

AMTECH SYSTEMS INC
Form 10-K
December 07, 2018

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

FORM 10-K

(Mark
One)

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

For the fiscal year ended: September 30, 2018

OR

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

For the transition period from _____ to _____

Commission File Number: 0-11412

AMTECH
SYSTEMS,
INC.

(Exact name
of registrant
as specified
in its
charter)

Arizona	86-0411215
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

131 South Clark Drive, Tempe, Arizona	85281
(Address of principal executive offices)	(Zip Code)

Registrant's
telephone
number,
including area
code:
480-967-5146

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

None

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

Common
Stock, \$0.01
Par Value
(Title of Class)

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

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

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. ☒ Yes ☐ No

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§229.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). ☒ Yes ☐ No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§ 229.405) 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. ☒

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

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

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

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

As of March 31, 2018, the last business day of the registrant's most recently completed second fiscal quarter, the aggregate market value of the voting and non-voting stock held by non-affiliates of the registrant was approximately \$90,900,902, based upon the closing sales price reported by the NASDAQ Global Market on that date.

As of November 19, 2018, the registrant had outstanding 14,216,596 shares of Common Stock, \$0.01 par value.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Definitive Proxy Statement related to the registrant's 2019 Annual Meeting of Shareholders, which Proxy Statement will be filed under the Securities Exchange Act of 1934, as amended, within 120 days of the end of the registrant's fiscal year ended September 30, 2018, are incorporated by reference into Items 10-14 of Part III of this Form 10-K.

AMTECH SYSTEMS, INC. AND SUBSIDIARIES

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Cautionary Statement about Forward Looking Statements

Unless otherwise indicated, the terms “Amtech,” the “Company,” “we,” “us” and “our” refer to Amtech Systems, Inc. together with its subsidiaries.

Our discussion and analysis in this Annual Report on Form 10-K, our 2018 Annual Report to Shareholders, our other reports that we file with the Securities and Exchange Commission (the “SEC”), our press releases and in public statements of our officers and corporate spokespersons contain “forward-looking” statements within the meaning of Section 27A of the Securities Act of 1933, as amended (the “Securities Act”), Section 21E of the Securities Exchange Act of 1934, as amended (the “Exchange Act”), and the Private Securities Litigation Reform Act of 1995.

Forward-looking statements give our current expectations or forecasts of future events. You can identify these statements by the fact that they do not relate strictly to historical or current events. We have tried, wherever possible, to identify such statements by using words such as “may,” “plan,” “anticipate,” “seek,” “will,” “expect,” “intend,” “estimate,” “anticipate,” “believe,” “continue,” “predict,” “potential,” “project,” “should,” “would,” “likely,” “future,” “target,” “forecast,” and “strategy” or the negative thereof or variations thereon or similar terminology. Any expectations based on these forward-looking statements are subject to risks and uncertainties and other important factors, including those discussed in the section entitled “Item 1A. Risk Factors.” Some factors that could cause actual results to differ materially from those anticipated include, among others, future economic conditions, including changes in the markets in which we operate; changes in demand for our services and products; our ability to successfully complete the turnkey orders and the associated costs and risks related thereto; difficulties in successfully executing our growth initiatives; the effects of competition in the markets in which we operate, including the adverse impact of competitive product announcements or new entrants into our markets and transfers of resources by competitors into our markets; control of costs and expenses; risks associated with new technologies and the impact on our business; legislative, regulatory, and competitive developments in markets in which we operate; possible future claims, litigation or enforcement actions and the results of any such claim, litigation proceeding, or enforcement action; and other circumstances and risks identified in this Annual Report on Form 10-K or referenced from time to time in our filings with the SEC. These and many other factors could affect Amtech’s future operating results and financial condition and could cause actual results to differ materially from expectations based on forward-looking statements made in this document or elsewhere by Amtech or on its behalf.

Forward-looking statements are neither historical facts nor assurances of future performance. Instead, they are based only on our current beliefs, expectations and assumptions regarding the future of our business, future plans and strategies, projections, anticipated events and trends, the economy and other future conditions. Because forward-looking statements relate to the future, they are subject to certain risks and uncertainties. In light of these risks and uncertainties, there can be no assurance that the forward-looking information contained in this Annual Report on Form 10-K will in fact transpire or prove to be accurate. You should not place undue reliance on these forward-looking statements, which speak only as of the date they were made.

The Company undertakes no obligation to update or publicly revise any forward-looking statement whether as a result of new information, future developments or otherwise. All subsequent written or oral forward-looking statements attributable to the Company or persons acting on its behalf are expressly qualified in their entirety by this paragraph. You are advised, however, to consult any further disclosures we make on related subjects in our subsequently filed Form 10-Q and Form 8-K reports and our other filings with the SEC. Also note that we provide a cautionary discussion of risks, uncertainties and possibly inaccurate assumptions relevant to our business under “Item 1A. Risk Factors” of this Annual Report on Form 10-K. We note these factors for investors as permitted by the Private Securities Litigation Reform Act of 1995. You should understand it is not possible to predict or identify all such factors.

PART I

ITEM 1. BUSINESS

OUR COMPANY

We are a leading, global manufacturer of capital equipment, including thermal processing and wafer handling automation, and related consumables used in fabricating semiconductor devices, light-emitting diodes, or LEDs, silicon carbide (SiC) and silicon power chips and solar cells. We sell these products to solar cell and semiconductor manufacturers worldwide, particularly in Asia, the United States and Europe. We were incorporated in Arizona in October 1981, under the name Quartz Engineering & Materials, Inc. We changed to our present name in 1987. We categorize each of our subsidiaries into one of three operating segments, based primarily on the industry they serve:

Operating Segment	% of 2018 Consolidated Net Revenue
Solar	47%
Semiconductor	45%
Polishing	8%

For information regarding net revenue, operating income and identifiable assets attributable to each of our three operating segments, see Note 17 of the Notes to Consolidated Financial Statements included in “Item 8. Financial Statements and Supplementary Data” and “Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations” in this Annual Report. For information on the products of each operating segment, see “Solar and Semiconductor Products” and “Polishing Products” within this “Item 1. Business” section. For information regarding risks to our business, see “Item 1A. Risk Factors.”

Our fiscal year is from October 1 to September 30. Unless otherwise stated, references to the years 2018, 2017 and 2016 relate to the fiscal years ended September 30, 2018, 2017 and 2016, respectively.

Our operating segments are made up of the following six wholly-owned subsidiaries:

Semiconductor:

Bruce Technologies, Inc., or Bruce Technologies, a Massachusetts corporation based in North Billerica, Massachusetts, acquired in July 2004; and

BTU International, Inc., or BTU, a Delaware corporation based in North Billerica, Massachusetts, with operations in China, Singapore, Malaysia and the United Kingdom, acquired in January 2015.

Polishing:

P.R. Hoffman Machine Products, Inc., or PR Hoffman, an Arizona corporation based in Carlisle, Pennsylvania, acquired in July 1997.

Solar:

Tempress Systems, Inc., or Tempress, a Texas corporation based in Vaassen, the Netherlands, acquired in 1994 and subsequently reincorporated in the Netherlands;

R2D Automation SAS, or R2D, a French corporation located near Montpellier, France, acquired in October 2007; and SoLayTec B.V., or SoLayTec, a Netherlands corporation based in Eindhoven, the Netherlands. We acquired a 51% controlling interest in 2014 and acquired the remaining 49% in 2017.

Our major emphasis in the semiconductor and solar industries is the development of equipment for thermal processes and deposition for semiconductor and solar cell manufacturing. The markets we serve are experiencing rapid technological advances and are, historically, cyclical. Therefore, future profitability and growth depend on our ability

to quickly develop or acquire and market new technology products and on our ability to adapt to cyclical trends.

Semiconductor chips, power chips, LEDs, solar cells and some microelectromechanical systems (“MEMS”) are semiconductors fabricated on silicon and silicon carbide wafer substrates, sliced from ingots. Semiconductor chips are part of the circuitry of many products including solar cells and inverters, computers, telecommunications devices, automotive products, consumer electronics, and industrial automation and control systems. LEDs manufactured using our equipment are used in industrial, commercial and residential lighting. Solar cells are assembled into solar panels and are responsible for converting sunlight into electricity. Our wafer handling, thermal processing and consumable

products currently address the diffusion and deposition steps, including atomic layer deposition, used in the fabrication of semiconductors, solar cells, LEDs, MEMS and the polishing of newly sliced silicon and compound semiconductor wafers, as well as the packaging and assembly of the electronic components. Our reflow ovens provide key thermal processing steps for both semiconductor packaging and electronics assembly. Key end-markets for these packages and assemblies include: communications, computing & networking, consumer and industrial electronics, and automotive electronics and sensors.

Our Polishing segment provides solutions to the lapping and polishing marketplace for LED, SiC power chip applications, optics and photonics. Lapping is the process of abrading components with a high degree of precision for flatness, parallelism and surface finish. Common applications for this technology are silicon wafers for semiconductor products, sapphire substrates for LED lighting and mobile devices, compound substrates, like silicon carbide wafers, for LED and power device applications, various glass and silica components for 3D image transmission, quartz and ceramic components for telecommunications devices, medical device components and optical and photonics applications.

We believe our product portfolio, developed through a track record of technological innovation as well as the successful integration of key acquisitions, provides exceptional value to semiconductor and solar cell manufacturing by increasing yields, efficiency and throughput. We have been providing manufacturing solutions to the semiconductor industry for over 30 years and have leveraged our semiconductor technology and industry presence to capitalize on growth opportunities. Our customers use our equipment to manufacture semiconductor chips, solar cells, silicon and compound semiconductor wafers and MEMS, which are used in end markets such as telecommunications, consumer and industrial electronics, computers, automotive electronics and sensors, mobile devices and solar power. To complement our research and development efforts, we also sell our equipment to, and coordinate certain development efforts with, research institutes, universities and customers.

The semiconductor and solar cell industries are cyclical and historically have experienced significant fluctuations. Our revenue is impacted by these broad industry trends. Since 2012, the solar cell industry has at times experienced structural imbalances between supply and demand. This imbalance has increased competitive pressure on selling prices and negatively impacted our results of operations. Our high throughput equipment platforms, technologies for higher cell efficiency, greater knowledge of the complete cell manufacturing process and advanced automation have contributed significantly to our success in securing the large orders for the first two phases of a multi-phase turnkey project announced in January and April of 2017 from a new solar cell manufacturer in China. For equipment orders that are not part of turnkey projects, we compete with Chinese equipment manufacturers that offer lower prices, liberal payment terms and have a more substantial local presence. As a result, we are finding it more difficult to participate in large capacity expansions in China. While we intend to continue developing advanced products and technologies, we believe we will need to significantly restructure our Solar segment operations to achieve profitability and compete effectively with Chinese equipment manufacturers. During this Solar restructuring, we intend to focus on our Semiconductor segment to enhance our opportunities as it becomes a more significant segment of our business.

ACQUISITIONS AND DISPOSITIONS

In September 2015, we sold a portion of our equity interest in Kingstone Technology Hong Kong Limited (“Kingstone Hong Kong”) to a China-based venture capital firm. Kingstone Hong Kong is the parent company of Shanghai Kingstone (“Shanghai Kingstone” and, together with Kingstone Hong Kong, “Kingstone”), a Shanghai-based technology company specializing in ion implant solutions for the solar and semiconductor industries (in which we acquired a 55% ownership in February 2011). Proceeds from this sale were paid to Amtech and used to fund our core strategic initiatives. After giving effect to this sale transaction, we owned 15% of Kingstone Hong Kong, which in turn represented an 8% beneficial ownership interest in Shanghai Kingstone. Effective June 29, 2018, we sold our remaining 15% ownership interest in Kingstone Hong Kong to the majority owner for approximately \$5.7 million.

In December 2014, in furtherance of our business model or growth through strategic acquisitions, we expanded our presence in the solar market by acquiring a 51% controlling interest in SoLayTec, which provides atomic layer deposition, or ALD, systems used in high efficiency solar cells. In July 2017, we acquired the remaining 49% interest in SoLayTec.

GROWTH STRATEGY

Our objective is to grow revenues and expand our operations, which we seek to accomplish through the pursuit of the following strategies:

Capitalize on Growth Opportunities in the Semiconductor Industry by Leveraging Our Thermal and Material Processing Expertise, Top-Tier Customer Relationships, Track Record of Technological Innovation and Exceptional Customer Service. We believe that long-term growth in the semiconductor industry will be driven by several macro-economic factors, such as increased adoption of customer and industrial electronics, from mobile devices, Internet-of-Things (IoT), and accelerated adoption of sensors and electronics in the automotive industry, and China's investment in their domestic semiconductor production capacity. As the semiconductor market continues to develop, advances in process technology will be vital to remaining competitive. We intend to continue leveraging our market position, relationships with leading global semiconductor customers and demonstrated track record of technical innovation and exceptional customer service to maximize sales of our current and next-generation technology solutions.

Develop Multi-Product Solutions to Expand Our Addressable Market. We are focused on acquiring, developing and licensing new products across our business in response to customer needs in the markets we serve. As we add to our product portfolio, we plan to continue expanding our offerings within the semiconductor production process, thus capturing a greater percentage of capital spent on increasing semiconductor production. We have successfully developed products to expand our addressable market and continue to make evolutionary upgrades to our existing semiconductor equipment and service offerings.

Pursue Strategic Acquisitions That Complement Our Strong Platform. Historically, we have developed and implemented an acquisition strategy consistent with our focus of maintaining market leadership and technology innovation that addresses the continued growth in the semiconductor and solar industries. As part of this strategy, we continually evaluate potential technology, product and business acquisitions or joint ventures that we believe will increase our existing market share in the semiconductor, SiC/LED and solar industries and expand our addressable market. In evaluating these opportunities, our objectives include: enhancing our earnings and cash flows, adding complementary product offerings, expanding our geographic footprint, improving our production efficiency and expanding our customer base.

SEMICONDUCTOR AND POLISHING OPERATIONS

We provide diffusion equipment as well as handling, storage and automation equipment and related services to leading semiconductor manufacturers. Our products include horizontal and vertical diffusion furnaces used to produce semiconductors, silicon wafers and MEMS, as well as dual side lapping and polishing equipment, dual side lapping and polishing carriers, single side polishing templates, mass wafer transfer systems, loaders and sorters.

As demand for increasingly sophisticated electronic devices continues, new technologies such as electric and autonomous automobiles, artificial intelligence, advanced power management, advances in consumer electronics, mobile devices and Internet-of-Things (IoT) will help to drive future growth. Electronic equipment continues to become more complex, yet end users are still demanding smaller, lighter and less expensive devices. This, in turn, requires increased performance and reduced cost, size, weight and power requirements of electronic assemblies, printed circuit boards and semiconductors. In response to these developments, manufacturers are increasingly employing more sophisticated production and assembly techniques requiring more advanced manufacturing equipment, such as that supplied by BTU.

Although the semiconductor market has experienced significant growth over the past fifteen years, it remains cyclical by nature. The market is characterized by short-term periods of under or over utilization of capacity for most semiconductors, including microprocessors, memory, power management chips and other logic devices. When

capacity utilization decreases due to the addition of excess capacity, semiconductor manufacturers typically slow their purchasing of capital equipment. Conversely, when capacity utilization increases, so does capital spending.

SOLAR OPERATIONS

We provide process equipment and related cell manufacturing equipment to many of the world's leading solar cell manufacturers.

Our primary process equipment focus is our existing solar diffusion furnace and the development of next-generation diffusion furnaces, including our proprietary N-type systems and our PECVD systems. Our N-type technology has

been developed through a three-party research collaboration agreement with the Energy Research Centre of the Netherlands, or ECN, a leading solar research center in Europe and Yingli Green Energy Holding Company Limited, or Yingli, one of the world's leading vertically integrated photovoltaic ("PV") product manufacturers. In 2012, we launched our PECVD system, which can be used for N-type or P-type systems. Additionally, through SoLayTec, we produce, develop, deliver and service ultrafast atomic layer deposition ("ALD") machines used in high efficiency solar cells.

We also offer furnace automation and wafer handling systems used within the diffusion and deposition processing steps of solar cell manufacturing. Our automation equipment includes mass wafer transfer systems, sorters, long-boat transfer systems, load station elevators, buffers and conveyers, which we sell both in connection with our diffusion furnaces and on a standalone basis.

Although the solar market has experienced tremendous growth over the past five years, it is characterized by periods of rapid capacity expansion followed by periods of rapid contraction in our customers' capital spending. When actual and expected end-user demand outstrips available capacity, this triggers the beginning of the next period of expansion.

SEMICONDUCTOR AND SOLAR PRODUCTS

Our furnace and automation equipment is manufactured in our facilities in Massachusetts, the Netherlands, France and China. The following paragraphs describe the products that comprise our semiconductor and solar businesses:

Horizontal Diffusion Furnaces. Through Tempress and Bruce Technologies, we produce and sell horizontal diffusion and deposition furnaces. Our horizontal furnaces currently address several steps in the solar and semiconductor manufacturing processes, including diffusion, phosphorus tetrachloride doping, or POCl_3 , boron tribromide, or BBR_3 , low-pressure chemical vapor deposition, or LPCVD, high temperature oxidation (used in silicon and silicon carbide power chips), and annealing.

Our horizontal furnaces generally consist of three large modules: the load station, where the loading of the wafers occurs; the furnace section, which is comprised of one to five thermal reactor chambers; and the gas distribution cabinet, where the flow of gases into the reactor chambers is controlled, and often customized to meet the requirements of our customers' particular processes. The horizontal furnaces utilize a combination of existing industry and proprietary technologies and are sold primarily to semiconductor and solar customers. Our models are capable of processing all currently existing wafer sizes.

Continuous Thermal Processing Systems. Through our BTU subsidiary, we produce and sell thermal processing systems used in the solder reflow and curing stages of printed circuit board assembly as well as systems for the thermal processes used in advanced semiconductor packaging. Our printed circuit board assembly products are used primarily in the advanced, high-density segments of the market that utilize surface mount technology.

Flip-chip reflow provides the physical and electronic bond of the semiconductor device to its package. Our range of convection reflow systems, utilizing patented closed loop convection technology, are rated at up to 400°C and operate in air or nitrogen atmospheres. These products utilize forced impingement convection technology to transfer heat to the substrate. Using thermal power arrays of up to five kilowatts, they can process substrates in dual lane, dual speed configurations, thereby enabling our customers to double production without increasing the machine's footprint. These products are available in four models based on the heated lengths of thermal processing chambers. Heated length is based on the required production rate and loading requirements.

Small Batch Vertical Furnace. Our small batch, two-tube vertical furnace was developed internally with the active support from a large semiconductor manufacturer and long-term customer. The specifications for this furnace include

a two-tube vertical furnace for wafer sizes of up to 200mm, with each tube having a small flat zone capable of processing 25-50 wafers per run. We are targeting niche semiconductor applications, including research and development, while we continue to develop additional processes, since the competition in the large batch vertical furnace market is intense and our competitors are much larger and have substantially greater financial resources, processing knowledge and advanced technology than we have.

Chemical Vapor Deposition (CVD). We have developed two applications utilized in solar device technology. Our solar PECVD product applies an anti-reflective coating to solar wafers; a coating critical to the efficiency of solar cells. PECVD layers are also used for passivation of the front and/or back side of the solar cell. We recently introduced tunnel

oxide passivated contact (TOPCON) technology, a new application in solar cell processing offering cell efficiency potentials of greater than 22%. We are exploring next-generation high-efficiency technology and dedicating our efforts to process development.

Atomic Layer Deposition (ALD). We produce, develop, deliver and service machines worldwide for ultrafast, spatial (ALD) equipment, a promising technology for ultrathin Al_2O_3 passivation layers on solar cells. The ALD machines from SoLayTec are intended for industrial production in the solar market. The unique feature of the SoLayTec machines is the leading, single-sided precision over the deposition thickness.

Automation Products - Solar & Semiconductor. Our automation products are used in several diffusion steps and in the anneal processing step of solar cell manufacturing. Our R2D automation equipment includes mass wafer transfer systems, sorters, long-boat transfer systems, load station elevators, buffers and conveyers. We use vacuum technology in our Standalone and our Full Automation solar wafer transfer systems designed to ensure high throughput and reduced breakage, resulting in increased yield.

Use of our automation products reduces human handling and, therefore, reduces exposure of wafers to particle sources during the loading and unloading of the process tubes and protects operators from heat and chemical fumes. The top reactor chamber of a horizontal furnace can be as much as eight feet from the floor on which the operator stands when manually loading wafer boats. Typical boats of 150mm to 300mm wafers weigh three to six pounds. Given these two factors, automating the wafer loading and unloading of a diffusion furnace improves employee safety and ergonomics in silicon wafer, solar cell and semiconductor manufacturing facilities.

S-300. Our patented S-300 model provides an efficient method of automatically transporting a full batch of up to 300 wafers to the designated tube level and automatically placing them directly onto the cantilever loader of a diffusion furnace. This product is suitable for the production of nearly all semiconductors manufactured using a horizontal furnace. The S-300 can be used in conjunction with all current wafer sizes and is particularly well suited for manufacturers of 300mm wafers.

Comet. Our Comet and Gemini series of wafer transfer systems include a wide range of throughputs and footprints to meet the needs of our customers who serve the semiconductor industry. Comet Sorter with Optical Character Recognition (OCR) is used in sorting, randomizing, compacting or tracking. The Comet Sorter is cassette to cassette with OCR front and back scribe functions, notch alignment and SECSII Gem communication. Comet ID Readers check tag carriers, then read each wafer scribe. The Comet ID Reader sends the information to the host with SECSII Gem commands.

We also specialize in precision controlled, high-temperature belt furnaces for a wide range of custom applications, such as brazing, direct bond copper (DBC), diffusion, sintering and advanced solar cell processing. These controlled atmosphere furnaces are available with temperature ranges up to 1150°C and with various process atmospheres, including hydrogen and nitrogen.

POLISHING PRODUCTS

Our Polishing division manufactures the products described below in Pennsylvania and sells them under our PR Hoffman brand name.

Wafer Carriers. We manufacture carriers in a variety of sizes and materials. Sizes range from 3 to 38 inches in diameter using a variety of special steels, laminates and extruded polymer raw materials. Silicon wafers, compound substrate wafers, and large optics require special insert carriers. These carriers combine the strength of hardened steel as the processing backbone with a softer plastic material in the work holes known as an insert. Inserts are permanently

molded into the work holes in a pressurized process. These inserted work holes provide smoother processing, improved wafer total thickness variation (TTV) and improved wafer edge quality. Insert carriers are available for all wafer sizes from 75mm to 450mm and can be made from hardened and tempered carbon steel or specialized stainless steel when metal contamination is a processing concern. Insert carriers are widely accepted as the industry solution for both prime wafer and reclaim wafer manufacturers when dual sided lapping or polishing are utilized in their front-end wafer process.

Semiconductor Polishing Templates. Our polishing templates are used to securely hold silicon carbide, silicon, sapphire or other wafer materials in place during single-sided wax-free polishing processes. Polishing templates are customized for specific applications and are manufactured to extremely tight tolerances. We offer a variety of options to provide

the best solution for each specific process. Polishing templates are manufactured for all brands of tools and virtually any wax-free customer process. Critical front-end wafer surface specifications are finalized during the polishing process.

Double-Sided Lapping and Polishing Machines. Double-sided lapping and polishing machines are designed to process thin and fragile materials, such as semiconductor, sapphire and other wafer-like materials, precision optics, computer disks, ceramic components, specialty metal products to exact tolerances of thickness, flatness, parallelism and surface finish. On average, we believe that we offer our surface processing systems with a lower cost of ownership than systems offered by our competitors. We target the compound substrate, semiconductor, optical sapphire, glass, quartz, ceramics, medical, computer disk and metal working markets.

MANUFACTURING, RAW MATERIALS AND SUPPLIES

Our solar and semiconductor manufacturing activities consist primarily of engineering design to meet specific and evolving customer needs and procurement and assembly of various commercial and proprietary components into finished thermal processing systems and related automation in Vaassen, the Netherlands; Clapiers, France; North Billerica, Massachusetts; and Shanghai, China.

Our manufacturing activities in the polishing business include laser-cutting and other fabrication steps in producing lapping and polishing consumables, including carriers, templates, gears, wear items and spare parts in Carlisle, Pennsylvania, from raw materials manufactured to our specifications by our suppliers. These products are engineered and designed for specific applications and to meet the increasingly tight tolerances required by our customers. Many items, such as proprietary components for our solar and semiconductor equipment and lapping plates, are purchased from suppliers who manufacture these items to our specifications. We purchase the automation for our PECVD equipment from a single source.

Final assembly and tests of our manufactured equipment and machines are performed within our manufacturing facilities. Quality control is maintained through inspection of incoming materials and components, in-process inspection during equipment assembly, testing of assemblies and final inspection and, when practical, operation of manufactured equipment prior to shipment.

Since much of our polishing supplies know-how relates to the manufacture of these products, our Carlisle facility is equipped to perform a significantly higher percentage of the fabrication steps required in the production of its products. However, injection molding for our insert carriers and the manufacture of raw cast iron plates are subcontracted out to various third parties. Our polishing supplies business relies on key suppliers for certain materials, including two steel mills in Germany and Japan, an injection molder, a single-sourced pad supplier from Japan and an adhesive manufacturer. To minimize the risk of production and service interruptions and/or shortages of key parts, we maintain appropriate inventory levels of key raw materials and parts.

CUSTOMERS AND SEASONALITY

Our customers are primarily manufacturers of integrated circuits and solar cells. During 2018, 86% of our net revenue came from customers outside of North America. This group represented 88% of revenues in 2017. In 2018, net revenue was distributed among customers in different geographic regions as follows: North/South America 14% (12% of which is in the United States), Asia 70% (including 53% to China, 6% to Malaysia and 7% to Taiwan) and Europe 16%. In 2018 and 2017, a turnkey customer accounted for 25% of net revenue in each year. In 2016, one customer accounted for 11% of net revenue. Our business is not seasonal in nature, but is cyclical based on the capital equipment investment patterns of semiconductor and solar cell manufacturers. These expenditure patterns are based on many factors, including capacity utilization, anticipated demand, the development of new technologies and global

and regional economic conditions.

SALES AND MARKETING

Due to the highly technical nature of our products, we market our products primarily by direct customer contact through our sales personnel and through a network of domestic and international independent sales representatives and distributors that specialize in solar and semiconductor equipment and supplies. Our promotional activities include direct sales contacts, participation in trade shows, an internet website, advertising in trade magazines and the distribution of product brochures.

Sales to distributors are generally on terms comparable to sales to end-user customers, as our distributors generally quote their customers after first obtaining a quote from us and have an order from the end-user before placing an order with us. Our sales to distributors are not contingent on their future sales and do not include a general right of return. Historically, returns have been rare. Distributors of our semiconductor and solar equipment do not stock a significant amount of our products, as the inventory they hold is generally limited to parts needed to provide timely repairs to customers.

RESEARCH, DEVELOPMENT AND ENGINEERING

The markets we serve are characterized by evolving industry standards and rapid technological change. To compete effectively, we must continually maintain or exceed the pace of such change by improving our products and our process technologies and by developing new technologies and products that are competitive based on price and performance. To assure that these technologies and products address current and future customer requirements, we obtain as much customer cooperation and input as possible, thus increasing the efficiency and effectiveness of our research and development efforts. In addition, we look for strategic acquisitions, that will provide us with new technologies to compete effectively in the markets in which we operate.

From time to time we add functionality to our products or develop new products during engineering and manufacturing to fulfill specifications in a customer's order, in which case the cost of development, along with other costs of the order, are charged to cost of sales. We periodically receive research grants for research and development of products, which are netted against our research, development and engineering costs. In 2018, 2017 and 2016, we recorded research, development and engineering expense of \$7.8 million, \$6.4 million and \$8.0 million, respectively.

COMPETITION

We compete in several distinct equipment markets for semiconductor devices, semiconductor wafers, solar cells, MEMS, electronics assembly, lapping and polishing machines as well as the markets for supplies used in the LED, mobile devices and semiconductor industries. Each of these markets is highly competitive. Our ability to compete depends on our ability to continually improve our products, processes and services, as well as our ability to develop new products that meet constantly evolving customer requirements. Significant competitive factors for succeeding in these markets include the product's technical capability, productivity, cost-effectiveness, overall reliability, ease of use and maintenance, contamination and defect control and the level of technical service and support. Since 2012, the solar cell industry has experienced a structural imbalance between supply and demand. This imbalance has increased competitive pressure on selling prices and negatively impacted our results of operations. Our high throughput equipment platforms, technologies for higher cell efficiency, and greater knowledge of the complete cell manufacturing process have contributed significantly to our success in securing the large orders for the first two phases of a multi-phase turnkey project announced in January and April of 2017 from a new solar cell manufacturer in China. For equipment orders not part of a turnkey solution, we compete with Chinese equipment manufacturers that offer lower prices coupled with liberal payment terms and localized service. We are finding it more difficult to participate in the capacity expansions of those Chinese companies that already have significant experience with all facets of producing solar cells and at least some prior experience working with local equipment vendors. We plan to seek further cost reductions to address the competition from Chinese equipment vendors and to focus on how we can participate profitably in the solar industry.

The Semiconductor Device, Solar Cell and MEMS Markets. Equipment and automation produced by our Semiconductor and Solar operating segments primarily compete with those produced by other original equipment manufacturers, some of which are well-established firms that are much larger and have substantially greater financial resources than we have. Competitors of our horizontal diffusion furnaces and PECVD equipment include Centrotherm GmbH, Koyo Systems Co. Ltd., Sandvik Thermal Process, Inc., a subsidiary of Sandvik AB, 48th Institute, Naura

Technology Group Co., CVD Equipment, Inc., Semco Engineering S.A., S.C New Energy and Meyer Burger, Ltd. We are experiencing increased competition from local Chinese equipment manufacturers, including S.C New Energy, 48th Institute and Naura Technology Group Co., which may receive varying levels of financial support from the Chinese government. Our primary competitive advantages over such local manufacturers include our high-throughput equipment platforms, higher-efficiency solar cell production technologies, greater knowledge of the complete cell manufacturing process and advanced automation, which we develop in collaboration with customers and research institutes. Our semiconductor equipment and polishing products also face competition on the low-end of the price spectrum, where the customers' requirements are less demanding.

Our principal competitors for printed circuit board assembly equipment and advanced semiconductor packaging vary by product application. The principal competitors for solder reflow systems are ITW/EAE Vitronics-Soltec, Heller, Folungwin, ERSA, Shenzhen JT Automation Equipment Co., Ltd. and Rehm. The principal competitors for advanced semiconductor packaging are ITW/EAE Vitronics-Soltec and Heller. Our in-line, controlled atmosphere furnaces compete primarily against products offered by Centrotherm and SierraTherm/Schmid Thermal Systems. We also face competition from emerging low-cost Asian manufacturers and other established European manufacturers.

Although price is a factor in buying decisions, we believe that technological leadership, process capability, throughput, safer designs, uptime, mean time-to-repair, cost of ownership and after-sale support have become increasingly important factors. We compete primarily on the basis of these criteria, rather than on the basis of price alone.

General Industrial Lapping and Polishing Machines, Supplies and Semiconductor Wafer Markets. Our Polishing operating segment experiences price competition for wafer carriers from foreign manufacturers for which there is very little publicly available information. As a result, we are intensifying our efforts to reduce the cost of our carriers and will continue to compete with other manufacturers of carriers by continuing to update our product line to keep pace with the rapid changes in our customers' requirements and by providing a high level of quality and customer service. We produce steel carriers, including insert carriers, on an advanced laser-cutting tool, which reduces our costs and lead times and increases our control over quality. Competitors of our lapping and polishing machines and supplies include Lapmaster Wolters, Speedfam Co. Ltd., Lapmaster International, LLC, Hamai Co., Ltd., Onse, Inc. and Eminess Technologies, Inc. Our strategy to enhance our sales of wafer carriers and templates includes developing new applications in close collaboration with our customers, continuous improvement in our products and providing a high level of customer support and products that deliver greater value to our customers.

EMPLOYEES

As of September 30, 2018, we employed 468 people. Of these employees, 12 were based at our corporate offices in Tempe, Arizona, 39 at our manufacturing plant in Carlisle, Pennsylvania, 98 at our manufacturing plant in N. Billerica, Massachusetts, 117 at our combined facilities in the Netherlands, 137 at our facilities in China, 12 at other Asia-Pacific offices, 46 at our facilities in France, and 7 at our office in the United Kingdom. Of the 39 people employed at our Carlisle, Pennsylvania facility, 21 were represented by the United Auto Workers Union - Local 1443. We have never experienced a work stoppage or strike, and other than employees at the Carlisle facility, no other employees are represented by a union. Certain of our employees are subject to collective bargaining agreements. We consider our employee relations to be good.

PATENTS

The following table shows our material patents, the patents licensed by us, and the expiration date of each patent and license:

Product	Countries	Expiration Date or Pending Approval
Multiple methods for manufacturing a solar cell and related equipment	Various	Various
Method for manufacturing a solar cell; N-type cells with reverse flow and metal wrap-through	Netherlands	2032
Method for manufacturing a solar cell; N-type cells with reverse flow and metal wrap-through	United States	2033
Wafer boat and use thereof	Netherlands	2034
Wafer boat loader assembly, furnace system, use thereof and method for operating said assembly	Netherlands	2035
IBAL (Individual Boats with Automated Loading) Model S-300	United States	Various
Systems and methods for charging solar cell layers	Various	Various
Gas-bearing-based Atomic Layer Deposition (ALD)	Europe	2028
Carrier-less gas bearing ALD	Europe	2029
Reciprocal and helical-scan multi-nozzle ALD configurations	Europe	2030
Ultrafast gas bearing-based reactive ion etching	Europe	2030
Contactless ALD patterning process	Europe	2030
Maskless patterned fast ALD	Europe	2030
Modular furnace system	United States	2021
Convection furnace thermal profile enhancement	United States	2023
Lapping machine adjustable mechanism	Various	2027
RFID-containing carriers used for silicon wafer quality	United States	2027

To our knowledge, there are currently no pending lawsuits against us regarding infringement of any existing patents or other intellectual property rights or any material unresolved claims made by third parties that we are infringing the intellectual property rights of such third parties.

AVAILABLE INFORMATION

Our website is located at www.amtechsystems.com. Through our website, we make available, without charge, our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, current reports on Form 8-K and any amendments to those reports, as soon as reasonably practicable after such materials are electronically filed, or furnished to, the Securities and Exchange Commission, or the SEC. The information found on our website, or information that may be accessed through links on our website, are not part of this or any other report we file with, or furnish to, the SEC. In addition, our SEC filings are available at the SEC's website at <http://www.sec.gov>.

ITEM 1A. RISK FACTORS

Our business faces significant risks. Because of the following factors, as well as other variables affecting our operating results and financial condition, past performance may not be a reliable indicator of future performance, and historical trends should not be used to anticipate results or trends in future periods. We operate in a continually

changing business environment, and new risks and uncertainties emerge from time to time. Management cannot predict such new risks and uncertainties, nor can it assess the extent to which any of the risk factors below or any such new risks and uncertainties, or any combination thereof, may impact our business. The following risk factors should be read in conjunction with the other information and risks set forth herein.

Risks Related to our Industries

There is ongoing volatility in the solar and semiconductor equipment industries.

The solar and semiconductor equipment industries are highly cyclical and the conditions of the industries we operate are volatile. As such, demand for, and the profitability of, our products can change significantly from period to period as a result of numerous factors, including the following:

- changes in global and regional economic conditions;
- the shift of solar and semiconductor production to Asia, where there often is increased price competition;
- tariffs, quotas and international trade barriers, including without limitation unfair trade proceedings against solar PV manufacturers in China;
- changes in capacity utilization and production volume of manufacturers of solar cells, semiconductors, silicon wafers and MEMS;
- the profitability and capital resources of those manufacturers;
- challenges associated with marketing and selling manufacturing equipment and services to a diverse and diffuse customer base; and
- the financial condition of solar PV customers and their access to affordable financing and capital.

For these and other reasons, our results of operations for past periods may not be indicative of future operating results.

The purchasing decisions of our customers are highly dependent on their capacity utilization, which changes when new facilities are put into production and with the level of demand for solar cells and semiconductors, as well as their company's capital expenditure budget. Purchasing decisions are also impacted by changes in the economies of the countries which our customers serve, as well as the state of the worldwide solar and semiconductor industries. The timing, length and severity of the up-and-down cycles in the solar and semiconductor equipment industries are difficult to predict. The cyclical nature of our marketplace affects our ability to accurately budget our expense levels, which are based in part on our projections of future revenue.

When cyclical fluctuations result in lower than expected revenue levels, operating results are adversely affected. Cost reduction measures may be necessary in order for us to remain competitive and financially sound. During a down cycle, our operating results may be adversely affected if we are unable to make timely adjustments to our cost and expense structure to correspond to the prevailing market conditions; effectively manage the supply chain; and motivate and retain key employees. In addition, during periods of rapid growth, our operating results may be adversely affected if we are unable to increase manufacturing capacity and personnel to meet customer demand, which may require additional liquidity. We can provide no assurance that we can timely and effectively respond to the industry cycles, and our failure to do so could have a material adverse effect on our business.

We are exposed to risks as a result of ongoing changes specific to the solar industry.

A significant portion of our business is to supply the solar market, which, in addition to the general industry changes described above, is characterized by ongoing changes specific to the solar industry, including:

- a structural imbalance between supply and demand, which has increased competitive pressure on selling prices;
- varying energy policies of governments around the world and their influence on the rate of growth of the solar PV market, including the availability and amount of government incentives for solar power such as tax credits, feed-in tariffs, rebates, renewable energy portfolio standards and requirements for solar installations on government facilities;
- the need to continually decrease the cost-per-watt of electricity produced by solar PV products to or below competing sources of energy by, among other things, reducing operating costs and increasing throughputs for solar PV

manufacturing, and improving the conversion efficiency of solar PV;
• the impact on demand for solar PV products arising from the cost of electricity generated by solar PV compared to the cost of electricity from the existing grid or other energy sources;
• varying levels of operating and industry experience among solar PV manufacturers and the resulting differences in the nature and extent of customer support services requested from us;
• the cost of polysilicon and other materials; and
• an increasing number of local equipment and parts suppliers based in Asia with certain cost and other advantages over suppliers from outside Asia.

In addition, current projections for global solar PV production exceed anticipated near-term end-use demand, which is heavily dependent on installed cost-per-watt, government policies and incentives, and the availability of affordable capital. An oversupply of solar PV may lead customers to delay or reduce investments in manufacturing capacity and new technology, and adversely impact the sales and/or profitability of our products. If we do not successfully manage the risks resulting from the ongoing changes occurring in the solar industry, our business, financial condition and results of operations could be materially and adversely affected.

The solar and semiconductor equipment industries are highly competitive and, because we are relatively small in size and have fewer financial and other resources compared to our competitors, we may not be able to compete successfully with them.

Our industry includes large manufacturers with substantial resources to support customers worldwide. Our future performance depends, in part, upon our ability to continue to compete successfully in these markets. Some of our competitors are diversified companies with extensive financial resources and research, engineering, manufacturing, marketing and customer service and support capabilities that are greater than ours. We face competition from companies whose strategy is to provide a broad array of products, some of which compete with the products and services we offer. These competitors may bundle their products in a manner that discourages customers from purchasing our products. In addition, we face competition from emerging solar and semiconductor equipment companies whose strategy is to provide a portion of the products and services that we offer often at a lower price than ours and use innovative technology to sell products into specialized markets. We also face competition from Chinese equipment manufacturers that may receive greater support than we do from Chinese customers and governmental agencies because they are locally based. For non-turnkey equipment solutions, our local Chinese competitors may offer lower prices and more liberal payment terms than ours. We also are encountering increasing competition due to capacity expansions of Chinese companies that have significant experience with all facets of solar cell production and some experience working with local Chinese equipment vendors. Loss of our competitive position due to any of these factors could impair our prices, customer orders, revenue, gross margin and market share, any of which would negatively affect our financial position and results of operations.

Demand declines could occur for horizontal diffusion furnaces and related equipment, or for other solar industry products.

The revenue of our solar equipment business is comprised primarily of sales of horizontal diffusion furnaces, PECVD equipment and automation products. Our automation products are useable almost exclusively with horizontal diffusion furnaces. A significant part of our growth strategy involves expanding our sales to the solar industry. The solar industry is subject to risks relating to industry shortages of polysilicon, the continuation of government incentives, tariffs and trade barriers, the availability of specialized capital equipment, global energy prices and rapidly changing technologies offering alternative energy sources and manufacturing processes. If the demand for solar industry products declines, the demand by the solar industry for our products would also decline and our financial position and results of operations would be harmed.

For example, there is a trend in the semiconductor industry towards the use of newer technology in manufacturing facilities, such as vertical diffusion furnaces, which are more efficient than horizontal diffusion furnaces in certain processes for manufacturing smaller chips on larger wafers. To the extent the trend to use new technologies such as vertical diffusion furnaces continues, our revenue may decline and our corresponding ability to generate income may be adversely affected.

Governmental subsidies to the solar industry or demand for solar energy could decline.

The solar energy sector is dependent upon governmental subsidies, some of which have been scaled back and are not guaranteed to continue. A further decline in these subsidies could reduce our ability to make investments in our company and grow our business in this market. The solar industry also faces overcapacity in production, which has a significant adverse impact on the demand for the capital equipment we supply. As a result, we cannot provide assurance that we will realize a return on these investments which may have a material adverse effect on our business.

Risks Related to Our Business and Our Operations

The number of turnkey project order opportunities available to us is uncertain, and our focus on such projects may increase our risks related to current and future performance, project management, supplier fulfillment, unforeseen site conditions, and the regulatory environment.

A turnkey project is a complete solar cell manufacturing line, including equipment manufactured by third parties, and the design, delivery, installation, start-up, and qualification of the entire line. Though historically we have successfully participated in turnkey projects, customer demand for turnkey projects can fluctuate significantly, such that the magnitude and frequency of previously announced turnkey orders may not be indicative of future turnkey orders or of our future financial performance. Additionally, turnkey orders may present additional project execution risks to us, such as the following:

- project delays and cost over-runs, leading to lower-than-expected revenue;
- organizational stress/burden that could impact fulfillment of other orders;
- project duration and customer acceptance;
- use of and reliance on subcontractors;
- supplier relationships and constraints;
- pricing and fulfillment;
- unfavorable turnkey site conditions, such as readiness of customer facilities and access restrictions;
- and
- local regulations and policies.

Such risks could make it difficult or impossible for us to complete a turnkey order or cause us to incur unforeseen costs and expenses to do so. Failure to complete a turnkey order or unforeseen costs and expenses incurred in completing a turnkey order could have a material adverse effect on our financial condition and results of operations.

We may not be able to generate sufficient cash flows or obtain access to external financing necessary to fund existing operations and planned expansions.

Cash flows may be insufficient to provide adequate working capital in the future and we may require additional financing for further implementation of our growth plans. There is no assurance that any additional financing will be available if and when required, or, even if available, that it would not materially dilute the ownership percentage of our then existing shareholders, result in increased expenses or result in covenants or special rights that would restrict our operations.

Our reliance on sales to a few major customers, often on credit terms, places us at financial risk.

We currently sell to a relatively small number of customers and expect to do so for the foreseeable future. Therefore, our operating results depend on the ability of these customers to sell products that require our equipment in their manufacture. Many of our customer relationships have developed over a short period of time and certain ones are in the early stages of development. The loss of sales to any of these customers would have a significant negative impact on our business. Additionally, our customers cancel their agreements with us if we fail to meet certain product specifications, materially breach agreements or encounter insolvency or bankruptcy. They also may seek to renegotiate the terms of current agreements or renewals. We cannot be certain our existing customers will generate significant revenue for us in the future or that these new customer relationships will continue to develop. If we are unable to expand our customer base, we may not be able to maintain or increase our revenue.

As of September 30, 2018, one customer individually represented 23% of our accounts receivable. As of September 30, 2017, two customers individually represented 24% and 11% of our accounts receivable. A concentration of our receivables from one or a small number of customers places us at risk. In such a scenario, a significant change in the liquidity or financial position of any of our customers that purchase large systems could have a material impact on the collectability of our accounts receivable and our future operating results. We attempt to manage this credit risk by performing credit checks, by requiring significant partial payments prior to shipment, where appropriate, and by actively monitoring collections. We also require letters of credit from certain customers depending on the size of the order, type of customer or its creditworthiness and its country of domicile. Our major customers may seek and, on occasion, may receive pricing, payment, intellectual property-related or other commercial terms that are less favorable to us than the current terms we customarily obtain. If any one or more of our major customers were to re-negotiate their agreements

on more favorable terms, or not pay us or continue business with us, it could adversely affect our financial position and results of operations.

If we are unable to require certain customers to make advance payments when they place orders with us, or if our customers fail to meet their payment obligations, we may experience increased needs to finance our working capital requirements and may be exposed to increased credit risk.

We require many of our customers to make an advance payment representing a percentage of their orders, which is a business practice that helps us manage our accounts receivable, prepay our suppliers and reduce the amount of funds that we need to meet our working capital requirements. We cannot assure that this practice will continue in the future. If this practice ceases, we may not be able to secure additional financing on a timely basis or on terms acceptable to us or at all. Currently, a significant portion of our revenue is derived from credit sales to our customers, generally with payments due within less than three months after shipment. As a result, any future decrease in the use of cash advance payments by our customers may negatively impact our short-term liquidity and expose us to additional and more concentrated credit risk. From time to time, we also may need to commence legal proceedings to recover accounts receivables from customers, which would increase our expenses. Any failure by our customers to settle outstanding accounts receivable in the future could materially and adversely affect our cash flow, financial condition and results of operations.

Our customers could cancel or fail to accept a large system order.

Our backlog includes orders for large systems, such as our diffusion furnaces, with system prices of up to and in excess of \$1.0 million, depending on the system configuration, options and any special requirements of the customer. Some orders include multiple systems. Because our orders are typically subject to cancellation or delay by the customer, our backlog at any particular point in time is not necessarily representative of actual sales for succeeding periods, nor is backlog any assurance that we will realize revenue or profit from completing these orders. Our financial position and results of operations could be materially and adversely affected should any large systems order be canceled prior to shipment or not be accepted by the customer. Cancellations may result in inventory that we may not be able to sell or reuse if those products have been tailored for a specific customer's requirements and cannot then be sold without significant incremental cost. We have experienced cancellations in the past. We cannot provide any assurance that we will realize revenue or profit from our backlog.

We may not be able to manage the business successfully through severe business cycles.

We may be unable to successfully expand or contract our business to meet fluctuating demands. Market fluctuations place significant strain on our management, personnel, systems and resources. In fiscal years 2010 and 2011, we purchased additional equipment and real estate to significantly expand our manufacturing capacity and hired additional employees to support an increase in manufacturing, field service, research and development and sales and marketing efforts. Over the past several years, the rapid decline in demand caused us to reduce headcount in manufacturing and field service and to reduce certain research and development costs. To successfully manage our growth through such market fluctuations, we believe we must effectively:

- maintain the appropriate number and mix of permanent, part-time, temporary and contract employees to meet the fluctuating demand for our products;
- train, integrate and manage personnel, particularly process engineers, field service engineers, sales and marketing personnel, and financial and information technology personnel to maintain and improve skills and morale;
- retain key management and augment our management team, particularly if we lose key members;
- continue to enhance our customer resource and manufacturing management systems to maintain high levels of customer satisfaction and efficiencies, including inventory control;

- implement and improve existing and new administrative, financial and operations systems, procedures and controls;
- expand and upgrade our technological capabilities; and
- manage multiple relationships with our customers, suppliers and other third parties.

We may encounter difficulties in effectively managing the budgeting, forecasting and other process control issues presented by rapidly changing business cycles. If we are unable to manage these cycles effectively, we may not be able

to take advantage of market opportunities, develop new technologies for the production of solar cells and other products, satisfy customer requirements, execute our business plan or respond to competitive pressures.

Manufacturing interruptions or delays could affect our ability to meet customer demand and lead to higher costs.

Our business depends on timely supply of equipment, services and related products that meet the rapidly changing technical and volume requirements of our customers. Some key parts to our products are subject to long lead times and/or obtainable only from a single supplier or limited group of suppliers. Cyclical industry conditions and the volatility of demand for manufacturing equipment increase capital, technical, operational and other risks for us and for companies throughout our supply chain. Further, these conditions may cause some suppliers to scale back operations, exit businesses, merge with other companies, file for bankruptcy protection or possibly cease operations. We also may experience significant interruptions of our manufacturing operations, delays in our ability to deliver products or services, increased costs or customer order cancellations as a result of any of the following:

- the failure or inability of suppliers to timely deliver sufficient quantities of quality parts on a cost-effective basis;
- volatility in the availability and cost of materials, including rare earth elements;
- difficulties or delays in obtaining required import or export approvals;
- information technology or infrastructure failures; and
- natural disasters or other events beyond our control (such as earthquakes, floods or storms, regional economic downturns, pandemics, social unrest, political instability, terrorism, or acts of war), particularly where we conduct manufacturing operations.

Because we depend on revenue from international customers, our business may be adversely affected by changes in the economies and policies of the countries or regions in which we do business.

During fiscal 2017, 88% of our net revenue came from customers outside of North America. During fiscal 2018, 86% of our net revenue came from customers outside of North America as follows:

- Asia - 70% (including China - 53%, Malaysia 6% and Taiwan - 7%); and
- Europe - 16%

Each geographic region in the markets in which we operate exhibits unique characteristics that can cause capital equipment investment patterns to vary significantly from period to period. Our business and results of operations could be negatively affected by periodic local or international economic downturns, trade balance issues and political, social and military instability in countries such as China, India, South Korea, Taiwan and possibly elsewhere. In addition, we face competition from a number of suppliers based in Asia that have certain advantages over suppliers from outside of Asia. These advantages include lower operating, shipping and regulatory costs, proximity to customers, favorable tariffs and other government policies that favor local suppliers. Additionally, the marketing and sale of our products to international markets expose us to a number of risks, including the following:

- increased costs associated with maintaining the ability to understand the local markets and follow their trends and customs, as well as developing and maintaining an effective marketing and distributing presence;
- limitations on our ability to require advance payments from our customers;
- difficulty in providing customer service and support in local markets;
- difficulty in staffing and managing overseas operations;
- longer sales cycles and time collection periods;
- fewer or weaker legal protections for our intellectual property rights;
- failure to develop appropriate risk management and internal control structures tailored to overseas operations;
-

difficulty and costs relating to compliance with the different or changing commercial and legal requirements of our overseas markets;

fluctuations in foreign currency exchange and interest rates;

failure to obtain or maintain certifications for our products or services in these markets; and

international trade barriers such as export requirements, tariffs, taxes and other restrictions and expenses.

Our business may be adversely affected by significant exchange rate fluctuations.

We incurred net foreign currency transaction losses of \$0.1 million during each of the fiscal years ended September 30, 2018 and September 30, 2017. Though our business has not been materially affected in the past by currency fluctuations, there is a risk that it may be materially adversely affected in the future, especially as we continue to expand operations into other countries. Such risk includes possible losses due to currency exchange rate fluctuations, future prohibitions against repatriation of earnings, or proceeds from disposition of investments.

We are exposed to risks associated with an uncertain global economy.

Uncertain global economic conditions and slowing growth in China, Europe and the United States, along with difficulties in the financial markets, national debt concerns and government austerity measures in certain regions, pose challenges to the industries in which we operate. Related factors, including unemployment, inflation and fuel prices, exacerbate negative trends in business and consumer spending and may cause our customers to delay, cancel, or refrain from placing orders for equipment or services. These actions may, in turn, reduce our net sales, reduce backlog, and affect our ability to convert backlog to sales. Uncertain market conditions, difficulties in obtaining capital, or reduced profitability also may cause some customers to scale back operations, exit businesses, merge with other manufacturers, or file for bankruptcy protection and potentially cease operations, which can result in lower sales and/or additional inventory or bad debt expense for us. These conditions may similarly affect key suppliers, impairing their ability to deliver parts and potentially causing delays or added costs for delivery of our products. In addition, these conditions may lead to strategic alliances by, or consolidation of, other equipment manufacturers, which could adversely affect our ability to compete effectively. Uncertainty about future economic and industry conditions also makes it more challenging for us to forecast our operating results, make business decisions, and identify and prioritize the risks that may affect our businesses, sources and uses of cash, financial condition and results of operations. We may be required to implement additional cost reduction efforts, including restructuring activities, and/or modify our business model, which may adversely affect our ability to capitalize on opportunities in a market recovery. If we do not timely and appropriately adapt to changes resulting from these uncertain macroeconomic environment and industry conditions, or to difficulties in the financial markets, our business, financial condition and results of operations may be materially and adversely affected.

We are dependent on key personnel for our business and product development and sales.

Historically, our relationships with key customers and partners have depended on personal relations and other contacts established by certain of our executive officers. Though we cannot assure that such relationships will continue, such cooperation is expected to continue to be a significant element in our future development efforts.

Furthermore, it may not be feasible for any successor to maintain the same business relationships that our executive officers have established. While we are the beneficiary of a life insurance policy on the life of our Executive Chairman, Mr. Whang, there is no assurance that such insurance will be sufficient to cover the cost of finding and hiring a suitable replacement for Mr. Whang. If we were to lose the services of Mr. Whang for any reason, it could have a material adverse effect on our business.

We also depend on the management efforts of our officers and other key personnel and on our ability to attract and retain key personnel. During times of strong economic growth, competition is intense for highly-skilled employees. There can be no assurance that we will be successful in attracting and retaining such personnel or that we can avoid increased costs in order to do so. There can be no assurance that employees will not leave Amtech or compete against us. Our failure to attract additional qualified employees, or to retain the services of key personnel, could negatively impact our financial position and results of operations.

Acquisitions can result in an increase in our operating costs, divert management's attention away from other operational matters and expose us to other risks.

We continually evaluate potential acquisitions and consider acquisitions an important part of our future growth strategy. In the past, we have made acquisitions of, or significant investments in, other businesses with synergistic products, services and technologies and plan to continue to do so in the future. Acquisitions involve numerous risks, including, but not limited to:

• difficulties and increased costs in connection with integration of geographically diverse personnel,

- operations, technologies and products;
- diversion of management's attention from other operational matters;
- the potential loss of our key employees and the key employees of acquired companies;
- the potential loss of our key customers and suppliers and the key customers and suppliers of acquired companies;
- disagreement with joint venture or strategic alliance partners;
- failure to comply with laws and regulations as well as industry or technical standards of the overseas markets into which we expand;
- our inability to achieve the intended cost efficiency, level of profitability or other intended strategic goals for the acquisitions, strategic investments, joint ventures or other strategic alliances;
- lack of synergy, or inability to realize expected synergies, resulting from the acquisition;
- the possibility that the issuance of our common stock, if any, in an acquisition or merger could be dilutive to our shareholders;
- impairment of acquired assets as a result of technological advancements or worse-than-expected performance of the acquired company;
- inability to complete proposed transactions as anticipated or at all and any ensuing obligation to pay a termination fee and any other associated transaction expenses;
- the potential impact of the announcement or consummation of a proposed transaction on relationships with third parties;
- potential changes in our credit rating, which could adversely impact our access to and cost of capital;
- potential litigation that may arise in connection with an acquisition;
- reductions in cash balances and/or increases in debt obligations to finance activities associated with a transaction, which reduce the availability of cash flow for general corporate or other purposes;
- inadequacy or ineffectiveness of an acquired company's internal financial controls, disclosure controls and procedures, and/or environmental, health and safety, anti-corruption, human resource or other policies or practices; and
- unknown, underestimated and/or undisclosed commitments or liabilities.

If we fail to maintain optimal inventory levels, our inventory obsolescence costs could increase, our liquidity could be significantly reduced or our revenue could decrease.

While we must maintain sufficient inventory levels to operate our business successfully and meet our customers' demands, accumulating excess inventory may have a significant unfavorable impact on our operating results and financial condition. Changing customer demands, supplier lead times and uncertainty surrounding new product launches expose us to risks associated with excess inventory or shortages. Our products are manufactured using a wide variety of purchased parts and raw materials and we must maintain sufficient inventory levels to meet the demand for the products we sell, which can change rapidly and unexpectedly. During peak years in the solar and semiconductor industries, increases in demand for capital equipment result in longer lead times for many important system components. Future increases in demand could cause delays in meeting shipments to our customers. Because of the variability and uniqueness of customer orders, we try to avoid maintaining an extensive inventory of materials for manufacturing. However, long lead times for important system components during industry upturns sometimes require us to carry higher levels of inventory and make larger purchase commitments than we otherwise would make. We may be unable to sell sufficient quantities of products in the event that market demand changes, resulting in increased risk of excess inventory that could lead to obsolescence or reduced liquidity as we fulfill our purchase commitments. On the other hand, if we do not have a sufficient inventory of a product to fulfill customer orders, we may lose orders or customers, which may adversely affect our business, financial condition and results of operations. We cannot assure that we can accurately predict market demand and events to avoid inventory shortages or inventories and purchase commitments in excess of our current requirements.

Supplier capacity constraints, supplier production disruptions, supplier quality issues or price increases could increase our operating costs and adversely impact the competitive positions of our products.

We use numerous materials suppliers covering a wide range of materials and services in the production of our products including custom electronic and mechanical components. Key vendors include suppliers of controllers, quartz and silicon carbide for our diffusion systems, two steel mills capable of producing the types of steel to the tolerances needed for our wafer carriers, an injection molder that molds plastic inserts into our steel carriers, an adhesive manufacturer that supplies the critical glue and a pad supplier that produces a unique material used in the manufacture of our polishing templates. We also rely on third parties for certain machined parts, steel frames and metal panels and other components

used particularly in the assembly of solar and semiconductor production equipment. Although we strive to ensure that parts are available from multiple suppliers, we procure some key parts from a single supplier or a limited group of suppliers. Thus, at times, certain parts may not be available in sufficient quantities, or on a timely and cost-efficient basis, to adequately meet our needs and the needs of our customers.

Further, because the selling price of some of our systems exceeds \$1.0 million, the delay in the shipment of even a single system could cause significant variations in our quarterly revenue. In the event of supplier capacity constraints, production disruptions, or failure to meet our requirements concerning quality, cost or performance factors, we may transfer our business to alternative sourcing which could lead to further delays, additional costs or other difficulties. If, in the future, we do not receive, in a timely and cost-effective manner, a sufficient quantity and quality of parts to meet our production requirements, our financial position and results of operations may be materially and adversely affected.

We might fail to develop adequate internal organizational structures, internal controls and risk monitoring and management systems for an organization of our scale.

Our business and operations have expanded rapidly through organic growth and acquisitions, as well as successfully managed frequent cyclical contractions. These periods of growth and contraction require the diversion of significant management resources to develop and implement adequate structures for internal organization and information flow, an effective internal control environment, risk monitoring and management systems in line with the scale of our organization, and the hiring and integration of qualified employees into our organization. In addition, disclosure and other ongoing obligations associated with being a public company further increase the challenges to our finance, legal and accounting teams. Furthermore, if we fail to continue to develop and implement appropriate structures for internal organization and information flow, an effective internal control environment and a risk monitoring and management system, we may not be able to identify unfavorable business trends, administrative oversights or other risks that could materially and adversely affect our business, prospects, financial condition and results of operations.

Unsatisfactory performance of, or defects in, our products may cause us to incur additional warranty expenses, damage our reputation and cause our sales to decline.

As of September 30, 2018 and 2017, our accrued warranty costs amounted to \$1.0 million and \$1.3 million, respectively. Our assumptions regarding the durability and reliability of our products may not be accurate, and because our products have relatively long warranty periods, we cannot assure you that the amount of accrued warranty by us for our products will be adequate in light of the actual performance of our products. If we experience a significant increase in warranty claims, we may incur significant repair and replacement costs associated with such claims. Furthermore, widespread product underperformances or failures will damage our reputation and customer relationships and may cause our sales to decline, which in turn could have a material adverse effect on our financial condition and results of operations.

We may incur impairment charges to goodwill or long-lived assets.

We have acquired, and may acquire in the future, goodwill and other long-lived intangible assets. Goodwill and purchased intangible assets with indefinite useful lives are not amortized, but are reviewed for impairment at least annually, typically during the fourth quarter of each fiscal year, and more frequently when events or changes in circumstances indicate that the carrying value of an asset may not be recoverable. The review compares the fair value for each of our reporting units to its associated carrying value, including goodwill. Factors that could lead to impairment of goodwill and intangible assets include adverse industry or economic trends, reduced estimates of future cash flows, declines in the market price of our common stock, changes in our strategies or product portfolio, and restructuring activities. Our valuation methodology for assessing impairment requires management to make judgments

and assumptions based on historical experience and projections of future operating performance. As is the case with our impairment charge in fiscal 2018, we may again be required to record a charge to earnings during the period in which an impairment of goodwill or amortizable intangible assets is determined to exist, which could materially and adversely affect our results of operations.

Our income taxes are subject to variables beyond our control.

Our net income and cash flow may be adversely affected by conditions affecting income taxes which are outside our control. Examples of the potential uncontrollable circumstances that could affect our tax rate are as follows:

- We sell and operate globally in the United States, Europe and Asia. Disagreement could occur on the jurisdiction of income and taxation among different governmental tax authorities. Potential areas of dispute may include transfer pricing, intercompany charges and intercompany balances.

We are subject to a China withholding tax on certain non-tangible charges made under our transfer pricing agreements. The interpretation of what charges are subject to the tax and when the liability for the tax occurs has varied and could change in the future.

• Tax rates may increase, and, therefore, have a material adverse effect on our earnings and cash flows.

Our officers, directors and largest shareholders could choose to act in their best interests and not necessarily those of our other shareholders.

Our directors, executive officers and holders of five percent or more of our outstanding common stock and their affiliates represent a significant portion of our common stock held as of September 30, 2018, and, therefore, have significant influence over our management and corporate policies. These shareholders have significant influence over all matters submitted to our shareholders, including the election of our directors and approval of business combinations, and could potentially initiate or delay, deter or prevent a change of control. Circumstances may occur in which the interests of these shareholders may conflict with the interests of Amtech or those of our other shareholders, and these shareholders may cause us to take actions that align with their interests. Should conflicts of interest arise, we can provide no assurance that these shareholders would act in the best interests of our other shareholders or that any conflicts of interest would be resolved in a manner favorable to our other shareholders. In addition, involvement of certain activist shareholders may impact our ability to recruit and retain talent or otherwise distract management or make decisions that we believe are in the long-term interest of all shareholders.

Information security breaches or failures of our information technology systems may have a negative impact on our operations and our reputation.

We may be subject to information security breaches or failures of our information technology systems caused by advanced persistent threats, unauthorized access, sabotage, vandalism, terrorism or accident. Compromises and failure to our information technology networks and systems could result in unauthorized release of our confidential or proprietary information, or that of our customers and suppliers, as well as employee personal data. The costs to protect against or alleviate breaches and systems failures require significant human and financial capital expenditures, which in turn could potentially disrupt our continuing operations, increase our liability as a result of compromises to personally identifiable information, and may lead to a material and adverse effect on our financial reporting, reputation and business.

Natural disasters, outbreaks of infectious diseases, terrorist attacks, wars and threats of war may negatively impact our operations, revenue, costs and stock price.

Natural disasters such as earthquakes, floods, severe weather conditions, outbreaks of infectious diseases or other catastrophic events may severely affect our operations or those of our suppliers and customers. Such catastrophic events may have a material adverse effect on our business.

Acts of terrorism, as well as events occurring in response or connection to them, including potential future terrorist attacks, rumors or threats of war, actual military conflicts or trade disruptions impacting our domestic or foreign

customers or suppliers, may negatively impact our operations by causing, among other things, delays or losses in the delivery of supplies or finished goods and decreased sales of our products. More generally, any of these events could cause consumer confidence and spending to decrease and/or result in increased volatility in the worldwide financial markets and economy. They also could result in economic recession either globally or in the markets in which we operate. Any of these occurrences could have a significant adverse impact on our financial position and results of operations.

In particular, our Solar segment's production, storage and administrative facilities are located in close proximity to one another in the Netherlands. A natural disaster or other unanticipated catastrophic event, including flood, power interruption, and war, could significantly disrupt our ability to manufacture our products and operate our business. If

any of our production facilities or equipment were to experience any significant damage or downtime, we would be unable to meet our production targets, our business would suffer and it could have a material adverse effect on our business, financial condition and results of operations.

Risks Related to Regulations and Litigation

Our business may be adversely affected by changes in foreign and domestic laws.

The operations of our companies are subject to numerous foreign and domestic regulatory regimes, including taxation policies, employment and labor laws, transportation regulations, import and export regulations and tariffs, possible foreign exchange restrictions and international monetary fluctuations. Changes in such laws and regulations may have a material adverse effect on our revenue and expenses.

We are subject to U.S. and certain non-U.S. anti-corruption/anti-bribery, export and import controls, sanctions, embargoes, anti-money laundering, anti-terrorist financing, and other similar laws and regulations. Compliance with these legal standards could impair our ability to compete in domestic and international markets. We can face criminal liability and other serious consequences for violations of these laws and regulations which can harm our business.

We are a U.S.-based multinational company with extensive operations, including manufacturing joint ventures, in Asia and elsewhere. We operate in several high-risk jurisdictions, including, but not limited to China. Various U.S. and certain non-U.S. anti-corruption/anti-bribery and other international trade laws and regulations apply to our company entities and businesses. These laws and regulations may include, among others, the Foreign Corrupt Practices Act of 1977, as amended, the U.S. Travel Act, the U.S. Domestic Bribery Statute contained in 18 U.S.C. §201, the Money Laundering Control Act (1986), the Uniting and Strengthening America by Providing Appropriate Tools to Restrict, Intercept, and Obstruct Terrorism Act of 2001 (the USA PATRIOT Act), the United States Export Administration Act of 1979, the U.S. Export Administration Regulations (15 C.F.R. §§730 et seq.), U.S. sanctions contained in 31 C.F.R. Parts 500-599, the United States International Emergency Economic Powers Act, the United States Trading with the Enemy Act, the International Boycott Provisions of Section 999 of the U.S. Internal Revenue Code of 1986, the UK Bribery Act 2010, the UK Proceeds of Crime Act 2002, and certain other anti-corruption, anti-bribery, anti-kickback, anti-fraud, anti-money laundering, anti-terrorist financing, anti-narcotics, anti-boycott, export control, sanctions, embargo, import control, customs, tax, insider trading, insurance, banking, false claims, anti-racketeering, and other laws, regulations, decrees, government or executive orders, or judicial or administrative decisions or determinations to the extent applicable.

The above-mentioned laws and regulations are interpreted very broadly and will impact and raise legal compliance risks for our business in the various jurisdictions where we operate. Violations of the above-mentioned laws and regulations may result in substantial civil and criminal fines and penalties, imprisonment, the loss of export or import privileges, debarment, tax reassessments, breach of contract and fraud litigation, reputational harm, and other consequences.

Anti-corruption/anti-bribery and the other laws and regulations mentioned above are actively enforced by U.S. and other governments agencies. Among various matters, anti-corruption/anti-bribery laws prohibit our companies, subsidiaries, directors, officers, employees, agents, contractors, vendors, and other business partners from authorizing, promising, offering, providing, soliciting, or accepting directly or indirectly, improper payments or anything else of value to or from recipients in the public or private sector. We may engage vendors and third party business partners to sell our products or services and/or to obtain necessary permits, licenses, patent registrations, and other regulatory approvals. We have direct or indirect interactions with officials and employees of government agencies or government-affiliated organizations. These factors raise our anti-corruption/anti-bribery risk exposure. We can be held liable for the corrupt or other illegal activities of our employees, agents, contractors, vendors, and other business

partners, even if we do not explicitly authorize or have actual knowledge of such activities. The application of these laws to us also may place us at a competitive disadvantage to foreign companies that are not subject to similar regulations.

The United States could withdraw from or materially modify certain international trade agreements, or change tariff, trade, or tax provisions related to the global manufacturing and sales of our products in ways that we currently cannot predict.

A portion of our business activities are conducted in foreign countries, including China, Malaysia, Taiwan, France and the Netherlands. Our business benefits from free trade agreements, and we also rely on various U.S. corporate tax provisions related to international commerce as we build, market and sell our products globally. The current U.S. presidential administration, with support of some members in Congress, has announced trade policy changes, including an intention to impose new tariffs on imported goods, which have created significant uncertainty about the future relationship between the United States and other countries with respect to trade, treaties and tariffs. For example, on June 15, 2018, the Office of the United States Trade Representative (the “USTR”) published a list of products covering 818 separate U.S. tariff lines valued at approximately \$34 billion in 2018 trade values, imposing an additional duty of 25% on the listed product lines. The list generally focuses on products from industrial sectors that contribute to or benefit from the “Made in China 2025” industrial policy, which include industries such as aerospace, information and communications technology, robotics, industrial machinery, new materials, and automobiles. The USTR also announced a second set of 284 proposed tariff lines, which cover approximately \$16 billion worth of imports from China, which will undergo further review in a public notice and comment process, including a public hearing. After completion of this process, USTR stated that it will issue a final determination on the products from this list that would be subject to the additional duties. We are continuing to evaluate the impact of the announced and other proposed tariffs on products that we import from China, and we may experience a material increase in the cost of our products, which may result in our products becoming less attractive relative to products offered by our competitors.

These developments, or the perception that any of them could occur, may have a material adverse effect on global economic conditions and the stability of global financial markets, and may significantly reduce global trade and, in particular, trade between the impacted nations and the United States. Any of these factors, or any changes to U.S. corporate tax policies related to international commerce, could depress economic activity and have a material adverse effect on our business, financial condition and results of operations.

Recent changes to U.S. tax laws may adversely affect our financial condition or results of operation and create the risk that we may need to adjust our accounting for these changes.

The Tax Cuts and Jobs Act (the “Act”), enacted on December 22, 2017, makes significant changes to U.S. tax laws and includes numerous provisions that affect businesses, including ours. For instance, as a result of lower corporate tax rates, the Act tends to reduce both the value of deferred tax assets and the amount of deferred tax liabilities. It also limits interest rate deductions and the amount of net operating losses that can be used each year and alters the expensing of capital expenditures. Other provisions have international tax consequences for businesses like ours that operate internationally. The Act is unclear in certain respects and will require interpretations and implementing regulations by the Internal Revenue Service, as well as state tax authorities, and the Act could be subject to amendments and technical corrections, any of which could lessen or increase the adverse (and positive) impacts of the Act. The accounting treatment of these tax law changes is complex, and some of the changes may affect both current and future periods. Others will primarily affect future periods. We have accounted for the impact of the Act on us for fiscal 2018 in this Annual Report on Form 10-K and, though we believe our analysis and computations of the tax effects of the Act on us to be correct, any adjustments to our conclusions or the effects of currently unknown impacts of the Act on us could affect our current or future financial statements, or both.

Regulations related to conflict minerals will force us to incur additional expenses, may make our supply chains more complex, and may result in damage to our relationships with customers.

Under the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, or the Dodd-Frank Act, the SEC adopted requirements for companies that manufacture products that contain certain minerals and metals known as “conflict minerals”. These rules require public companies to perform diligence and to report annually to the SEC whether such minerals originate from the Democratic Republic of Congo and adjoining countries. The implementation of these requirements could adversely affect the sourcing, availability, and pricing of minerals we use in the manufacture of our products. In addition, we have incurred and will continue to incur additional costs to comply with the disclosure requirements, including costs related to determining the source of any of the relevant minerals used in our products. Given the complexity of our supply chain, we may not be able to ascertain the origins of these minerals used in our products through the due diligence procedures that we implement, which may harm our reputation. We may also face difficulties in satisfying customers who may require that our products be certified as conflict mineral free, which could

harm our relationships with these customers and lead to a loss of revenue. These requirements could limit the pool of suppliers that can provide conflict-free minerals, and we may be unable to obtain conflict-free minerals at competitive prices, which could increase our costs and adversely affect our manufacturing operations and our profitability.

We are subject to environmental regulations, and our inability or failure to comply with these regulations could result in significant costs or the suspension of our ability to operate portions of our business.

We are subject to environmental regulations in connection with our business operations, including regulations related to manufacturing and our customers' use of our products. From time to time, we receive notices regarding these regulations. It is our policy to respond promptly to these notices and to take any necessary corrective action. Our failure or inability to comply with existing or future environmental regulations could result in significant remediation liabilities, the imposition of fines and/or the suspension or termination of development, manufacturing or use of certain of our products or facilities, each of which could damage our financial position and results of operations.

We face the risk of product liability claims or other litigation, which could be expensive and may divert management's attention from running our business.

Amtech and our subsidiaries are defendants from time to time in actions for matters arising out of our business operations. The manufacture and sale of our products, which, in our customers' operations, involve toxic materials and robotic machinery, involve the risk of product liability claims. In addition, a failure of one of our products at a customer site could interrupt the business operations of our customer. Our existing insurance coverage limits may not be adequate to protect us from all liabilities that we might incur in connection with the manufacture and sale of our products if a successful product liability claim or series of product liability claims were brought against us.

We also may be involved in other legal proceedings or claims and experience threats of legal action from time to time in the ordinary course of our business. For example, securities class action litigation are often brought against companies following periods of volatility in the market price of its securities or in connection with strategic transactions. We may in the future be the target of securities litigation due to volatility in the market price of our common stock or for other reasons. Any securities litigation could result in substantial costs and could divert the attention and resources of our management.

Where appropriate, we intend to vigorously defend all claims. However, any actual or threatened claims, even if not meritorious or material, could result in the expenditure of significant financial and managerial resources. The continued defense of these claims and other types of lawsuits could divert management's attention away from running our business. In addition, required amounts to be paid in settlement of any claims, and the legal fees and other costs associated with their defense or also settlement, cannot be estimated and could, individually or in the aggregate, materially harm our financial condition. We may also experience higher than expected warranty claims.

Risks Related to Our Research and Development and Intellectual Property Activities

We may not be able to keep pace with the rapid change in the technology needed to meet customer requirements.

Success in the solar and semiconductor equipment industries depends, in part, on continual improvement of existing technologies and rapid innovation of new solutions. For example, the solar industry continues to develop new technologies to increase the efficiencies and lower the costs of solar cells. Also, the semiconductor industry continues to shrink the size of semiconductor devices. These and other evolving customer needs require us to continually respond with new product developments.

Technical innovations are inherently complex and require long development cycles and appropriate professional staffing. Our future business success depends on our ability to develop and introduce new products, or new uses for existing products, that successfully address changing customer needs and win market acceptance. We also must manufacture these new products in a timely and cost-effective manner. To realize future growth through technical innovations in the solar and semiconductor industries, we must acquire the technology through product development, merger and acquisition activity or through the licensing of products from our technology partners. Potential disruptive technologies could have a material adverse effect on our business if we do not successfully develop and introduce new products, technologies or uses for existing products in a timely manner and continually find ways of reducing the cost to produce them in response to changing market conditions or customer requirements.

Our research and development investments may not result in timely new products that can be sold at favorable prices and obtain market acceptance.

The rapid change in technology in our industry requires that we continue to make investments in research and development in order to enhance the performance, functionality and cost of ownership of our products to keep pace with competitors' products and to satisfy customer demands for improved performance, features and functionality. We can be provide assurance that revenue from future products or enhancements will be sufficient to recover the development costs associated with such products or enhancements, or that we will be able to secure the financial resources necessary to fund future development. Research and development costs are typically incurred before we confirm the technical feasibility and commercial viability of a product, and not all development activities result in commercially viable products. We cannot assure that products or enhancements will receive market acceptance, or that we will be able to sell these products at prices that are favorable to us, or at all. In addition, from time to time we receive funding from government agencies for certain strategic development programs to increase our research and development resources and address new market opportunities. As a condition to this government funding, we may be subject to certain record-keeping, audit, intellectual property rights-sharing and/or other obligations. If we do not successfully manage our investments in research and development, our business, financial condition and results of operations could be materially and adversely affected.

Third parties may violate our proprietary rights, in which we have made significant investments, resulting in a loss of value of some of our intellectual property or costly litigation.

Our success is dependent in part on our technology and other proprietary rights. We own various United States and international patents and have additional pending patent applications relating to some of our products and technologies. Protecting and defending our patents domestically, and especially internationally, is costly. In addition, the process of seeking patent protection is lengthy and expensive. Therefore, we cannot be certain that pending or future applications will result in issued patents, or that issued patents will be of sufficient scope or strength to provide meaningful protection or commercial advantage to us. Other companies and individuals, including our larger competitors, may develop technologies that are similar or superior to our technology or design around the patents we own or license. In addition, the patent for the technology that we license and use in our manufacture of insert carriers has expired, which, along with the other risks related to our patents described above, may have the effect of diminishing or eliminating any competitive advantage we may have with respect to our manufacturing process.

We also maintain trademarks on certain of our products and claim copyright protection for certain proprietary software and documentation. We can give no assurance, however, that our trademarks and copyrights will be upheld or will successfully deter infringement by third parties.

We attempt to protect our trade secrets and other proprietary information through confidentiality agreements with our customers, suppliers, employees and consultants and through other security measures. We also maintain exclusive and non-exclusive licenses with third parties for the technology used in certain products. However, these employees, consultants and third parties may breach these agreements, and we may not have adequate remedies for wrongdoing. In addition, the laws of certain territories, such as China, in which we develop, manufacture or sell our products may not protect our intellectual property rights to the same extent as do the laws of the United States.

We may face intellectual property infringement claims that could be time-consuming and costly to defend and could result in our loss of significant rights and the assessment of treble damages.

From time to time, we have received communications from other parties asserting the existence of patent rights or other intellectual property rights that they believe cover certain of our products, processes, technologies or information. Some of these claims may lead to litigation. We cannot assure that we will prevail in these actions, or

that other actions alleging misappropriation or misuse by us of third-party trade secrets, infringement by us of third-party patents and trademarks or the validity of our patents, will not be asserted or prosecuted against us. If there is a successful claim of infringement against us, we may be required to pay substantial damages (including treble damages if we were to be found to have willfully infringed a third party's patent) to the party claiming infringement, incur costs to develop non-infringing technology, stop selling or using technology that contains the allegedly infringing intellectual property, or enter into royalty or license agreements that may not be available on acceptable or commercially practical terms, if at all. Intellectual property litigation, regardless of outcome, is expensive and time-consuming, and could divert management's attention from our business. Our failure to successfully defend against infringement claims, or to develop

non-infringing technologies or license the proprietary rights on a timely basis, could have a material negative effect on our business, operating results or financial condition.

Risks Related to Our Common Stock

Our results of operations are difficult to predict, and, we have experienced, and may continue to experience, significant volatility in our stock price as a result.

A variety of factors may cause the price of our stock to be volatile. For example, our results of operations are difficult to predict and have fluctuated from time to time in the past. We expect that our results of operations may continue to fluctuate from time to time in the future. It is possible that our results of operations in some reporting periods will be below market expectations. If our results of operations for a particular reporting period are lower than the market expectations for such reporting period, investors may react negatively and, as a result, the price of our stock may materially decline.

Furthermore, the stock market in general, and the market for shares of high-technology companies in particular, including ours, have experienced extreme price fluctuations, which have often been unrelated to the operating performance of affected companies. During the two-year period ended September 30, 2018 the price of our common stock has ranged from \$15.45 to \$3.99. The price of our stock may be more volatile than the stock of other companies due to, among other factors, the unpredictable, volatile and seasonal nature of the semiconductor and solar industries, our significant customer concentration, intense competition, our fluctuating backlog and our relatively low daily stock trading volume. As a result, the market price of our common stock is likely to continue to fluctuate significantly in the future, including fluctuations related and unrelated to our performance.

Future sales of our common stock by us or our existing shareholders could depress the market price of our common stock.

If we or our existing shareholders sell a large number of shares of our common stock, the market price of our common stock could decline significantly. Further, even the perception in the public market that we or our existing shareholders might sell shares of common stock could depress the market price of the common stock.

If securities analysts do not publish research or reports about our business or if they downgrade our stock, the price of our stock could decline.

The trading market for our shares of common stock could rely in part on the research and reporting that industry or financial analysts publish about us or our business. We do not control these analysts. Furthermore, if one or more of the analysts who do cover us downgrades our stock, the price of our stock could decline. If one or more of these analysts ceases coverage of our company, we could lose visibility in the market, which in turn could cause our stock price to decline.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

We believe that our properties are adequate for our current needs. In addition, we believe that adequate space can be obtained to meet our foreseeable business needs. The following chart identifies the principal properties which we own or lease.

Location	Use	Own or Lease	Size
Corporate			
Tempe, AZ	Corporate Headquarters	Own	15,000 sf
Solar Equipment Segment			
Vaassen, the Netherlands	Office, Mfg. & Warehouse	Own	54,000 sf
Eindhoven, the Netherlands	Office, Mfg. & Warehouse	Rent	6,800 sf
Clapiers, France	Office, Mfg. & Warehouse	Rent	12,000 sf
Clapiers, France	Manufacturing	Rent	6,700 sf
Le Cres, France	Manufacturing	Rent	3,000 sf
Semiconductor Equipment Segment			
N. Billerica, MA	Office, Mfg. & Warehouse	Own	150,000 sf
Ashvale, Surrey, U.K.	Office	Lease	1,900 sf
Shanghai, China	Office, Mfg. & Warehouse	Lease	49,000 sf
Singapore	Office	Lease	1,600 sf
Penang, Malaysia	Office	Lease	1,570 sf
Polishing Supplies Segment			
Carlisle, PA	Office & Mfg.	Lease	22,000 sf

Our building in North Billerica, Massachusetts secures a mortgage note with a remaining balance of \$5.9 million as of September 30, 2018 and a maturity date of September 26, 2023. The debt was refinanced in September 2016 with an interest rate of 4.11% through September 26, 2021, at which time the interest rate will be adjusted to a per annum fixed rate equal to the aggregate of the Federal Home Loan Board Five Year Classic Advance Rate plus two hundred forty basis points.

In 2017, Tempres borrowed approximately \$0.4 million as part of the construction of a large, bi-facial solar PV park at its headquarters in the Netherlands. The debt is secured by Tempres' real property in Vaassen, the Netherlands, and carries an interest rate equal to the 10-year interest rate swap rate plus a 2.4% premium, reduced by a 1% discount, which at September 30, 2018 was 2.23%. The debt has a 15-year term. As of September 30, 2018, Tempres' remaining debt balance is \$0.3 million.

ITEM 3. LEGAL PROCEEDINGS

Amtech and its subsidiaries are defendants from time to time in actions for matters arising out of their business operations. We do not believe that any matters or proceedings presently pending will have a material adverse effect on our consolidated financial position, results of operations or liquidity.

ITEM 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

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

MARKET INFORMATION

Our common stock, par value \$0.01 per share ("Common Stock"), is trading on the NASDAQ Global Select Market, under the symbol "ASYS."

ISSUER PURCHASES OF EQUITY SECURITIES

On March 28, 2018, we announced that our Board approved a stock repurchase program, pursuant to which we may repurchase up to \$4 million of our outstanding Common Stock over a one-year period, commencing on April 2, 2018. We completed the repurchase program during the quarter ended September 30, 2018, and those repurchases are reflected in the table below. All shares repurchased during the year ended September 30, 2018 have been retired.

Period	(a) Total Number of Shares Purchased	(b) Average Price Paid per Share	(c) Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs	(d) Approximate Dollar Value of Shares that May Yet Be Purchased Under the Plans or Programs
July 1, 2018 through July 31, 2018	—	\$ —	—	\$ 4,000,000
August 1, 2018 through August 31, 2018	452,439	\$ 5.15	452,439	\$ 1,671,921
September 1, 2018 through September 30, 2018	318,710	\$ 5.24	318,710	\$ —
Total	771,149	\$ 5.19	771,149	

COMPARISON OF STOCK PERFORMANCE

The following line graph and related information shall not be deemed “soliciting material” or “filed” with the SEC, nor shall such information be incorporated by reference into any future filings under the Securities Act of 1933 or the Exchange Act, each as amended, except to the extent that we specifically incorporated by reference it into such filing.

The following line graph compares cumulative total shareholder return, assuming reinvestment of dividends, for our Common Stock, the NASDAQ Composite Index and the NASDAQ Industrial Index. Because we did not pay dividends on our Common Stock during the measurement period, the calculation of the cumulative total shareholder return on our Common Stock did not include dividends. The following graph assumes that \$100 was invested on October 1, 2013.

HOLDERS

As of November 19, 2018, there were 417 shareholders of record of our Common Stock. Based upon a recent survey of brokers, we estimate there were approximately an additional 6,134 beneficial shareholders who held shares in brokerage or other investment accounts as of that date.

DIVIDENDS

We have never paid dividends on our Common Stock. Our present policy is to apply cash to investment in product development, acquisition or expansion; consequently, we do not expect to pay dividends on Common Stock in the foreseeable future.

UNREGISTERED SALES OF EQUITY SECURITIES

There were no unregistered sales of equity securities in fiscal 2018.

ITEM 6. SELECTED FINANCIAL DATA

The selected financial data presented below should be read in conjunction with Item 7, “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” and our consolidated financial statements (including the related notes thereto) contained elsewhere in this report.

	Years Ended September 30,				
	2018	2017	2016	2015	2014
Operating Data:					
Net revenue	\$176,426	\$164,516	\$120,308	\$104,883	\$56,501
Gross profit	\$55,157	\$51,932	\$34,063	\$27,008	\$11,626
Gross margin	31	% 32	% 28	% 26	% 21
Operating income (loss) ⁽¹⁾	\$1,919	\$10,425	\$(7,908)	\$(13,521)	\$(13,089)
Net income (loss) attributable to Amtech Systems, Inc. ⁽²⁾⁽³⁾	\$5,305	\$9,131	\$(7,008)	\$(7,771)	\$(13,047)
Income (loss) per share attributable to Amtech Systems, Inc.:					
Basic income (loss) per share	\$0.36	\$0.68	\$(0.53)	\$(0.65)	\$(1.34)
Diluted income (loss) per share	\$0.35	\$0.68	\$(0.53)	\$(0.65)	\$(1.34)
Order backlog	\$51,101	\$102,377	\$48,610	\$34,589	\$28,522
Balance Sheet Data:					
Cash and cash equivalents	\$58,331	\$51,121	\$27,655	\$25,852	\$27,367
Working capital	\$79,147	\$71,144	\$44,860	\$46,331	\$32,289
Total assets	\$149,406	\$191,623	\$118,430	\$125,456	\$89,904
Total current liabilities	\$45,143	\$85,969	\$38,064	\$39,371	\$33,136
Current maturities of long-term debt	\$374	\$361	\$1,134	\$919	\$—
Long-term debt	\$7,960	\$8,134	\$9,097	\$8,448	\$—
Total equity	\$93,090	\$90,483	\$65,339	\$72,647	\$53,588

Includes \$0.5 million, \$0.4 million, \$0.1 million, \$0.1 million and \$0.3 million of expense related to inventory write-downs in 2018, 2017, 2016, 2015 and 2014, respectively. Includes \$0.9 million and \$0.6 million of expense (1) related to restructuring in 2018 and 2015, respectively. Includes \$45,000, \$(0.7) million, \$1.7 million, \$(0.2) million and \$1.3 million of expense (benefit) related to provision for doubtful accounts receivable in 2018, 2017, 2016, 2015 and 2014, respectively. Includes \$7.0 million related to long-lived asset impairment charges in 2018.

Includes a pre-tax gain of \$2.9 million on the sale of our remaining ownership interest in Kingstone Hong Kong in (2) 2018, a pre-tax gain of \$2.6 million on the sale of Kingstone service rights in 2016 and a \$8.8 million gain on deconsolidation resulting from the deconsolidation of Kingstone in 2015.

Excludes losses of \$1.0 million, \$1.5 million, \$1.3 million and \$1.7 million in 2017, 2016, 2015 and 2014, respectively, which are attributable to the 55% controlling interest in Kingstone acquired February 18, 2011 (3) (subsequently deconsolidated in 2015) and the 51% interest in SoLayTec acquired December 24, 2014. During 2017, we acquired the remaining 49% interest in SoLayTec, resulting in Amtech becoming the sole owner. Effective July 1, 2017, Amtech results no longer include a non-controlling interest attributable to SoLayTec.

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

The following discussion of our financial condition and results of operations should be read together with our Consolidated Financial Statements and the accompanying notes included in Item 8, "Financial Statements and Supplementary Data" in this Annual Report on Form 10-K. This discussion contains forward-looking statements, which involve risks and uncertainties. Our actual results could differ materially from those anticipated in the forward-looking statements as a result of certain factors including, but not limited to, those described in "Risk Factors" and elsewhere in this Annual Report on Form 10-K. Please refer to page 3 for further information regarding forward-looking statements and "Item 1A. Risk Factors" for a description of our risk factors.

Overview

We are a leading, global manufacturer of capital equipment, including thermal processing and wafer handling automation, and related consumables used in fabricating semiconductor devices, light-emitting diodes, or LEDs, silicon carbide ("SiC") and silicon power chips and solar cells. We sell these products to semiconductor and solar cell manufacturers worldwide, particularly in Asia, the United States and Europe. We operate in three reportable business segments, based primarily on the industry they serve: (i) Semiconductor, (ii) Solar and (iii) Polishing. In our Semiconductor segment, we supply thermal processing equipment, including solder reflow equipment and related controls and diffusion for use by leading semiconductor manufacturers, and in electronics assembly for automotive and other industries. In our Solar segment, we supply thermal processing systems, including diffusion, plasma-enhanced chemical vapor deposition ("PECVD"), atomic layer deposition ("ALD"), and related automation, parts and services, to the solar/photovoltaic industry. In our Polishing segment, we produce consumables and machinery for lapping (fine abrading) and polishing of materials, such as silicon wafers for semiconductor products, sapphire substrates for LED lighting and mobile devices, compound substrates, like silicon carbide wafers, for LED and power device applications, various glass and silica components for 3D image transmission, quartz and ceramic components for telecommunications devices, medical device components and optical and photonics applications.

Our customers are primarily manufacturers of integrated circuits and solar cells. The semiconductor and solar cell industries are cyclical and historically have experienced significant fluctuations. Our revenue is impacted by these broad industry trends. Since 2012, the solar cell industry has at times experienced structural imbalances between supply and demand. This imbalance has increased competitive pressure on selling prices and negatively impacted our results of operations. Our high throughput equipment platforms, technologies for higher cell efficiency, greater knowledge of the complete cell manufacturing process and advanced automation have contributed significantly to our success in securing the large orders for the first two phases of a multi-phase turnkey project announced in January and April of 2017 from a new solar cell manufacturer in China. For equipment orders that are not part of turnkey projects, we compete with Chinese equipment manufacturers that offer lower prices, liberal payment terms and have a more substantial local presence. As a result, we are finding it more difficult to participate in large capacity expansions in China. While we intend to continue developing advanced products and technologies, we believe we will need to significantly restructure our Solar segment operations to achieve profitability and compete effectively with Chinese equipment manufacturers.

In July 2018, we established a restructuring plan related to our operations in the Netherlands, which are part of our Solar operating segment (the "Plan"). The goal of the Plan is to reduce operating costs and better align our workforce with the current needs of our solar business and enhance our competitive position for long-term success. Once fully implemented, we expect the Plan to reduce operating costs by approximately \$3.0 million on an annualized basis. Under the Plan, we will reduce our Solar workforce by approximately 35-40 employees (approximately 20%). The affected employees are covered by a collective bargaining agreement, which defines the amount due to employees in the event of involuntary termination. We recorded approximately \$0.9 million of one-time termination costs in the

fourth quarter of fiscal 2018. It is expected that these efforts will be completed by the end of our third quarter of fiscal 2019.

Our quarterly and annual operating results have been and will continue to be impacted by the timing of large system orders. Further, the solar and semiconductor equipment industries are highly cyclical and the conditions of the industries we operate in are volatile. Therefore, our order flow fluctuates quarter to quarter. For additional information regarding the risks related to our business and industry, please refer to Item 1A. Risk Factors within this Form 10-K.

Our fiscal year is from October 1 to September 30. Unless otherwise stated, references to the years 2018, 2017 and 2016 relate to the fiscal years ended September 30, 2018, 2017 and 2016, respectively.

Results of Operations

The following table sets forth certain financial data as a percentage of net revenue for the periods indicated:

	Years Ended	
	September	
	30,	
	2018	2017
Net revenue	100 %	100 %
Cost of sales	69 %	68 %
Gross margin	31 %	32 %
Selling, general and administrative	21 %	21 %
Research, development and engineering	4 %	4 %
Impairment charges	4 %	— %
Restructuring charges	1 %	— %
Operating income	1 %	7 %
Gain on sale of other assets	2 %	— %
(Loss) income from equity method investment	— %	— %
Interest and other expense, net	— %	— %
Income before income taxes	3 %	7 %
Income tax provision	0 %	1 %
Net income	3 %	6 %
Add: Net loss attributable to non-controlling interest	— %	1 %
Net income attributable to Amtech Systems, Inc.	3 %	7 %

Fiscal 2018 compared to Fiscal 2017

Net Revenue

Net revenue consists of revenue recognized upon shipment or installation of equipment, with the exception of products using new technology, for which revenue is recognized upon customer acceptance. Spare parts sales are recognized upon shipment and service revenue is recognized upon completion of the service activity or ratably over the term of the service contract. Since the majority of our revenue is generated from large system sales, revenue and operating income can be significantly impacted by the timing of orders, system shipments, and recognition of revenue based on customer acceptances. The revenue of business units included in the Solar segment include some sales of equipment and parts to the semiconductor, silicon wafer and microelectromechanical (“MEMS”) industries, comprising less than 25% of the Solar segment revenue. See Critical Accounting Policies – Revenue Recognition.

Our net revenue by operating segment for the years ended September 30, 2018 and 2017 were as follows (dollars in thousands):

	Years Ended		Increase	
	September 30,		(Decrease)	
Segment	2018	2017		%
				Change
Solar	\$82,502	\$87,031	\$ (4,529)	(5)%
Semiconductor	80,163	67,237	12,926	19 %
Polishing	13,761	10,248	3,513	34 %

Total net revenue \$176,426 \$164,516 \$ 11,910 7 %

Net revenue for the years ended September 30, 2018 and 2017 were \$176.4 million and \$164.5 million, respectively, an increase of \$11.9 million or 7%. Revenue from the Solar segment decreased \$4.5 million, or 5%, primarily due to lower shipments of our solar equipment in fiscal 2018. Although both fiscal 2018 and 2017 each included a phase of shipments of the previously announced turnkey orders, we continue to operate in a challenging, competitive environment

due to lower prices and liberal payment terms that are offered by Chinese equipment manufacturers. These competitive pricing pressures are making it increasingly difficult for us to participate in our customers' solar expansions. Revenue from the Semiconductor segment increased 19% due primarily to strong industry trends and customer demand for our thermal processing systems and diffusion furnaces. Our Polishing segment also experienced strong industry trends and customer demand, particularly in the silicon carbide industry, leading to increased sales of our polishing templates and equipment and an increase in revenues of 34%.

Backlog and Orders

Our backlog, including deferred revenue, as of September 30, 2018 and 2017 were as follows (dollars in thousands):

Segment	September 30, 2018	September 30, 2017	Increase (Decrease)	% Change
Solar	\$ 27,383	\$ 81,371	\$ (53,988)	(66)%
Semiconductor	21,023	19,318	1,705	9 %
Polishing	2,695	1,688	1,007	60 %
Total backlog	\$ 51,101	\$ 102,377	\$ (51,276)	(50)%

The backlog of business units included in the Solar segment include some sales of equipment and parts to the semiconductor, silicon wafer and MEMS industries, comprising less than 25% of the Solar segment backlog.

New orders booked in the years ended September 30, 2018 and 2017 were as follows (dollars in thousands):

Segment	September 30, 2018	September 30, 2017	Increase (Decrease)	% Change
Solar	\$ 36,073	\$ 126,577	\$ (90,504)	(72)%
Semiconductor	81,868	72,931	8,937	12 %
Polishing	14,769	10,980	3,789	35 %
Total new orders	\$ 132,710	\$ 210,488	\$ (77,778)	