elect to increase the maximum Funded Debt Leverage Ratio to 4.0 to 1 for four fiscal quarters immediately following the fiscal quarter in which the Company acquires another business, with the maximum permitted ratio reducing back to 3.5 to 1 in the fifth fiscal quarter following such acquisition. The Company can make this election twice during the term of the Credit Agreement.

The Credit Agreement also limits the Company's ability to, among other things, create liens, make investments, incur more indebtedness, merge or consolidate, make dispositions of property, pay dividends and make distributions to stockholders or repurchase our stock, enter into a new line of business, enter into transactions with affiliates and enter into burdensome agreements. The Credit Agreement does not limit the Company's ability to acquire other businesses or companies except that the acquired business or company must be in the Company's line of business, the Company must be in compliance with the financial covenants on a pro forma basis after taking into account the acquisition, and, if the acquired business is a separate subsidiary, in certain circumstances the lenders will receive the benefit of a guaranty of the subsidiary and liens on its assets and a pledge of its stock.

As of December 31, 2018, the Company was in compliance with the terms of the Credit Agreement, and has undertaken to continuously monitor compliance with these covenants.

Liquidity and Capital Resources Outlook

Future Sources of Cash

We expect our future sources of cash to include cash flow generated from our operating activities and borrowings under our Credit Agreement. Our revolving credit facility is available for cash advances required for working capital

and for letters of credit to support our operations. Acquisitions are funded through available cash and borrowings under the Credit Agreement.

Future Uses of Cash

We expect our future uses of cash will primarily be for acquisitions, international expansion, stock repurchases, purchases or manufacture of field testing equipment to support growth, additional investments in technology and software products and the replacement of existing assets and equipment used in our operations. We often make purchases to support new sources of revenues, particularly in our Services segment. In addition, we will need to fund a certain amount of replacement equipment, including our fleet vehicles. We historically spend approximately 2% to 3% of our total revenues on capital expenditures, excluding acquisitions, and expect to fund these expenditures through a combination of cash and lease financing. Our cash

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capital expenditures, excluding acquisitions, for the year ended December 31, 2018 and 2017, the transition period ended December 31, 2016 and for fiscal 2016 were approximately 3%, 3%, 2% and 2% of revenues, respectively.

Our future acquisitions may also require capital. We acquired one company during the year ended December 31, 2018 and three companies during the year ended December 31, 2017 for an aggregate cash outlay of $227 million. In some cases, additional equipment will be needed to upgrade the capabilities of these acquired companies. In addition, our future acquisition and capital spending may increase as we pursue growth opportunities. Other investments in infrastructure, training and software may also be required to match our growth, but we plan to continue using a disciplined approach to building our business. In addition, we will use cash to fund our operating leases, capital leases, long-term debt repayments and various other obligations as they arise.

We also expect to use cash to support our working capital requirements for our operations, particularly in the event of further growth and due to the impacts of seasonality on our business. Our future working capital requirements will depend on many factors, including the rate of our revenue growth, our introduction of new solutions and enhancements to existing solutions and our expansion of sales and marketing and product development activities. To the extent that our cash and cash equivalents and future cash flows from operating activities are insufficient to fund our future activities, we may need to raise additional funds through bank credit arrangements, public or private equity financings, or debt financings. We also may need to raise additional funds in the event we determine in the future to effect one or more acquisitions of businesses, technologies or products that will complement our existing operations. In the event additional funding is required, we may not be able to obtain bank credit arrangements or effect an equity or debt financing on acceptable terms.

Contractual Obligations

We generally do not enter into long-term minimum purchase commitments. Our principal commitments, in addition to those related to our long-term debt discussed below, consist of obligations under facility leases for office space and equipment leases and contingent consideration obligations in connection with our acquisitions.

The following table summarizes our outstanding contractual obligations as of December 31, 2018:

($ in thousands)	Total	December 31, 2019	December 31, 2020	December 31, 2021	December 31, 2022	December 31, 2023	Thereafter
Long-term debt (1)	$290,620	$ 6,831	$ 6,515	$ 8,750	$ 11,030	$ 255,043	$ 2,451
Capital lease obligations (2)	13,987	4,686	3,489				