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 December 31, 2022
OR

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

For the transition period from to .
Commission File Number: 001-33155

IPG PHOTONICS CORPORATION
(Exact name of registrant as specified in its charter)

Delaware	**04-3444218**
(State or other jurisdiction of incorporation or organization)	*(IRS Employer Identification No.)*
377 Simarano Drive, Marlborough, Massachusetts	**01752**
(Address of principal executive offices)	*(Zip Code)*

Registrant's telephone number, including area code: **(508) 373-1100**

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

Title of Class	Trading Symbol	Name of Exchange on Which Registered
Common Stock, Par Value $0.0001 per share	**IPGP**	**The Nasdaq Stock Market LLC**

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

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

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

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

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

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company or 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 has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☑

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). ☐

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

The aggregate market value of the registrant's common stock held by non-affiliates of the registrant was approximately $2.4 billion, calculated based upon the closing price as reported by the Nasdaq Global Select Market on June 30, 2022. For purposes of this disclosure, shares of common stock held by persons who own 5% or more of the outstanding common stock and shares of common stock held by each officer and director have been excluded in that such persons may be deemed to be "affiliates" as that term is defined under the Rules and Regulations of the Exchange Act. This determination of affiliate status is not necessarily conclusive.

As of February 24, 2023, 47,627,143 shares of the registrant's common stock were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Proxy Statement for its 2023 Annual Meeting of Stockholders to be filed pursuant to Regulation 14A within 120 days of the end of the registrant's fiscal year ended December 31, 2022 are incorporated by reference into Part III of this Annual Report on Form 10-K to the extent stated herein.

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This Annual Report on Form 10-K contains certain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended, and we intend that such forward-looking statements be subject to the safe harbors created thereby. For this purpose, any statements contained in this Annual Report on Form 10-K except for historical information are forward-looking statements. Without limiting the generality of the foregoing, words such as "may," "will," "expect," "believe," "anticipate," "intend," "target," "project," "intend," "plan," "seek," "strive," endeavor," goal," "could," "estimate," or "continue" or the negative or other variations thereof or comparable terminology are intended to identify forward-looking statements. In addition, any statements that refer to projections of our future financial performance, trends in our businesses, or other characterizations of future events or circumstances are forward-looking statements.

The forward-looking statements included herein are based on current expectations of our management based on available information and involve a number of risks and uncertainties, all of which are difficult or impossible to accurately predict and many of which are beyond our control. As such, our actual results may differ significantly from those expressed in any forward-looking statements. Factors that may cause or contribute to such differences include, but are not limited to, those discussed in more detail in Item 1 (Business) and Item 1A (Risk Factors) of Part I and Item 7 (Management's Discussion and Analysis of Financial Condition and Results of Operations) of Part II of this Annual Report on Form 10-K. Readers should carefully review these risks, as well as the additional risks described in other documents we file from time to time with the Securities and Exchange Commission (the "SEC"). In light of the significant risks and uncertainties inherent in the forward-looking information included herein, the inclusion of such information should not be regarded as a representation by us or any other person that such results will be achieved, and readers are cautioned not to rely on such forward-looking information. We undertake no obligation to revise the forward-looking statements contained herein to reflect events or circumstances after the date hereof or to reflect the occurrence of unanticipated events.

PART I

ITEM 1. *BUSINESS*

Our Company

IPG Photonics Corporation ("IPG", the "Company", the "Registrant", "we", "us" or "our") develops, manufactures and sells high-performance fiber lasers, fiber amplifiers and diode lasers that are used for diverse applications, primarily in materials processing. Fiber lasers are a type of laser that combine the advantages of semiconductor diodes, such as long life and high efficiency, with the high amplification and precise beam qualities of specialty optical fibers to deliver superior performance, reliability and usability.

Our portfolio of laser solutions are used in materials processing, medical and advanced applications. We sell our products globally to original equipment manufacturers ("OEMs"), system integrators and end users. We market our products internationally, primarily through our direct sales force. Our major manufacturing facilities are located in the United States, Germany, Russia and Belarus. Refer to "Factors and Trends That Affect Our Operations and Financial Results" within Part II Item 7 for trends impacting our reliance on our Russian and Belarus operations. We have sales service offices and applications laboratories worldwide.

We are vertically integrated. We design and manufacture most of the key components used in our finished products, from semiconductor diodes to optical fiber preforms, finished fiber lasers and amplifiers. We manufacture complementary products used with our lasers including optical delivery cables, fiber couplers, beam switches, optical processing heads, in-line sensors and chillers. We offer laser-based and non-laser based systems for certain markets and applications. Our vertically integrated operations allow us to reduce manufacturing costs, control quality, rapidly develop and integrate advanced products and protect our proprietary technology.

We are listed on the Nasdaq Global Select Market (ticker: IPGP). We began operations in 1990, and we were incorporated in Delaware in 1998. Our principal executive offices are located at 377 Simarano Drive, Marlborough, Massachusetts 01752, and our telephone number is (508) 373-1100.

Industry Overview

Laser technology has revolutionized a broad range of applications and products in manufacturing, automotive, aerospace, medical, research, consumer electronics, semiconductors and communications. A laser converts electrical energy to optical energy that can be focused and shaped, creating a powerful, concentrated beam that causes materials to melt, vaporize or change their character. In a laser, an energy source excites or pumps a gain medium, which converts the energy from the source into an emission consisting of particles of light, called photons, at particular wavelengths. Lasers provide flexible, non-contact and high-speed ways to process and treat various materials and enable automated production, miniaturization and increasing product complexity.

Lasers are utilized in materials processing applications requiring very high power densities, such as cutting, welding, marking, engraving, additive manufacturing, ablation and cleaning, printing, drilling and cladding. Historically, machine tools such as grinding machines, mechanical saws, milling machines, lathes, presses, water jet cutters, plasma cutters and welding machines have been used to cut, combine, form or otherwise process metal in the production of finished goods such as automobiles, consumer appliances, electronics and heavy machinery. Laser-based systems are increasingly gaining share within the materials processing market because of the greater precision, processing speeds and flexibility enabled by this technology. Beyond materials processing, lasers are well-suited for imaging and inspection applications and the ability to confine laser light to narrow wavelengths makes them particularly effective in medical, non-destructive inspection and sensing applications.

Fiber Lasers

Fiber lasers use semiconductor diodes as the energy source to pump a gain medium consisting of specialty optical fibers, which are infused with rare earth ions. These fibers are called active fibers and are comparable in diameter to a human hair. The laser emission is created within optical fibers and delivered through a flexible optical fiber cable. As a result of their different design and components, fiber lasers are more reliable, efficient, robust, compact and easier to operate than gas, crystal and solid state lasers that were initially used in industrial applications. In addition, fiber lasers free the end users from fine mechanical adjustments and the high maintenance costs that are typical for other laser technologies.

Although low power fiber lasers were introduced four decades ago, their increased adoption in the last twenty years has been driven primarily by our improvements in their output power levels and cost, as well as their superior performance, lower cost of ownership and greater reliability compared with other laser and non-laser technologies. We successfully increased output power levels, efficiency and reliability by improving optical components such as diodes and active fibers that increased their power capacities and improved their performance. Fiber lasers now offer output powers that exceed those of other laser technologies in many categories. Our substantial advancements in diode technology, packaging design and other optical components together with increased production volumes over the last two decades reduced the cost and increased the reliability of our products. As a result, the average cost per watt of output power has decreased dramatically and our fiber lasers effectively compete in many applications that used other laser technologies and non-laser solutions historically. We believe that fiber lasers provide a combination of benefits that include: superior performance; enhanced end user productivity; lower cost of ownership; greater ease of use; a more compact footprint; and greater choice of wavelengths and more precise beam control. There remain applications and processes where other laser and non-laser technologies may provide superior performance with respect to particular features or applications notwithstanding the benefits offered by fiber lasers.

Our Competitive Strengths

Our key strengths and competitive advantages include the following:

World's Leading Producer of Fiber Laser Technology. As a pioneer and technology leader in fiber lasers, we are able to leverage our scale to reduce costs for our customers and drive the proliferation of fiber lasers in existing and new applications.

Vertically Integrated Development and Manufacturing. We develop and manufacture most of our key high-volume specialty components, along with optical heads and other products used in conjunction with our lasers, which we believe enhances our ability to meet customer requirements, reduce costs and accelerate product development.

Manufacturing Scale. We have invested extensively in our production capabilities allowing us to efficiently manufacture and deliver large volumes of fiber lasers in short delivery cycles which provide us with a competitive advantage.

Breadth and Depth of Expertise. Our extensive know-how in materials sciences and experience in optical, electrical, mechanical and semiconductor engineering enable us to develop and manufacture proprietary components, products, accessories and systems and assist customers in improving their manufacturing using our fiber lasers.

Broad Product Portfolio and Ability to Meet Customer Requirements. Our broad range of standard and custom fiber lasers operating at various wavelengths and pulse durations allow us to meet varied customer requirements. Further, our vertically integrated manufacturing and broad technology expertise allow us to design, prototype and commence high-volume production of our products rapidly.

Diverse Customer Base, End Markets and Applications. Our diverse customer base, end markets and applications provide us with many growth opportunities. In 2022, we shipped products to thousands of customers worldwide. Our principal end markets and representative applications within those markets include:

Materials Processing Markets

End Market	Applications	Principal Products
General Manufacturing	Flat sheet, tube and 3D cutting	Continuous Wave ("CW") lasers (1-50 kW) and IPG systems
	Welding, brazing, hardening and cladding	CW lasers (1-125 kW) and IPG systems
	Surface cleaning and texturing, paint and coating stripping and drying	Nanosecond ("NS") pulsed lasers (100-3,000 W), single-mode CW lasers (1-5 kW), diode lasers (1-40 kW) and IPG systems
	3D printing	CW lasers (200-6,000 W)
	Marking, engraving and printing	NS pulsed lasers (10-1,000 W) and Quasi-CW ("QCW") lasers (100-2,000 W)
Automotive	Cutting of high-strength steel and aluminum	CW lasers (1-20 kW)
	Welding tailored blanks, frames and auto parts	CW lasers (1-50 kW)
	Seam welding and brazing	CW lasers(1-20 kW) and IPG systems
	Electric vehicle battery and motor manufacturing	CW and QCW lasers, NS pulsed lasers and IPG systems
Consumer Goods	Micro welding, cutting and marking	QCW and NS pulsed lasers
	Marking of polymers and other non-metals	Infrared ("IR"), green and ultraviolet ("UV") pulsed lasers
Medical Devices	Stent, pacemaker and other medical device manufacturing	CW, NS , Picosecond ("PS") and Femtosecond ("FS") pulsed lasers and IPG systems
Energy/Renewable Energy	Hardening and welding of tubes and pipes	CW lasers (4-50 kW) and IPG systems
	Cladding of turbine blades and drill bits	CW lasers (1-20 kW)
	Solar cell processing	Green NS pulsed lasers
Aerospace, Rail and Shipbuilding	Welding/cutting thick steel plates, titanium	CW lasers (1-50 kW) and IPG systems
	Percussion drilling of aerospace parts	QCW lasers (1-2 kW)
	Surface cleaning and texturing, paint and coating stripping and drying	NS pulsed lasers (100-3,000 W), single-mode CW lasers (1-5 kW), diode lasers (1-40 kW) and IPG systems
Micro Electronics	Wafer inspection and annealing, disk mastering, flat panel display, LED lift-off	Ultraviolet CW and NS pulsed lasers
	Processing of glass, ceramics, sapphire, silicon, diamond, Teflon, PCB, CFRP and other non-metals	IR, green and UV NS pulsed lasers, PS and FS pulsed lasers, QCW lasers

Other Markets

End Market	Applications	Principal Products
Aerospace and Defense	Directed energy	Single-mode CW lasers, amplifiers and diode lasers
	IR countermeasures, thermal imaging	Mid-IR NS pulsed lasers
Medical Procedures	Surgery, urology and soft tissue	Mid-infrared, thulium, FS and laser systems
	Therapeutic procedures	Diode lasers
	Aesthetic procedures - skin, wrinkle/hair/tattoo removal	Erbium, thulium, green lasers
	Dental procedures	Diode lasers
	Diagnostic procedures	Mid-infrared and FS
OEM Instrument Manufacturing	Biomedical analytical instruments, metrology, disinfection/sterilization, environmental and security monitoring, quantum computing	FS, PS, NS and CW lasers, Mid-infrared, IR, visible and UV lasers
Scientific	Academic research: sensing, imaging, microscopy, spectroscopy, quantum optics	Mid-infrared, IR, visible and UV lasers; diode, FS, PS, NS and CW lasers, linearly polarized and single frequency lasers and amplifiers

Products

We design and manufacture a broad range of high-performance fiber lasers and amplifiers. We also make packaged diodes, direct diode lasers, laser and non-laser systems and communications components and systems. Many of our products are designed to be used as general-purpose energy or light sources, making them useful in diverse applications and markets.

Our laser products are based on a common proprietary technology platform using many of the same core components, such as semiconductor diodes and specialty fibers, which we configure to our customers' specifications. Our engineers and scientists work closely with OEMs, system integrators and end users to develop and customize our products for their needs. Because of our flexible and modular product architecture, we offer products in different configurations according to the desired application, including modules, rack-mounted units and tabletop units. Our engineers and other technical experts work directly with the customer in our application and development centers to develop and configure the optimal solution for such customer's requirements. We also manufacture certain complementary products that are used with our lasers, such as optical delivery cables, fiber couplers, beam switches, optical processing heads and chillers.

Lasers

Our laser products include medium (1 to 999 watts) and high (1,000 watts and above) output power lasers from 0.3 to 4.5 microns in wavelength. These lasers may be CW, QCW or pulsed. Our pulsed line includes nanosecond, picosecond and femtosecond lasers. We offer lasers with different gain mediums and wavelengths. The gain mediums are ytterbium, erbium and thulium, as well as Raman and hybrid fiber-solid state lasers using our crystal technology. We produce hybrid fiber-solid state lasers at green and ultraviolet wavelengths for a range of micro processing applications and in the mid-IR spectrum for sensing, imaging and spectroscopy applications. We also sell fiber pigtailed packaged diodes and fiber coupled direct diode laser systems that use semiconductor diodes rather than optical fibers as their gain medium. In addition, we offer high-energy pulsed lasers, multi-wavelength lasers, tunable lasers, single-polarization and single-frequency lasers, as well as other versions of our products.

We believe that we produce the highest power solid-state lasers in the industry. Our ytterbium fiber lasers reach power levels of up to 125,000 watts. We also make single-mode and low-mode output ytterbium fiber lasers with power levels of up to 20,000 watts and single-mode, erbium and thulium fiber lasers with power levels of up to 1,000 watts.

For 2022 fiscal year, high power continuous wave ("CW") lasers accounted for 43% of revenue and were 47% and 54% of revenue, in 2021 and 2020, respectively. Pulsed lasers accounted for 18%, 17%, and 13% of revenue in 2022, 2021 and 2020, respectively.

Accessories

We manufacture and sell accessories that include high power optical fiber delivery cables, fiber couplers, beam switches, chillers and scanners for our fiber lasers. We are expanding our line of cutting and welding optical processing heads for use with our fiber lasers and sell devices for in-line coherent monitoring for welding.

Systems

In addition to selling laser sources, we also offer integrated laser systems for particular geographic markets or custom-developed for a customer's manufacturing requirements. In 2020, we introduced our new LightWELD product line, a handheld laser welding system to provide fabricators a laser-based solution for welding. We offer 2D compact flat sheet cutter systems and multi-axis systems for fine welding, cutting and drilling. We produce high precision laser systems for the medical device industry. We also offer a welding seam stepper and picker, which is an automated fiber laser welding tool providing customers increased processing speeds, better quality and the elimination of certain clamping tools. In 2018, we acquired Genesis Systems Group LLC (United States), a leader in the integration of laser and non-laser robotic welding and automation solutions, and Robot Concept GmbH (Germany), an integrator of laser-based systems. IPG also develops and sells specialized fiber laser systems for unique material processing applications as requested by customers desiring a complete laser-based solution, including orbital welding, pipe welding and remote welding. The platforms include robotic and multi-axis workstations for welding, cutting and cladding, flatbed cutting systems, and diode markers. For the 2022, 2021 and 2020 fiscal years, laser and non-laser systems accounted for 11%, 9%, and 8%, respectively, of revenues.

Our Markets

We broadly classify our principal end markets as material processing, advanced applications, communications and medical procedures. With the sale of sale of our telecom transmission product lines to Lumentum Holdings Inc. in August 2022, we no longer intend to target communications as a principal market. The following table shows the allocation of our net sales (in thousands) among our principal markets:

	Year Ended December 31,					
	2022		2021		2020	
		% of Total		% of Total		% of Total
Materials processing	$ 1,291,262	90.3 %	$ 1,325,404	90.7 %	$ 1,082,478	90.2 %
Medical procedures	70,402	4.9 %	42,936	2.9 %	31,243	2.6 %
Advanced applications	54,308	3.8 %	69,257	4.8 %	63,859	5.3 %
Communications	13,575	1.0 %	23,263	1.6 %	23,144	1.9 %
Total	$ 1,429,547	100.0 %	$ 1,460,860	100.0 %	$ 1,200,724	100.0 %

These estimates are based upon customer information and when customer information has not been provided, upon our best information and belief.

Materials Processing

The most significant materials processing applications for fiber lasers are cutting, welding and brazing, marking and engraving, cleaning and stripping, solar cell manufacturing, additive manufacturing such as laser sintering, 3D printing and ablation. Other applications include precision processing, drilling and annealing.

Cutting, Welding and Brazing Applications. Laser-based cutting technology has several advantages compared to alternative technologies. Laser cutting is fast, flexible and highly precise and can be used to cut complex contours on flat, tubular or three-dimensional materials. The laser source can be programmed to process many different kinds of materials such as steel, aluminum, brass, copper, glass, ceramic and plastic at various thicknesses. Laser cutting technology is a non-contact process that is easy to integrate into an automated production line and is not subject to wear of the cutting medium. We sell mid and high power ytterbium fiber lasers for laser cutting. Our high power pulsed lasers are used in thin foil cutting applications in electric vehicle battery production. High electrical efficiency, low maintenance and operating cost, excellent beam quality, wide operating power range, power stability and small spot size are some of the qualities offered by IPG fiber lasers for many cutting applications, which enable customers to cut a variety of materials faster.

Laser welding offers several important advantages compared to conventional welding technology as it is non-contact, precise, easy to automate, provides high process speed and results in narrow-seamed, high-quality welds that generally require little or no post-processing machining. The high beam quality of our fiber lasers coupled with high CW power offer deep penetration welding as well as shallow conduction mode welding. Adjustable mode beam (AMB) lasers allow beam tunability for precise high-quality welding required in electric vehicle battery manufacturing. In addition, fiber lasers enable remote welding "on the fly," a flexible method of three-dimensional welding in which the laser beam is positioned by a robot-guided scanner. Remote welding stations equipped with fiber lasers are used for welding door panels, seat backs, spot and lap welds over the entire auto body frame ("body-in-white") and tailor welded blanks for automotive applications. We also offer a real-time weld monitoring system to determine weld quality in an integrated solution. Our LightWELD product line offers a handheld laser welding system that is easier to learn and operate than traditional solutions and offers high process consistency.

Our products are used also for laser brazing of visible joints in automobiles such as tailgates, roof joints and columns. Brazing is a method of joining sheet metal by using a melted filler material similar to soldering but requiring higher temperatures.

Marking and Engraving. With the increasing need for source traceability, component identification and product tracking as a means of reducing product liability and preventing falsification, as well as the demand for modern robotic production systems, manufacturers increasingly demand laser marking systems capable of applying serialized alphanumeric, graphic or bar code identifications directly onto their manufactured components. Laser engraving is similar to marking but forms deeper grooves in the material. In contrast to conventional acid etching and ink-based technologies, lasers can mark a wide variety of metal and non-metal materials, such as ceramic, glass and plastic surfaces, at high speeds and without contact by changing the surface structure of the material or by engraving. Laser marking systems can be easily integrated into a customer's production process and do not subject the item being marked to mechanical stress. In addition, we make high powered lasers for ablation and cleaning applications.

3D Printing. Historically, metalworking has been performed with processes that remove material to produce component parts. The development of 3D printing technology enables the production of three-dimensional objects from digital design data through an additive manufacturing process, which builds up components in layers using materials that are available in fine powder form. 3D printers take advantage of improvements in computing power and motion and process control to deposit a range of materials, including metals, plastics and composite materials, accurately at high speed. Within metal-based 3D printing processes that include laser metal deposition (LMD) and selective laser melting (SLM), a laser beam is used to fuse metallic powder at points defined by computer-generated design data. 3D printing permits highly complex structures, with a high degree of customization capability and significantly less waste than subtractive manufacturing processes.

Micro-materials processing. In the semiconductor industry, lasers typically are used as the light source in microlithography and for annealing, dicing, drilling, lift-off and marking of wafers. In the electronics industry, lasers typically are used to cut, join, mark, scribe or otherwise process a variety of materials that include ceramics, metals, plastics, silicon, and sapphire among others. Consumer electronic devices such as mobile phones, computers and handheld computers contain many parts that are laser-cut, marked or welded. In the photovoltaic or solar panel industry, pulsed lasers are used to remove materials and to scribe, or cut, solar cells. The high beam quality, increased peak output powers, flexible fiber delivery and competitive price of fiber lasers have accelerated the adoption of fiber lasers in these low power applications.

Precision Processing. The trend toward miniaturization in numerous industries such as consumer electronics, as well as innovations in materials and structures, is driving end users to utilize lasers in processing and fabrication. The ability of lasers to cut, weld, drill, ablate, etch and add materials on a fine scale is enabling new technologies and products across many industries. Our low power CW and QCW lasers are used to cut medical stents and weld medical batteries. In photovoltaic manufacturing, our lasers etch and perform edge isolation processes. The aerospace industry requires precise manufacturing of engine parts so that cooling is effective and aerospace manufacturers use lasers for percussion drilling of fine holes. Processing of plastics and semi-conductors require short pulse and high energy lasers, in the green, UV and mid-IR wavelengths.

Medical Procedures

We sell our commercial fiber and diode laser modules, subassemblies and complete systems to medical device manufacturers that incorporate our products into their devices. Our ultrafast, CW and QCW ytterbium, erbium, thulium fiber and hybrid lasers with average power from 1 to 200 watts, and diode laser systems can be used in various medical and biomedical applications. We have also developed and are now selling medical laser systems and consumable fiber applications, including benign prostatic hyperplasia and lithotripsy, as an OEM and, in certain territories, as an IPG-branded product. Aesthetic applications addressed by IPG lasers include skin rejuvenation, hair removal, and treatment of pigmented and vascular lesions.

Advanced Applications

Our fiber lasers and amplifiers are utilized by commercial firms and by academic and government institutions worldwide for advanced and scientific applications. These markets may sell specialty products developed by us or our commercial products. Representative applications include directed energy, spectroscopy, optical trapping, remote sensing, LIDAR and materials characterization.

Communications

Prior to the sale of our telecom transmission product lines to Lumentum Holdings Inc. in August 2022, we designed and manufactured optical amplifiers and optical transceiver and transponder modules for communications applications for deployment in data center networks, service provider optical networks, and communications networks of oil and gas utilities. We no longer intend to target communications as a principal market.

Technology

Our products are based on our proprietary technology platform that we have developed and refined since our formation. The following technologies are key elements in our products.

Specialty Optical Fibers

We have extensive expertise in the disciplines and techniques that form the basis for the multi-clad active and passive optical fibers used in our products. We believe that our large portfolio of specialty active and passive optical fibers has a number of advantages as compared to other commercially available optical fibers. Using our knowledge of optical fibers, we recently extended our product line by manufacturing fibers for medical uses in connection with our proprietary medical laser systems.

Semiconductor Diode Laser Processing and Packaging Technologies

We use multiple multi-mode, or broad area, single-emitter diodes rather than diode bars or stacks as a pump source. We believe that multi-mode single-emitter diodes are the most efficient and reliable pumping source presently available, surpassing diode bars and stacks in efficiency, brightness and reliability. Single-emitter diodes have substantially reduced cooling requirements and typically have long lifetimes at high operating currents, compared to typical lifetimes of diode bars.

We developed advanced molecular beam epitaxy techniques to grow alumina indium gallium arsenide wafers for our diodes. This method yields high-quality optoelectronic material for low-defect density and high uniformity of optoelectronic parameters. In addition, we have developed numerous proprietary wafer processes and testing and qualification procedures in order to create a high energy output in a reliable and high power diode. Our diode is packaged to dissipate heat produced by the diode and withstands vibration, shock, high temperature, humidity and other environmental conditions, enabling world-class reliability and efficiency of the products.

Specialty Components and Combining Techniques

We developed a wide range of advanced optical components that are capable of handling high optical power levels and contribute to the superior performance, efficiency and reliability of our products. In addition to fibers and diodes, our optical component portfolio includes fiber gratings, couplers, isolators, combiners, and crystals. We also developed special methods and expertise in splicing fibers together with low optical energy loss and on-line loss testing. We believe that our internal development and manufacturing of key optical components allows us to lower our manufacturing costs and improve product performance and reliability.

Side Pumping of Fibers and Fiber Block Technologies

Our technology platform allows us to efficiently combine a large number of multi-mode single-emitter semiconductor diodes with our active optical fibers that are used in all of our products. A key element of this technology is that we pump our fiber lasers through the cladding surrounding the active core. We splice our specialty active optical fibers with other optical components and package them in a sealed box, which we call a fiber block. The fiber blocks are compact and are designed to eliminate the risk of contamination or misalignment due to mechanical vibrations and shocks as well as temperature or humidity variations. Our design is scalable and modular, permitting us to make products with high output power by coupling a large number of diodes with fiber blocks, which can be combined in parallel and serially.

High-Stress Testing

We employ high-stress techniques in testing components and final products that help increase reliability and accelerate product development. For example, we test all of our diodes with high current and temperatures to identify and eliminate potentially unreliable diodes. We also have built a large database of diode test results that allows us to predict the estimated lifetime of our diodes. This testing allows us to eliminate defective diodes prior to further assembly and thus increase reliability.

Research and Development

We perform research and development to develop new products or components, improve existing products or components, develop new applications for our products and improve our manufacturing processes.

We research, develop and manufacture most of the key components of our lasers. In addition to our cladding-pumped specialty fiber platform, we have core competencies in high power multi-mode and single-mode semiconductor laser diodes, diode packaging, specialty active and passive optical fibers, high-performance optical components, crystal growth and processing, fiber gain blocks and fiber modules, thin film optical coatings, as well as splicing and combining techniques and high-stress test methods. The strategy of developing our proprietary components has allowed us to leverage our optical experience and large volume requirements to lower the cost of our products.

Our research and development supports expanding and improving our product line by increasing power levels, improving beam quality and electrical efficiency, decreasing the size of our products and lowering the cost per watt. We are engaged in research projects to expand the spectral range of products that we offer. We are investing our research and development funds on laser systems and products for medical applications.

We have assembled a team of scientists and engineers with specialized experience and knowledge in fiber lasers and amplifiers, materials science, optics, critical components, testing and manufacturing process design, and laser application development. Our team of experienced scientists and engineers works closely with many of our customers to develop and introduce custom products and laser processing that address specific applications and performance requirements.

We incurred research and development costs of approximately $116.1 million, $139.6 million and $126.9 million for the years ended December 31, 2022, 2021 and 2020, respectively. We expect to continue our commitment to research and development and to introduce new products, systems and complementary products. See Item 7, "Management's Discussion and Analysis of Financial Condition and Results of Operations."

Intellectual Property

We rely on the technical expertise, creativity, and knowledge of our personnel, and we utilize trade secret, patent, trademark, copyright and contractual protections to maintain our competitive position and protect our proprietary rights in our products and technology. While our intellectual property rights are important to our success, we believe that our business as a whole is not materially dependent on any particular patent, trademark, copyright or other intellectual property right. IPG has used, registered or applied to register a number of trademark registrations in the United States and in other countries.

As of December 31, 2022, we have over 700 patents issued and over 350 pending patent applications worldwide. Intellectual property rights, including those that we own, those that we license and those of others, involve significant risks. See Item 1A, "*Risk Factors — In the past, we were subject to litigation alleging that we infringed third-party intellectual property rights. Intellectual property claims could result in costly litigation and harm our business*" and "*Risk Factors — Our inability to protect our intellectual property and proprietary technologies could result in the unauthorized use of our technologies by third parties, hurt our competitive position and adversely affect our operating results*."

Manufacturing

Vertical integration is one of our core business strategies through which we control our proprietary processes and technologies as well as the supply of key components and assemblies. Our vertically integrated manufacturing operations include the manufacturing or assembly of optical preforms, specialty fiber, semiconductor wafers, laser diodes and packaged laser diodes, specialty optical components, fiber blocks, fiber laser modules, power supplies, circuit boards, electronics and control systems and software, crystals, chillers, housings and cabinets and final assembly of finished product. In addition, we make some of the automated production systems, tools and fixtures and testing systems that we use in our own manufacturing processes. Over the last several years, we added additional production capabilities, including multi-wafer growth reactors, diode test stations, fiber preform and fiber drawing equipment and mid and high power laser production and testing, in order to increase our capacity as well as reduce the risks associated with our production processes.

We operate our own semiconductor foundry for the production of multi-mode single-emitter diodes. We also process, package and extensively test all of our diodes. We developed proprietary components and accessories, manufacturing tools, equipment and techniques over many years in an effort to address the major issues that had been inhibiting the development of fiber laser technology and to provide products that differentiate us from our competitors. In addition, we have acquired the technology to produce additional components, such as volume Bragg gratings and crystals. Using our technology platform, we configure standard laser and amplifier products based upon each customer's specifications. We have developed proprietary testing methodologies that allow us to develop higher power components and products in short periods of time, enable us to introduce products to the market more quickly, capitalize on new opportunities and provide superior service to our customers. In our materials processing systems business, we manufacture standard configuration systems and also systems customized for specific customer requirements. We purchase common and specialized mechanical, electrical and optical parts and raw materials from vendors.

Sales, Marketing and Support

We market our products internationally primarily through our direct sales force. Our direct sales force sells to end users, OEMs and systems integrators. Once our fiber laser products are designed into an OEM system, the OEM's sales force markets its systems, allowing us to leverage our sales capability through the OEM sales channels because the OEMs typically have several sales persons in locations other than where our sales offices are located. We have sales and service offices and application development centers in the Americas, Europe and Asia. To a lesser extent, we market through agreements with independent sales representatives and distributors, although we do use such channels more widely for our LightWELD product.

We typically provide one to five-year parts and service warranties on lasers. Most of the Company's sales offices provide support to customers in their respective geographic areas.

Customers

We sell our products globally to OEMs, system integrators and end users in a wide range of diverse markets who have the in-house engineering capability to integrate our products into their own systems. We also sell complete laser and non-laser solutions to end users for their production needs. We have thousands of customers worldwide. We rely on a few customers for a significant portion of our sales. In the aggregate, our top five customers accounted for 15%, 19% and 24% of our consolidated net sales in 2022, 2021 and 2020, respectively.

Competition

Our markets are highly competitive and characterized by rapidly changing technology, continuously evolving customer requirements and reduced average selling prices over time. In the materials processing market, we compete with makers of fiber lasers and other lasers, such as Coherent, Inc., Laserline GmbH, Lumentum Holdings Inc., Maxphotonics Co., Ltd., MKS Instruments, Inc., nLight, Inc., Trumpf GmbH + Co. KG and Wuhan Raycus Fiber Laser Technologies Co. Ltd., as well as other smaller competitors. Some of our customers have developed products for their own use which are competitive to our products. Such vertical integration by our customers could reduce the market opportunity for our products. Many of our fiber laser competitors are increasing the output powers of their fiber lasers to compete with our products.

We also compete with end users that produce their own laser technology as well as with manufacturers of non-laser methods and tools, such as traditional non-laser welding, cutting dies, mechanical cutters and plasma cutters in the materials processing market. Some of our competitors are larger than we are and have substantially greater financial, managerial and technical resources, more extensive distribution and service networks, greater sales and marketing capacity, and larger installed customer bases than we do.

Backlog

At December 31, 2022, our backlog of orders (generally scheduled for shipment within one year) was approximately $811.0 million compared to $729.0 million at December 31, 2021. At December 31, 2022, our backlog included $500.9 million of orders with firm shipment dates and $310.1 million of frame agreements that we expect to ship within one year, compared to $487.3 million of orders with firm shipment dates and $241.7 million of frame agreements at December 31, 2021. Frame agreements are non-binding indications of customer pricing and volume levels but are not firm customer purchase obligations. Orders used to compute backlog are generally cancellable without substantial penalties or any penalties. We anticipate shipping a substantial majority of the present backlog during fiscal year 2023. However, our backlog at any given date is not necessarily indicative of actual sales for any future period.

Employees and Human Capital Management

Our employees are our most valuable assets. They contribute to IPG’s success and, in particular, the skilled and experienced employees within our manufacturing, sales, service, research and development and quality assurance departments are instrumental in driving operational execution and strong financial performance, advancing innovation and maintaining a strong quality and compliance program.

As of December 31, 2022, we had approximately 6,230 full-time employees, including 500 in research and development, 4,950 in manufacturing and service operations, 340 in sales and marketing, and 440 in general and administrative functions. As a global company, our employees are distributed throughout our more than thirty locations in twenty-four countries. Of our total full-time employees at our principal facilities, approximately 2,190 were in the United States, 1,370 were in Germany, 1,550 were in Russia, 410 were in Belarus and 230 were in China. We have never experienced a work stoppage, and none of our employees at our principal manufacturing facilities are subject to a collective bargaining agreement.

The success and growth of IPG’s business is dependent in large part on our ability to attract, retain and develop a diverse population of talented and high-performing employees at all levels of our organization. For our research, engineering and production management positions, we require employees with university and graduate-level degrees in physics, optics, electrical, mechanical and software engineering. Globally, the demand for employees with such levels of education is high and competitive.

To succeed in these conditions, IPG implements key recruitment and retention strategies, objectives and effectiveness measures as part of the overall management of our business. These core strategies are advanced through the following programs, policies and initiatives:

Competitive Pay and Benefits. IPG’s compensation programs are designed to align the compensation of our employees, who operate in a highly competitive and technologically challenging environment, with IPG’s business performance and to provide the proper incentives to attract, retain and motivate employees to achieve superior performance. The structure of our compensation programs balances incentive earnings for both short-term and long-term performance. Specifically:

- We provide employee wages that are competitive and consistent with employee's positions, skill levels, experience, knowledge and geographic location.
- All employees participate in our annual cash bonus program, allowing them to share in the profitability and business performance of IPG. We also generally provide equity grants and an employee stock purchase plan to salaried employees consistent with geographic compensation practices and subject to regulatory compliance. These programs further align our employees' financial interests with the performance of the business and the interests of our stockholders.
- We generally provide annual increases and incentive compensation based on merit.
- We purchase compensation data from a compensation and benefits consulting firm to allow us to ensure we provide competitive compensation in each of the geographic locations in which we operate.
- We align our executives' annual and long-term equity compensation with our stockholders' interests by linking realizable pay with operating metrics and stock performance.
- We provide comprehensive benefit options designed to retain our employees and support their families in living healthier and more secure lives.

Employee recruitment, retention and development. IPG works diligently to attract the best talent from a broad array of sources to meet the current and future demands of our business. We have established relationships with trade schools, world-class universities, professional associations and industry groups to proactively attract talented and capable new hires. We also utilize social media, local job fairs and educational organizations to find diverse, motivated and responsible employees. IPG has made strides to increase diversity in management positions, building internal resources for potential future leadership openings. IPG has a strong employee value proposition that leverages our technology leadership, unique culture, collaborative working environment, shared sense of purpose, and desire to do the right thing to attract talent to our company. In 2022, we hired approximately 1,080 new employees.

We monitor employee turnover rates as our success depends upon retaining and investing in our highly trained manufacturing and technical staff. IPG strives to decrease voluntary turnover rates and thereby increase employee tenure by ensuring a combination of competitive compensation, individual developmental opportunities and personal career enrichment and growth. Our retention at the technical, professional and executive levels is high. Over the last three years, amidst global uncertainty and turmoil resulting from the COVID-19 pandemic, we introduced a number of special initiatives to minimize the impact upon our employees to safeguard the health and safety of them and their communities. Throughout the pandemic, we believe our employees took immense pride in the shared purpose of making products that supported the world's critical supply chains within a wide range of essential businesses and services including medical devices, transportation, communications, packaging and agriculture.

Executive Officers of the Registrant

The following table sets forth certain information regarding our executive officers as of February 27, 2023:

Name	Age	Position with the Company
Eugene A. Scherbakov, Ph.D.	75	Chief Executive Officer
Angelo P. Lopresti	59	General Counsel, Secretary and Senior Vice President
Timothy P.V. Mammen	53	Chief Financial Officer and Senior Vice President
Trevor D. Ness	50	Senior Vice President, Sales and Strategic Business Development
Alexander Ovtchinnikov, Ph.D.	62	Senior Vice President, Chief Technology Officer
Igor Samartsev, Ph.D.	59	Senior Vice President, Chief Scientist
Felix Stukalin	61	Senior Vice President, Chief Operating Officer

Eugene A. Scherbakov, Ph.D. has served as our Chief Executive Officer since May 2021. Prior to that, he was Chief Operating Officer since February 2017, Managing Director of IPG Laser GmbH, our German subsidiary, since August 2000 and Senior Vice President, Europe, since 2013. He served as the Technical Director of IPG Laser from 1995 to August 2000. From 1983 to 1995, Dr. Scherbakov was a senior scientist in fiber optics and head of the optical communications laboratory at the General Physics Institute, Russian Academy of Science in Moscow. Dr. Scherbakov graduated from the Moscow Physics and Technology Institute with an M.S. in Physics. In addition, Dr. Scherbakov attended the Russian Academy of Science in Moscow, where he received a Ph.D. in Quantum Electronics from its Lebedev Physics Institute and a Dr.Sci. degree in Laser Physics from its General Physics Institute.

Angelo P. Lopresti has served as our General Counsel, Secretary and Vice President since February 2001. He was promoted to Senior Vice President in February 2013. Prior to joining us, Mr. Lopresti was a partner at the law firm of Winston & Strawn LLP from 1999 to 2001. He was a partner at the law firm of Hertzog, Calamari & Gleason from 1998 to 1999 and an associate there from 1991 to 1998. He served on the board of Coastway Bancorp, Inc. from 2016 to 2018, prior to its acquisition by HarborOne Bancorp, Inc. Mr. Lopresti holds a B.A. in Economics from Trinity College and a J.D. from the New York University School of Law.

Timothy P.V. Mammen has served as our Chief Financial Officer since July 2000 and as Vice President since November 2000. He was promoted to Senior Vice President in February 2013. Between May 1999 and July 2000, Mr. Mammen served as the Group Finance Director and General Manager of the United Kingdom operations for IPFD. Mr. Mammen was Finance Director and General Manager of United Partners Plc, a commodities trading firm, from 1995 to 1999 and, prior to that, he worked in the finance department of E.I. du Pont de Nemours and Company. Mr. Mammen holds an Upper Second B.Sc. Honours degree in International Trade and Development from the London School of Economics and Political Science. He is a Chartered Accountant and a member of the Institute of Chartered Accountants of Scotland.

Trevor D. Ness has served as our Senior Vice President, Sales and Strategic Business Development since February 18, 2022. Prior to that, he was Senior Vice President, World Wide Sales and Marketing, from February 2013 to 2022. From January 2011 until February 2013, he served as our Vice President-Asian Operations. Prior to joining us, Mr. Ness was Director of GSI Precision Technologies China from May 2005 to December 2010 and prior to that he held technical sales management roles with GSI Group, Inc. and Cobham Plc, located in UK, Japan and Taiwan. Mr. Ness holds a B.S. in Geology from Imperial College, a H.N.C. from Bournemouth University and an M.B.A. from The Open University.

Alexander Ovtchinnikov, Ph.D., has served as our Senior Vice President, Chief Technology Officer since February 2022. Prior to that, he was Vice President, Components, from September 2005 to February 2022 and Director of Material Sciences from October 2001 to September 2005. He was promoted to Senior Vice President in February 2013. Prior to joining us, Dr. Ovtchinnikov was Material Science Manager of Lasertel, Inc., a maker of high-power semiconductor lasers, from 1999 to 2001. For 15 years prior to joining Lasertel, Inc., he worked on the development and commercialization of high power diode pump technology at the Ioffe Institute, Tampere University of Technology, Coherent, Inc. and Spectra-Physics Corporation. He holds an M.S. in Electrical Engineering from the Electrotechnical University of St. Petersburg, Russia, and a Ph.D. from Ioffe Institute of the Russian Academy of Sciences.

Igor Samartsev, Ph.D. has served as our Senior Vice President, Chief Scientist since February 2022. Prior to that, he was Chief Technology Officer from 2011 to 2022 and Deputy General Manager of our Russian subsidiary, NTO IRE-Polus from 2005 to 2011 after having served in technical leadership roles at NTO IRE-Polus. Dr. Samartsev holds a Ph.D. in Physics from the Imperial College London.

Felix Stukalin has served as our Senior Vice President, Chief Operating Officer since February 2022. Prior to that, he was Senior Vice President, North America Operations, from February 2013 to February 2022. From March 2009 until February 2013, he served as our Vice President, Devices. Prior to joining us, he was Vice President, Business Development of GSI Group Inc. from April 2002 to September 2008, and from March 2000 to April 2002 he was Vice President of Components and President of the Wave Precision divisions of GSI Lumonics. Mr. Stukalin holds a B.S. in Mechanical Engineering from the University of Rochester and he is a graduate of the Harvard Business School General Management Program.

Seasonality

Our net sales can fluctuate from quarter to quarter with general economic trends, specific industry cycles, holidays in foreign countries such as Lunar New Year in the first quarter of our fiscal year and the timing of capital expenditures by our customers. Historically, our net sales have generally been higher in the second half of the year than in the first half of the year.

Government Regulation

Regulatory Compliance

The majority of our laser and amplifier products sold in the United States are classified as Class IV Laser Products under the applicable rules and regulations of the Center for Devices and Radiological Health ("CDRH") of the U.S. Food and Drug Administration ("FDA"). The same classification system is applied in the European markets. Safety rules are formulated with "Deutsche Industrie Norm" (i.e., German Industrial Standards) or International Organization for Standardization ("ISO") standards, which are internationally harmonized. CDRH regulations generally require a self-certification procedure pursuant to which a manufacturer must submit a filing to the CDRH with respect to each product incorporating a laser device, make periodic reports of sales and purchases and comply with product labeling standards, product safety and design features and informational requirements.

Our business activities are subject to various export controls and trade and economic sanctions laws and regulations, including, without limitation, the U.S. Commerce Department's Export Administration Regulations, the U.S. Treasury Department's Office of Foreign Assets Control's trade and economic sanctions programs, the U.S. Department of State's Nonproliferation Sanctions and International Traffic in Arms Regulations, as well as those of the European Community and Germany, which we collectively refer to as Trade Controls. We further discuss the impact of such Trade Controls under "*Risk Factors*" in Item 1A "*—We must comply with and could be impacted by various export controls and trade and economic sanctions laws and regulations that could negatively affect our business and may change due to diplomatic and political considerations outside of our control"*.

Environmental Regulation

Our operations are subject to various federal, state, local and international laws governing the environment, including those relating to the storage, use, discharge, disposal, product composition and labeling of, human exposure to and hazardous and toxic materials. In the event of an accident involving such materials, we could be liable for damages and such liability could exceed the amount of our liability insurance coverage and the resources of our business.

We face increasing complexity in our product design and procurement operations due to the evolving nature of environmental compliance regulations and standards, as well as specific customer compliance requirements. These regulations and standards have an impact on the material composition of our products entering specific markets. For example, the European Union ("EU") adopted the Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), and China enacted the Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation (China-RoHS). In addition to these regulations and directives, we may face costs and liabilities in connection with product take-back legislation.

For further discussion of risks relating to the regulations to which we are subject, see Item 1A. Risk Factors.

Availability of Reports

Our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and any amendments to such reports are available free of charge on our website at www.ipgphotonics.com as soon as reasonably practicable after such reports are electronically filed with, or furnished to, the Securities and Exchange Commission ("SEC"). The SEC maintains an internet site that contains reports, proxy and information statements and other information regarding issuers that file electronically with the SEC at www.sec.gov. We will also provide electronic or paper copies of such reports free of charge, upon request made to our Corporate Secretary. The information included on our website is not a part of, nor is it incorporated by reference into, this annual report on Form 10-K.

ITEM 1A. *RISK FACTORS*

The factors described below are the principal risks that could materially adversely affect our operating results and financial condition. Other factors may exist that we do not consider significant based on information that is currently available. In addition, new risks may emerge at any time and we cannot predict those risks or estimate the extent to which they may affect us.

Risks Relating to Economic Conditions and Other External Factors

The COVID-19 pandemic, including private and public sector responses, could materially adversely affect our business, financial condition, results of operations and/or cash flows.

The ongoing COVID-19 pandemic and related countermeasures have caused economic and financial disruptions in most of the regions in which we sell our products and services and conduct our business operations. Governmental authorities have implemented numerous and evolving measures to address the virus as it continues to mutate. There is no certainty that measures implemented by governmental authorities or by us in our operations will be sufficient to mitigate the risks posed by the COVID-19 virus. Changes in customer demand, supply chain constraints experienced by us, our suppliers and our customers, pandemic fears and market downturns, and restrictions on business and individual activities has created significant economic and demand uncertainty. COVID-19 may impact different markets at different times with disparate severity. We have experienced and expect to continue to experience unpredictable volatility in demand in several of our end-markets.

The degree to which the COVID-19 pandemic impacts our financial condition, cash flows and results of operations depends upon future developments, which are highly uncertain and cannot be predicted, including but not limited to the duration, location and spread of outbreak, the emergence, contagiousness, and threat of new and different strains of virus, the availability, acceptance, and effectiveness of vaccines, governmental and business measures to contain the virus and address its impact, and how quickly and to what extent normal economic and operating conditions can resume. These factors, and others that are currently unknown or considered immaterial, could have a material adverse effect on our business, prospects, financial condition, cash flows and results of operations.

The ongoing conflict between Russia and Ukraine may adversely affect our business and results of operations.

In the first quarter of 2022, Russian military forces invaded Ukraine. This military action had significant and immediate adverse economic impacts globally. Given the nature of our business and our global operations, particularly those in Russia and Belarus, the current conflict between Russia and Ukraine has affected and may adversely affect our business and results of operations.

Historically we have manufactured a variety of components, including proprietary fiber-based components, and sub-assemblies at our facility in Russia and mechanical components at our facility in Belarus. Our operations in Russia and Belarus are subject to additional regulatory and political constraints and additional compliance costs in connection with sanctions, other trade controls and higher tariffs imposed by the United States, the European Union and other governments in response to Russia's military operations in Ukraine. The European Union enacted additional sanctions effective in January 2023 that restrict our ability to import components in Europe from Russia. While certain components can be exported from Russia to the United States, the United States imposed significant import tariffs that make it commercially undesirable. We continue to implement steps to mitigate the impacts of the Russia-Ukraine conflict on our business and reduce reliance on our facilities in Russia and Belarus, such as migrating the production of a number of our components that had been manufactured in Russia and Belarus into other countries.

The current conflict between Russia and Ukraine and our continued operations in Russia and Belarus may also have the effect of heightening many other risks disclosed in our public filings, any of which could adversely affect our business and results of operations. Such risks include, but are not limited to, increases in tariffs; adverse effects on global macroeconomic conditions; increased exposure to cyberattacks; impact of export controls and economic sanctions; limitations in our ability to implement and execute our business strategy; risks to employees, assets and operations we have in Russia and Belarus; disruptions in global supply chains; asset write-downs; exposure to foreign currency fluctuations and potential nationalizations and asset seizures in Russia; constraints or disruption in the capital markets and our sources of liquidity; and potential contractual breaches and litigation.

We must comply with and could be impacted by various export controls and trade and economic sanctions laws and regulations that could negatively affect our business and may change due to diplomatic and political considerations outside of our control.

A significant part of our business involves the export and import of components and products among many countries, including the U.S., Germany, Russia, Belarus and China. The U.S. government and governments of other countries in which we do business have Trade Controls that impact our ability to export, re-export or transfer products, software and technology originating in those countries. Trade Controls may require that we obtain a license before we can export, re-export or transfer certain products, software or technology. The requirement to obtain a license could put us at a competitive disadvantage by restricting our ability to sell products to customers in certain countries or by giving rise to delays or expenses related to obtaining a license. We have experienced and, in the future, may experience delays in obtaining export licenses based on issues solely within the control of the applicable government agency. Licenses may also include conditions that limit the use, resale, transfer, re-export, modification, disassembly, or transfer of a product, software or technology after it is exported without first obtaining permission from the relevant government agency. Delays in obtaining or failure to obtain required export licenses may require us to defer shipments for substantial periods or cancel orders. Any of these circumstances could adversely affect our operations and, as a result, our financial results could suffer. Although we have implemented compliance measures designed to prevent transactions prohibited by current or future Trade Controls, we have previously identified, and may continue to identify, instances in which we exported products without obtaining the required export authorizations and/or submitting the required requests. As a result, we have submitted a limited number of voluntary self-disclosures regarding compliance with export control laws and regulations with the U.S. Department of Commerce's Bureau of Industry and Security ("BIS"). In October 2021, the U.S. Department of Justice ("DOJ") advised us it was conducting an investigation into certain shipments of equipment. We believe the DOJ's investigation has concluded however BIS continues its investigation and we received an administrative subpoena from BIS regarding our export practices. While we are cooperating fully with BIS's review, we are unable to estimate its ultimate impact on the Company. Our failure to comply with these laws and regulations could result in costly government investigations, government sanctions, including substantial monetary penalties, civil or criminal penalties, denial of export privileges, debarment from government contracts, and a loss of revenues and reputational harm.

Our manufacturing facilities in the U.S., Germany and Russia provide finished products to China, our largest market. Should the United States, the European Union or Russia implement new or broad-based Trade Controls directed at each other or China, our production and/or deliveries as well as results of operations and/or financial condition could be affected.

In connection with the Russia-Ukraine conflict, broad-based sanctions (including asset-freeze/blocking sanctions) have been imposed by the U.S., UK, EU, and numerous other governments targeting Russia, including but not limited to major Russian banks. In the U.S., these sanctions are administered by the Office of Foreign Assets Control ("OFAC") and are typically known as the OFAC regulations. These regulations are extensive and complex, and they differ from one sanctions regime to another. Failure to comply with these regulations could subject us to legal and reputational consequences, including civil and criminal penalties.

In addition, Trade Controls and their implementation are fluid and may change due to diplomatic and political considerations outside of our control. The United States, the European Union and Russia have imposed numerous additional trade restrictions and sanctions in response to the Russia-Ukraine conflict. Such changes, including the potential expansion of sanctions and sanctions designations, as well as public statements by government officials, could be significant. While the Company has a trade compliance program, there is a risk that IPG may not be able to comply due to the number, complexity and fast-changing nature of sanctions being added in response to the Russia-Ukraine conflict. Trade Controls and governmental responses to the conflict may require us to take certain actions, including increasing costs and abandoning operations or writing-down asset values, or respond to nationalization or expropriation of assets abroad, adversely affect prevailing market prices of our common stock, have a reputational impact, or otherwise have a material adverse impact on us, our business and financial results.

Uncertainty and adverse changes in the general economic conditions of markets in which we participate negatively affect our business.

Current and future conditions in the economy have an inherent degree of uncertainty. As a result, it is difficult to estimate the level of growth or contraction for the economy as a whole. It is even more difficult to estimate growth or contraction in various parts, sectors and regions of the economy, including the materials processing, telecommunications, advanced and medical markets and applications in which we participate. Because all components of our budgeting and forecasting are dependent upon estimates of growth or contraction in the markets and applications we serve and demand for our products, the prevailing economic uncertainties render estimates of future income and expenditures very difficult to make. A significant portion of our sales are to customers in China, which accounted for 34%, 38% and 42% of net sales in 2022, 2021 and 2020, respectively. Slowing economic growth or recession, tariff-trade wars or other adverse economic developments or uncertainty in any of our key markets, including in China, may result in a decrease in our sales. Adverse changes have occurred and may occur in the future as a result of declining or flat global or regional economic conditions, fluctuations in currency and commodity prices, wavering confidence, capital expenditure reductions, unemployment, declines in stock markets, contraction of credit availability, declines in real estate values, or other factors affecting economic conditions generally. These changes may negatively affect the sales of our products, increase exposure to losses from bad debts, increase the cost and decrease the availability of financing, increase the risk of loss on investments, or increase costs associated with manufacturing and distributing products. An economic downturn could have a material adverse effect on our business, financial condition and results of operations.

Downturns in the markets we serve, particularly materials processing, could have a material adverse effect on our sales and profitability.

Our business depends substantially upon capital expenditures by manufacturers in the materials processing market, which includes general manufacturing, automotive, aerospace, other transportation, heavy industry, electronics and photovoltaic industries. Approximately 90% of our revenues in 2022 were from customers in the materials processing market. Although applications in this market are broad, sales for these applications are cyclical and have historically experienced sudden and severe downturns and periods of oversupply, resulting in significantly reduced demand for capital equipment, including the products that we manufacture and market. For example, our sales decreased by 25% in the materials processing market in 2009 as a result of the global economic recession, our material processing sales declined 10% in the second half of 2018 and 11% in the 2019 fiscal year, in part due to decreased capital equipment demand stemming from adverse changes to U.S.-China relations, including rounds of tariff increases and retaliations and declined 12% in the 2020 fiscal year, in part due to decreased capital equipment demand attributed to the COVID-19 pandemic . For the foreseeable future, our operations will continue to depend upon capital expenditures by customers in these industries or markets, which, in turn, depend upon the demand, as well as forecasted demand, for their products or services. A softening of demand for our customers' products and services, whether caused by a weakening of the U.S. or global economies or other factors, may result in decreased revenue or growth for our customers and may lead to decreased demand for our products, which would reduce our sales and margins. We may not be able to respond by decreasing our expenses quickly enough or sufficiently, due in part, to our fixed overhead structure related to our vertically integrated operations and our commitments to continuing investment in research and development and infrastructure for long term growth.

Risks Relating to Industry Dynamics and Competition

The markets for our products are highly competitive and currently subject to significant price and technological competition, and if we are unable to compete successfully, it could result in reduced sales, reduced gross margins or the loss of market share.

The industries in which we operate are characterized by significant price and technological competition. We compete with makers of fiber lasers, solid-state lasers, direct diode lasers, high power CO_2, YAG and disc lasers. These include public and private companies such as Coherent, Inc., Laserline GmbH, Lumentum Holdings Inc., Maxphotonics Co., Ltd., MKS Instruments, Inc., nLight, Inc., Trumpf GmbH + Co. KG, and Wuhan Raycus Fiber Laser Technologies Co. Ltd., as well as other smaller competitors. Several of these are larger and have substantially greater financial, managerial and technical resources, more extensive distribution and service networks, greater sales and marketing capacity, and larger installed customer bases than we do. Many of our fiber laser competitors are increasing the output powers, improving the quality of their fiber lasers and decreasing prices to compete with our products. Our current or potential customers may determine to develop and produce products for their own use which are competitive to our products. Such vertical integration could reduce the market opportunity for our products. We also compete in the materials processing, advanced and medical applications markets with end users that produce their own solid-state and gas lasers as well as with manufacturers of non-laser methods and tools, such as traditional non-laser welding, cutting dies mechanical cutters and plasma cutters in the materials processing market and other energy-based devices in the medical market.

We may not be able to successfully differentiate our current and proposed products from our competitors' products and current or prospective customers may not consider our products to be superior to competitors' products. To maintain our competitive position, we believe that we will be required to continue a high level of investment in research and development, application development, manufacturing facilities and customer service and support, and to react to market pricing conditions. As a result of the foregoing factors, competitive pressures have resulted in price reductions, reduced margins, loss of sales and loss of market share.

The laser and amplifier industries are experiencing declining average selling prices, which could cause our gross margins to decline and harm our operating results.

Our products are experiencing and may in the future continue to experience a significant decline in average selling prices ("ASPs") as a result of increased competition, pressure to reduce prices from significant customers and new product and technology introductions. Market participants, particularly in China, have reduced and may continue to reduce, prices of competing products to gain market share. If the ASPs of our products decline further and we are unable to increase our unit volumes, introduce new or enhanced products with higher margins or reduce manufacturing costs to offset anticipated decreases in the prices of our existing products, our operating results may be adversely affected. In addition, because of our significant fixed costs, we are limited in our ability to reduce total costs quickly in response to any revenue shortfalls. Because of these factors, we have experienced and we may experience in the future material adverse fluctuations in our operating results on a quarterly or annual basis if the ASPs of our products continue to decline.

Our ability to maintain or increase sales depends upon our ability to develop new products, penetrate new applications and end markets for fiber lasers and maintain or increase our market share in existing applications.

Our level of sales will depend on our ability to generate sales of fiber lasers in new and developing markets including applications for lasers where they have not been used previously and in applications in which other lasers, such as CO_2 and YAG lasers, have been used. To date, a significant portion of our revenue growth has been derived from sales of fiber lasers primarily for applications where CO_2 and YAG lasers historically have been used. We have made significant sales into the cutting, welding and marking and engraving applications, large applications where the use of other laser technologies was well established. As fiber lasers increase penetration in core materials processing applications and there is more competition in these core material processing applications, the development of new applications, end markets and products outside our core applications becomes more important to our ability to generate sales. In order to maintain or increase market demand for our products, we will need to devote substantial resources to:

- demonstrate the effectiveness of fiber lasers in new applications for materials processing, medical, communications and advanced applications;

- successfully develop new product lines, such as the handheld welder, UV, visible and ultrafast fiber lasers with competitive features that extend our product line;
- increase our direct and indirect sales efforts;
- effectively meet growing competition and pricing pressures; and
- continue to reduce our manufacturing costs and enhance our competitive position.

Potential customers may have substantial investments and know-how related to their existing laser and non-laser technologies. They may perceive risks relating to the reliability, quality, usefulness and profitability of integrating fiber lasers in their systems when compared to other laser or non-laser technologies available in the market or that they manufacture themselves. Despite fiber lasers having better performance and prices compared to other lasers or tools, OEM customers may be reluctant to switch incumbent suppliers or we may miss the design cycles of our customers. Many of our target markets, such as the automotive, machine tool and other manufacturing, communications and medical industries, have historically adopted new technologies slowly. These markets often require long test and qualification periods or lengthy government approval processes before adopting new technologies.

If we are unable to successfully implement our strategy to develop new applications and end markets for our products or develop new products, our revenues, operating results and financial condition could be adversely affected. In addition, any newly developed or enhanced products may not achieve market acceptance or may be rendered obsolete or less competitive by the introduction of new products by other companies.

We depend on our OEM customers and system integrators to incorporate our products into their systems.

Our sales depend in part on our ability to maintain existing and secure new OEM customers. Our revenues also depend in part upon the ability of our current and potential OEM customers and system integrators to incorporate our laser and amplifier products. The commercial success of these systems depends to a substantial degree on the efforts of these OEM customers and system integrators to develop and market products that incorporate our technologies. Relationships and experience with traditional laser makers, limited marketing resources, reluctance to invest in research and development and other factors affecting these OEM customers and third-party system integrators could have a substantial impact upon our financial results. If OEM customers or integrators are not able to adapt existing tools or develop new systems to take advantage of the features and benefits of fiber lasers or if they perceive us to be an actual or potential competitor, then the opportunities to increase our revenues and profitability may be severely limited or delayed. In addition, some of our OEM customers are developing their own fiber laser sources. If they are successful, this may reduce our sales to these customers. Furthermore, if our OEM customers or third-party system integrators experience financial or other difficulties that adversely affect their operations, our financial condition or results of operations may also be adversely affected.

Risks Relating to Our Operations

Our vertically integrated business results in high levels of fixed costs and inventory levels that may adversely impact our gross profits and our operating results in the event that demand for our products declines or we maintain excess inventory levels.

We have a high fixed cost base due to our vertically integrated business model. Approximately 79% of our approximately 6,230 employees as of December 31, 2022 were employed in our manufacturing operations. We may not adjust these fixed costs quickly enough or sufficiently to adapt to rapidly changing market conditions. Our gross profit, in absolute dollars and as a percentage of net sales, is impacted by our sales volume, the corresponding absorption of fixed manufacturing overhead expenses and manufacturing yields. In addition, because we are a vertically integrated manufacturer and design and manufacture our key specialty components, insufficient demand for our products may subject us to the risks of high inventory carrying costs and increased inventory obsolescence. If our capacity and production levels are not properly sized in relation to expected demand, we may need to record write-downs for excess or obsolete inventory. Because we are vertically integrated, the rate at which we turn inventory has historically been low when compared to our cost of sales. We do not expect this to change significantly in the future and believe that we will have to maintain a relatively high level of inventory compared to our cost of sales. As a result, we expect to have a significant amount of working capital invested in inventory. Changes in our level of inventory lead to an increase in cash generated from our operations when inventory is sold or a decrease in cash generated from our operations at times when the amount of inventory increases. Decreases in inventory may decrease our overhead absorption and decrease our gross margins and profitability.

Our manufacturing capacity and operations may not be appropriate for future levels of demand and may adversely affect our gross margins.

We have added and are continuing to add substantial manufacturing capacity at our facilities in the United States, Germany, Italy and Poland. We are adding manufacturing capabilities and capacity outside of Russia in response to trade sanctions imposed on Russia, where we have large production facilities. The trade restrictions impose limits our our ability to purchase components and other items from our subsidiary in Russia. A significant portion of our manufacturing facilities and production equipment, such as our semiconductor production and processing equipment, diode packaging equipment and diode burn-in stations, are special-purpose in nature and cannot be adapted easily to make other products. If the demand for fiber lasers or amplifiers does not increase or if our revenue decreases from current levels, we may have significant excess manufacturing capacity and under-absorption of our fixed costs, which could in turn adversely affect our gross margins and profitability.

To maintain our competitive position and to meet anticipated demand for our products, we invest significantly in the expansion of our manufacturing and operations throughout the world and may do so in the future. We had capital expenditures of $110 million and $123 million in 2022 and 2021, respectively, and we expect to incur approximately $140 million to $160 million in capital expenditures, excluding acquisitions, in 2023. In connection with these projects, we may incur cost overruns, construction delays, project cancellations, labor difficulties or regulatory issues which could cause our capital expenditures to be higher than what we currently anticipate, possibly by a material amount, which would in turn adversely impact our operating results. Moreover, we may experience higher costs due to yield loss, production inefficiencies, equipment problems and lower margins until any operational issues associated with the opening of new manufacturing facilities are resolved.

A few customers account for a significant portion of our sales, and if we lose any of these customers or they significantly curtail their purchases of our products, our results of operations could be adversely affected.

We rely on a few customers for a significant portion of our sales. In the aggregate, our top five customers accounted for 15%, 19% and 24% of our consolidated net sales in 2022, 2021 and 2020, respectively. A few of our larger customers, including our largest customer, are making fiber lasers or announced plans to develop fiber lasers. We generally do not enter into agreements with our customers obligating them to purchase our fiber lasers or amplifiers. Our business is characterized by short-term purchase orders and shipment schedules. If any of our principal customers discontinues its relationship with us, replaces us as a vendor for certain products or suffers downturns in its business, our business and results of operations could be adversely affected.

Because we lack long-term purchase commitments from our customers, our sales can be difficult to predict, which could lead to excess or obsolete inventory and adversely affect our operating results.

We generally do not enter into long-term agreements with our customers obligating them to purchase our fiber lasers or amplifiers. Our business is characterized by short-term purchase orders and shipment schedules and, in some cases, orders may be canceled or delayed without significant penalty or any penalty. As a result, it is difficult to forecast our revenues and to determine the appropriate levels of inventory required to meet future demand. In addition, due to the absence of long-term volume purchase agreements, we forecast our revenues and plan our production and inventory levels based upon the demand forecasts of our OEM customers, end users and distributors, which are highly unpredictable and can fluctuate substantially. This could lead to increased inventory levels and increased carrying costs and risk of excess or obsolete inventory due to unanticipated reductions in purchases by our customers. In addition, provisions have been recorded as a result of changes in market prices of certain components, the value of those inventories that was realizable through finished product sales due to declines in certain end market demand and uncertainties related to the recoverability of the value of inventories due to technological and product changes, and excess quantities. In 2022, approximately $74.1 million was related to inventory provision and related charges at our Russian operations. If our OEM customers, end users or distributors fail to accurately forecast the demand for our products, fail to accurately forecast the timing of such demand, or are unable to consistently negotiate acceptable purchase order terms with customers, our results of operations may be adversely affected.

We depend upon internal production and on outside single or limited-source suppliers for many of our key components and raw materials, including cutting-edge optics and materials. Any interruption in the supply or availability of these key components and raw materials could adversely affect our results of operations.

We rely exclusively on our own production capabilities to manufacture certain of our key components, such as semiconductor diodes, specialty optical fibers and optical components. We do not have redundant production lines for some of our components, such as our diodes and some other components, which are made at a single manufacturing facility. These are not readily available from other sources at our current costs and may not be available at all. If our manufacturing activities were obstructed or hampered significantly, it could take a considerable length of time, or it could increase our costs, to resume manufacturing or find alternative sources of supply. Many of the tools and equipment we use are custom-designed, and it could take a significant period of time to repair or replace them. Our primary manufacturing facilities are located in Massachusetts, Germany, Russia and Belarus. Despite our efforts to mitigate the impact of any flood, fire, natural disaster, political unrest, act of terrorism, war, trade sanctions, outbreak of disease or other similar event, our business could be adversely affected to the extent that we do not have redundant production capabilities if any of our major manufacturing facilities or equipment should become inoperable, inaccessible, damaged or destroyed.

Also, we purchase certain raw materials used to manufacture our products and other components, such as semiconductor wafer substrates, diode packages, modulators, micro-optics, bulk optics and high power beam delivery products, from single or limited-source suppliers. We typically purchase our components and materials through purchase orders or agreed-upon terms and conditions and we do not have guaranteed supply arrangements with many of these suppliers. These suppliers are relatively small private companies that may discontinue their operations at any time and may be particularly susceptible to prevailing economic conditions. Some of our suppliers are also our competitors. Some of our suppliers may not be able to meet demand from our growing business or because of global demand for their components. As a result, we experienced and may in the future experience longer lead times or delays in fulfillment of our orders. Furthermore, other than our current suppliers, there are a limited number of entities from whom we could obtain these supplies. We do not anticipate that we would be able to purchase these components or raw materials that we require in a short period of time or at the same cost from other sources in commercial quantities or that have our required performance specifications. Any interruption or delay in the supply of any of these components or materials, or the inability to obtain these components and materials from alternate sources at acceptable prices and within a reasonable amount of time, could adversely affect our business. If our suppliers face financial or other difficulties, if our suppliers do not maintain sufficient inventory on hand or if there are significant changes in demand for the components and materials we obtain from them, they could limit the availability of these components and materials to us, which in turn could adversely affect our business.

We may experience lower than expected manufacturing yields, which would adversely affect our gross margins.

The manufacture of semiconductor diodes and the packaging of them is a highly complex process. Manufacturers often encounter difficulties in achieving acceptable product yields from diode and packaging operations. We have from time to time experienced lower than anticipated manufacturing yields for our diodes and packaged diodes. This occurs during the production of new designs and the installation and start-up of new process technologies and new equipment. If we do not achieve planned yields, our product costs could increase resulting in lower gross margins, and key component availability would decrease.

We are highly dependent on the significant experience and specialized expertise of our CEO and other senior management and scientific staff. The unavailability or loss of one or more of these key employees or our failure to attract other highly skilled personnel necessary to compete successfully could harm our business and results of operations.

Our future success is substantially dependent on the continued service and performance of our executive officers. Although the board engages in executive succession planning, our inability to effectively and immediately transition knowledge or responsibilities to successors in the event of an unexpected absence or departure could harm our business and disrupt our operations. We also rely on our highly trained team of scientists, many of whom have numerous years of experience and specialized expertise in optical fibers, semiconductors and optical component technology, and other key engineering, sales, marketing, manufacturing and support personnel, any of whom may depart for a variety of reasons, which could harm our business. Competition for qualified personnel in our industry is intense, particularly for physicists, software engineers and other technical staff. If we fail to attract, integrate and retain the necessary personnel, it could delay the development or introduction of new products, negatively impact our ability to market, sell or support our products, and significantly harm our business.

Risks Relating to Intellectual Property, Litigation, Information Systems and Regulations

In the past, we were subject to litigation alleging that we infringed third-party intellectual property rights. Intellectual property claims could result in costly litigation and harm our business.

There has been significant litigation involving intellectual property rights in many technology-based industries, including our own. We face risks and uncertainties in connection with such litigation, including the risk that patents issued to others may harm our ability to do business; that there could be existing patents of which we are unaware that could be pertinent to our business; and that it is not possible for us to know whether there are patent applications pending that our products might infringe upon. Moreover, the frequency with which new patents are granted and the diversity of jurisdictions in which they are granted make it impractical and expensive for us to monitor all patents that may be relevant to our business.

From time to time, we have been notified of allegations and claims that we may be infringing patents or intellectual property rights owned by third parties. We have defended against several patent infringement claims in the past and we engage in patent office opposition proceedings internationally for patents owned by others.

There can be no assurance that we will be able to dispose without a material effect any claims or other allegations made or asserted in the future. Even if we ultimately are successful on the merits of any such litigation or re-examination, legal and administrative proceedings related to intellectual property are typically expensive and time-consuming, generate negative publicity and divert financial and managerial resources. Some litigants may have greater financial resources than we have and may be able to sustain the costs of complex intellectual property litigation more easily than we can.

If we do not prevail in any intellectual property litigation brought against us, it could affect our ability to sell our products and materially harm our business, financial condition and results of operations. These developments could adversely affect our ability to compete for customers and increase our revenues. Plaintiffs in intellectual property cases often seek, and sometimes obtain, injunctive relief. Intellectual property litigation commenced against us could force us to take actions that could be harmful to our business, including the following:

- stop selling our products or using the technology that contains the allegedly infringing intellectual property;
- pay actual monetary damages, royalties, lost profits or increased damages and the plaintiff's attorneys' fees; and
- attempt to license the relevant intellectual property which may not be available on reasonable terms.

In addition, intellectual property lawsuits can be brought by third parties against OEMs and end users that incorporate our products into their systems or processes. In some cases, we indemnify OEMs against third-party infringement claims relating to our products and we often make representations affirming, among other things, that our products do not infringe the intellectual property rights of others. As a result, we may incur liabilities in connection with lawsuits against our customers. Any such lawsuits, whether or not they have merit, could be time-consuming to defend, damage our reputation or result in substantial and unanticipated costs.

Our inability to protect our intellectual property and proprietary technologies could result in the unauthorized use of our technologies by third parties, hurt our competitive position and adversely affect our operating results.

We rely on patents, trade secret laws, contractual agreements, technical know-how and other unpatented proprietary information to protect our products, product development and manufacturing activities from unauthorized copying by third parties. Our patents do not cover all of our technologies, systems, products and product components and may not prevent third parties from unauthorized copying of our technologies, products and product components. We have significant international operations and are subject to foreign laws which differ in many respects from U.S. laws. Policing unauthorized use of our trade secret technologies throughout the world and proving misappropriation of our technologies are particularly difficult, especially due to the number of our employees and operations in numerous foreign countries. The steps that we take to acquire ownership of our employees' inventions and trade secrets in foreign countries may not have been effective under all such local laws, which could expose us to potential claims or the inability to protect intellectual property developed by our employees. Furthermore, any changes in, or unexpected interpretations of, the trade secret and other intellectual property laws in any country in which we operate may adversely affect our ability to enforce our trade secret and intellectual property positions. Costly and time-consuming litigation could be necessary to determine the scope of our confidential information and trade secret protection. However, there can be no assurance that confidentiality agreements we enter into with consultants, suppliers, employees and others will not be breached, that we will be able to effectively enforce them or that we will have adequate remedies for any breach.

Given our reliance on trade secret laws, others may independently develop similar or alternative technologies or duplicate our technologies and commercialize discoveries that we have made. Therefore, our intellectual property efforts may be insufficient to maintain our competitive advantage or to stop other parties from commercializing similar products or technologies. Many countries outside of the United States afford little or no protection to trade secrets and other intellectual property rights. Intellectual property litigation can be time-consuming and expensive, and there is no guarantee that we will have the resources to fully enforce our rights. If we are unable to prevent misappropriation or infringement of our intellectual property rights, or the independent development or design of similar technologies, our competitive position and operating results could suffer.

Our information systems are subject to cyber-attacks, interruptions and failures. If unauthorized access is obtained to our information systems, we may incur significant legal and financial exposure and liabilities.

Like many multinational corporations, we maintain several information technology systems, including software products licensed from third parties. These systems vary from country to country. Any system, network or internet failures, misuse by system users, the hacking into or disruption caused by the unauthorized access by third parties or loss of license rights could disrupt our ability to timely and accurately manufacture and ship products or to report our financial information in compliance with the timelines mandated by the SEC. Any such failure, misuse, hacking, disruptions or loss would likely cause a diversion of management's attention from the underlying business and could harm our operations. In addition, a significant failure of our various information technology systems could adversely affect our ability to complete an evaluation of our internal controls and attestation activities pursuant to Section 404 of the Sarbanes-Oxley Act of 2002 under the updated framework issued in 2013.

As part of our day-to-day business, we store our data and certain data about our customers, employees and service providers in our information technology system. While our system is designed with access security, if a third party gains unauthorized access to our data or technology, including information regarding our customers, employees and service providers, such security breach could expose us to a risk of loss of this information, loss of business, litigation and possible liability. Our security measures may be breached as a result of third-party action, including intentional misconduct by computer hackers, employee error, malfeasance or otherwise. Additionally, third parties may attempt to fraudulently induce employees or customers into disclosing sensitive information such as user names, passwords or other information in order to gain access to our customers' data or our data, including our intellectual property and other confidential business information, employee information or our information technology systems. Because the techniques used to obtain unauthorized access, or to sabotage systems, change frequently and generally are not recognized until launched against a target, we may be unable to anticipate or detect these techniques or to implement adequate preventative measures. Any unauthorized access could negatively impact our customers' products, result in a loss of confidence by our customers, damage our reputation, disrupt our business, result in a misappropriation of our assets (including cash), lead to legal liability and negatively impact our future sales. Additionally, such actions could result in significant costs associated with loss of our intellectual property, impairment of our ability to conduct our operations, rebuilding our network and systems, prosecuting and defending litigation, responding to regulatory inquiries or actions, paying damages or taking other remedial steps. In addition, we may incur significant costs designed to prevent or mitigate the damage related to cybersecurity incidents. For instance, we may retain additional employees or consultants, implement new policies and procedures, and install information technology to detect and prevent identity theft, data breaches, or system disruptions. We would incur any such costs with the intent that proactively preventing a cybersecurity incident ultimately helps to mitigate potential cybersecurity liability. As previously disclosed, on September 14, 2020, the Company detected a ransomware attack impacting certain of our operational and information technology systems that did not have a material impact on the Company's business, operations or financial condition.

The costs to address the foregoing security problems and security vulnerabilities before or after a cyber-incident could be significant. Our remediation efforts may not be successful and could result in interruptions, delays, a cessation of service, and a loss of existing or potential customers, impeding our sales, manufacturing, distribution, and other critical functions.

We may face particular privacy, data security and data protection risks due to laws and regulations regulating the protection or security of personal and other sensitive data.

We may face particular privacy, data security and data protection risks due to laws and regulations regulating the protection or security of personal and other sensitive data, including in particular several laws and regulations that have recently been enacted or adopted or are likely to be enacted or adopted in the future. For instance, in 2018, the European General Data Protection Regulation (“GDPR”) imposed additional obligations and risk upon our business and substantially increased the penalties to which we could be subject in the event of any non-compliance. GDPR requires companies to satisfy requirements regarding the handling of personal data (generally, of EU residents), including its use, protection and the rights of affected persons regarding their data. Failure to comply with GDPR requirements could result in penalties of up to 4% of worldwide revenue. In addition, several other jurisdictions around the world have recently enacted privacy laws or regulations similar to GDPR. For instance, in 2020, California enacted the California Consumer Privacy Act (“CCPA”), giving consumers many of the same rights as those available under GDPR. Several laws similar to the CCPA have been approved in the United States at the state level and more are being proposed at the federal and state levels. GDPR and other similar laws and regulations, as well as any associated inquiries or investigations or any other government actions, may be costly to comply with, result in negative publicity, increase our operating costs, require significant management time and attention, and subject us to remedies that may harm our business. We are evaluating these requirements and taking measures to ensure compliance with all applicable privacy and data protection-related laws and regulations. Due to the lack of experience with the interpretation and enforcement of many of these laws and regulations, some measures initially might not satisfy standard or best practices that will be established in the coming years.

Changes in tax rates, tax liabilities or tax accounting rules could affect future results.

As a global company, we are subject to taxation in the United States and various other countries and jurisdictions. Significant judgment is required to determine worldwide tax liabilities. Our future tax rates could be affected by changes in the composition of earnings in countries or states with differing tax rates, transfer pricing rules, changes in the valuation of our deferred tax assets and liabilities, or changes in the tax laws. In addition, we are subject to regular examination of our income tax returns by the Internal Revenue Service ("IRS") and other tax authorities. From time to time the United States, foreign and state governments make substantive changes to tax rules and the application of rules to companies, including various announcements from the United States government potentially impacting our ability to defer taxes on international earnings. We regularly assess the likelihood of favorable or unfavorable outcomes resulting from these examinations to determine the adequacy of our provision for income taxes. Although we believe our tax estimates are reasonable, there can be no assurance that any final determination will not be materially different than the treatment reflected in our historical income tax provisions and accruals, which could materially and adversely affect our operating results and financial condition.

If we or our third-party vendors fail to comply with FDA regulations or similar legal requirements in foreign jurisdictions relating to the manufacturing of our products or any component part, we may be subject to fines, injunctions and penalties, and our ability to commercially distribute and sell our products may be negatively impacted.

We now make fiber laser systems and accessories targeted at specific medical applications. In addition, we sell our commercial fiber and diode laser modules, subassemblies and systems to OEMs that incorporate them into their medical products. With respect to such products, some of our manufacturing facilities, and the manufacturing facilities of any of our third-party component manufacturers or critical suppliers, are required to comply with the FDA's Quality System Regulation and those of other countries ("QSR"), which sets forth minimum standards for the procedures, execution and documentation of the design, testing, production, control, quality assurance, labeling, packaging, sterilization, storage, and shipping of the products we sell in the medical industry, and related regulations, including Medical Device Reporting ("MDR") regulations regarding reporting of certain malfunctions and adverse events potentially associated with our products. The FDA and other regulatory agencies may evaluate our compliance with the QSR, MDR and other regulations, among other ways, through periodic announced or unannounced inspections which could disrupt our operations and interrupt our manufacturing. If in conducting an inspection of our manufacturing facilities, or the manufacturing facilities of any of our third-party component manufacturers or critical suppliers, an investigator from the FDA observes conditions or practices believed to violate the QSR, the investigator may document their observations on a Form FDA 483 that is issued at the conclusion of the inspection. A manufacturer that receives an FDA 483 may respond in writing and explain any corrective actions taken in response to the inspectional observations. The FDA will typically review the facility's written response and may re-inspect to determine the facility's compliance with the QSR and other applicable regulatory requirements. Failure to take adequate and timely corrective actions to remedy objectionable conditions listed on an FDA 483 could result in the FDA taking administrative or enforcement actions. Among these may be the FDA's issuance of a Warning Letter to a manufacturer, which informs it that the FDA considers the observed violations to be of "regulatory significance" that, if not corrected, could result in further enforcement action.

FDA enforcement actions, which include seizure, injunction, criminal prosecution, and civil penalties, could result in total or partial suspension of a facility's production and/or distribution, product recalls, fines, suspension of the FDA's review of product applications, and/or the FDA's issuance of adverse publicity. Thus, an adverse inspection could force a shutdown of our manufacturing operations for products servicing the medical industry or a recall of such products. Adverse inspections could also delay FDA approval of our products for the medical industry.

Failure to maintain effective internal controls may cause a loss of investor confidence in the reliability of our financial statements or to cause us to delay filing our periodic reports with the SEC and adversely affect our stock price.

The SEC, as directed by Section 404 of the Sarbanes-Oxley Act of 2002, adopted rules requiring public companies to include a report of management on internal control over financial reporting in their annual reports on Form 10-K that contain an assessment by management of the effectiveness of our internal control over financial reporting. In addition, our independent registered public accounting firm must attest to and report on the effectiveness of our internal control over financial reporting. We have experienced rapid growth and have extensive and complex international manufacturing and sales and service locations which may make us more vulnerable to weaknesses in our internal controls. Although we test our internal control over financial reporting in order to ensure compliance with the Section 404 requirements, our failure to maintain adequate internal controls over financial reporting could result in an adverse reaction in the financial marketplace due to a loss of investor confidence in the reliability of our financial statements or a delay in our ability to timely file our periodic reports with the SEC, which ultimately could negatively impact our stock price.

Our products could contain defects, which may reduce sales of those products, harm market acceptance of our fiber laser and other products or result in claims against us.

The manufacture of our products involves highly complex and precise processes. Despite testing by us and our customers, errors have been found, and may be found in the future, in our products. These defects may cause us to incur significant warranty, support and repair costs, incur additional costs related to a recall, divert the attention of our engineering personnel from our product development efforts and harm our relationships with our customers. These problems could result in, among other things, loss of revenues or a delay in revenue recognition, loss of market share, harm to our reputation or a delay or loss of market acceptance of our fiber laser products. Additionally, a recall, particularly in our products used or incorporated in medical devices, could result in significant costs and lost sales and customers, enforcement actions and/or investigations by state and federal governments or other enforcement bodies, as well as negative publicity and damage to our reputation that could reduce future demand for our products. The development and sale of medical devices and component products involves an inherent risk of product liability claims. Defects, integration issues or other performance problems in our fiber laser and other products could also result in personal injury or financial or other damages to our customers, which in turn could damage market acceptance of our products and result in significant product liability claims being brought against us. A product liability claim brought against us, even if unsuccessful, could be time-consuming and costly to defend. If a product liability action were determined against us, it could result in significant damages, including punitive damages, and our consolidated financial position, results of operations or cash flows could be materially adversely affected.

We are subject to government regulations, including tariffs and duties that could restrict our international sales and negatively affect our business.

The United States, Germany, the European Union, China, Japan, South Korea and many other foreign governments impose tariffs and duties on the import of products, including some of those which we sell. In recent years, the U.S. instituted changes in trade policies that included the negotiation or termination of trade agreements, the imposition of higher tariffs on imports into the United States, including, in particular, on Russian and Chinese-made goods, economic sanctions on individuals, corporations or countries and other government regulations affecting trade between the United States and other countries where we conduct our business.

Policy changes and proposals could require time-consuming and expensive alterations to our business operations and may result in greater restrictions and economic uncertainty and disincentives on international trade, which could negatively impact our competitiveness in jurisdictions around the world as well as lead to an increase in costs in our supply chain. We are a multinational corporation, with manufacturing located both in the United States and internationally and with approximately 77% of our net sales arising from foreign customers. As such, we may be more susceptible to negative impacts from these tariffs or change in trade policies than other less internationally focused enterprises. In addition, new tariffs and other changes in U.S. trade policy could trigger retaliatory actions by affected countries, and certain foreign governments, including the Chinese government (which has imposed retaliatory tariffs on a range of U.S. goods including certain optical and electronic products and components), may impose trade sanctions on certain U.S. manufactured goods. Such changes by the United States and other countries have the potential to adversely impact U.S. and worldwide economic conditions, our industry and the global demand for our products, and as a result, could negatively affect our business, financial condition and results of operations.

We are subject to various environmental laws and regulations that could impose substantial costs upon us and may adversely affect our business, operating results and financial condition.

Some of our operations use substances regulated under various federal, state, local and international laws governing the environment, including those relating to the storage, use, discharge, disposal, product composition and labeling of, and human exposure to, hazardous and toxic materials. We could incur costs, fines and civil or criminal sanctions, third-party property damage or personal injury claims, or could be required to incur substantial investigation or remediation costs, if we were to violate or become liable under environmental laws. Compliance with current or future environmental laws and regulations could restrict our ability to expand our facilities or require us to acquire additional expensive equipment, modify our manufacturing processes, or incur other significant expenses in order to remain in compliance with such laws and regulations. There can be no assurance that violations of environmental laws or regulations will not occur in the future as a result of the lack of, or failure to obtain, permits, human error, accident, equipment failure or other causes.

Risks Relating to Our Common Stock

Certain trusts and a company created by the late founder of the Company collectively control over 30% of our voting power and have a significant influence on the outcome of director elections and other matters requiring stockholder approval, including a change in corporate control.

IP Fibre Devices (UK) Ltd. ("IPFD"), together with trusts created by the late founder of the Company, Dr. Valentin P. Gapontsev, beneficially own approximately 33% of our common stock. Dr. Scherbakov, our CEO, is the sole managing director of IPFD. Trustees of the trusts are officers or employees of the Company. These trustees and Dr. Scherbakov, as managing director of IPFD, have significant influence on the outcome of matters requiring stockholder approval, including election of our directors, stockholder proposals and approval of significant corporate transactions. IPFD and the trusts may vote their shares of our common stock in ways that other stockholders may consider would be adverse to the interests of the other stockholders. These significant ownership interests could delay, prevent or cause a change in control of the Company and might affect the market price of our common stock.

Provisions in our charter documents and Delaware law, and our severance arrangements, could prevent or delay a change in control of our company, even if a change in control would be beneficial to our stockholders.

Provisions of our certificate of incorporation and by-laws, including certain provisions that will take effect when founder of the Company, the late Dr. Valentin P. Gapontsev, together with his affiliates and associates, ceases to beneficially own an aggregate of 25% or more of our outstanding voting securities, may discourage, delay or prevent a merger, acquisition or change of control, even if it would be beneficial to our stockholders. The existence of these provisions could also limit the price that investors might be willing to pay in the future for shares of our common stock. These provisions include:

- authorizing the issuance of "blank check" preferred stock;
- establishing a classified board and providing that directors thereon may only be removed for cause;
- providing that directors fill board vacancies;
- prohibiting stockholder action by written consent;
- limiting the ability of stockholders to call a special meeting of stockholders;
- establishing advance notice requirements for nominations for election to the board of directors and for proposing matters to be submitted to a stockholder vote;
- supermajority stockholder approval to change certificate of incorporation and by-laws and
- lack of cumulative voting for director elections.

Section 203 of the Delaware General Corporation Law, which will apply to the Company following such time as the late Dr. Gapontsev, together with his affiliates and associates, ceases to beneficially own 25% or more of the total voting power of our outstanding shares, may prohibit business combinations with stockholders owning 15% or more of our outstanding voting stock. The terms of our employment agreements and severance plan with executives include change-of-control severance provisions which provide for the payment of cash following a termination of employment following a change of control. These provisions may discourage, delay or prevent a merger or acquisition, make a merger or acquisition costlier for a potential acquirer, or make removal of incumbent directors or officers more difficult.

General Risk Factors

We have experienced, and expect to experience in the future, fluctuations in our quarterly operating results. These fluctuations may increase the volatility of our stock price and may be difficult to predict.

We have experienced, and expect to continue to experience, fluctuations in our quarterly operating results. We believe that fluctuations in quarterly results may cause the market price of our common stock to fluctuate, perhaps substantially. Factors which may have an influence on our operating results in a particular quarter include those below and others included in the Risk Factors:

- the increase, decrease, cancellation or rescheduling of significant customer orders;
- the timing of revenue recognition based on the installation or acceptance of certain products shipped to our customers;

- the timing of customer qualification of our products and commencement of volume sales of systems that include our products;
- the gain or loss of a key customer;
- product or customer mix;
- competitive pricing pressures and new market entrants;
- our ability to design, manufacture and introduce new products on a cost-effective and timely basis;
- our ability to manage our inventory levels and any provisions for excess or obsolete inventory;
- our ability to collect outstanding accounts receivable balances;
- incurring expenses to develop and improve application and support capabilities, the benefits of which may not be realized until future periods, if at all;
- incurring expenses related to impairment of values for goodwill, intangibles and other long-lived assets;
- different capital expenditure and budget cycles for our customers, which affect the timing of their spending;
- expenses associated with acquisition-related activities;
- health pandemic; and
- our ability to control expenses.

These factors make it difficult for us to accurately predict our operating results. In addition, our ability to accurately predict our operating results is complicated by the fact that many of our products have long sales cycles, some lasting as long as twelve months or more. Once a sale is made, our delivery schedule typically ranges from four weeks to four months, and therefore our sales will often reflect orders shipped in the same quarter that they are received and will not enhance our ability to predict our results for future quarters. In addition, long sales cycles may cause us to incur significant expenses without offsetting revenues since customers typically expend significant effort in evaluating, testing and qualifying our products before making a decision to purchase them. Moreover, customers may cancel or reschedule shipments, and production difficulties could delay shipments. Accordingly, our results of operations are subject to significant fluctuations from quarter to quarter, and we may not be able to accurately predict when these fluctuations will occur.

Our inability to manage risks associated with our international customers and operations could adversely affect our business.

We have significant facilities in and our products are sold in numerous countries. Our principal markets include China, the United States, the European Union, Japan, Korea, Turkey and Russia. A substantial majority of our revenues are derived from customers outside the United States. In addition, we have substantial tangible assets outside of the United States. We anticipate that foreign sales will continue to account for a significant portion of our revenues in the foreseeable future. Our operations and sales in these markets are subject to risks inherent in international business activities, including the following and others mentioned in the Risk Factors:

- fluctuations in the values of foreign currencies;
- changes, including recession, and other general economic uncertainties affecting the macroeconomic and local economic communities in which we and our customers operate or serve;
- longer accounts receivable collection periods and less developed credit assessment and collection procedures;
- compliance with domestic and foreign laws and regulations, unexpected changes in those laws and regulatory requirements, including uncertainties regarding taxes, tariffs, quotas, export controls, export licenses, trade sanctions and other trade barriers, and any corresponding retaliatory actions by affected countries, including China and Russia;
- certification requirements;
- less effective protection of intellectual property rights in some countries;
- potentially adverse tax consequences;
- different capital expenditure and budget cycles for our customers, which affect the timing of their spending;
- political, legal and economic instability, foreign conflicts, labor unrest and the impact of regional and global infectious illnesses in the countries in which we and our customers, suppliers, manufacturers and subcontractors are located;
- preference for locally produced products;

- difficulties and costs of staffing and managing international operations across different geographic areas and cultures;
- seasonal reductions in business activities;
- fluctuations in freight rates and transportation disruptions;
- investment restrictions or requirements;
- repatriation restrictions or requirements;
- export and import restrictions; and
- limitations on the ability of our employees to travel without restriction to certain countries in which we operate.

Political, economic and monetary instability and changes in governmental regulations or policies, including trade tariffs and protectionism, could adversely affect both our ability to effectively operate our foreign sales offices and the ability of our foreign suppliers to supply us with required materials or services. Any interruption or delay in the supply of our required components, products, materials or services, or our inability to obtain these components, materials, products or services from alternate sources at acceptable prices and within a reasonable amount of time, could impair our ability to meet scheduled product deliveries to our customers and could cause customers to cancel orders.

We are subject to risks of doing business in Russia through our subsidiary, NTO-IRE Polus, which sells finished lasers to customers in Russia and supplies our Chinese subsidiary with a portion of the finished lasers they sell to customers in China. We are also subject to risks of doing business in Belarus, which provides mechanical parts to our German and Russian operations. We are also subject to risks of doing business in China, as approximately 34% of our sales in 2022 were to Chinese customers. The results of our operations, business prospects and facilities in Russia, China and Belarus are subject to the economic and political environment there and global geopolitical conditions. The future economic direction of these emerging market countries remains largely dependent upon the effectiveness of economic, financial and monetary measures undertaken by the government, together with tax, legal, regulatory and political developments. As a result of the conflict involving Russia and Ukraine, the U.S. and certain allies in Europe imposed severe economic and trade sanctions on Russia and could impose further sanctions against it. Russia has responded in kind. Sanctions imposed by any of these countries has and could disrupt our supply of critical components among our manufacturing facilities in the U.S., Germany, Russia or Belarus, and cause us to shift all or portions of work occurring in Russia or Belarus to other countries. In addition, sanctions targeting the banking sector have impacted the transfer of cash to and from Russia to fund operations or repatriate surplus liquidity. Such disruptions could negatively affect our ability to provide critical components to affiliates or produce finished goods for customers, which could increase our costs, require capital expenditures and harm our results of operations and financial condition. Further, Russia and Belarus adopted rules that impose conditions on sale of assets by U.S. and western companies and decreasing the values of assets realized, as well as payments to owners of entities there. Our failure to manage the risks associated with our operations in Russia, China and Belarus and our other existing and potential future international business operations could have a material adverse effect upon our results of operations.

Foreign currency risk may negatively affect our net sales, cost of sales and operating margins and could result in exchange losses.

We conduct our business and incur costs in the local currency of most countries in which we operate. In 2022 our net sales outside the United States represented a substantial majority of our total sales. We incur currency transaction risk whenever one of our operating subsidiaries enters into either a purchase or a sales transaction using a different currency from the currency in which it operates or holds assets or liabilities in currencies different than their functional currency. Changes in exchange rates can also affect our results of operations when the value of sales and expenses of foreign subsidiaries are translated to U.S. dollars. We cannot accurately predict the impact of future exchange rate fluctuations on our results of operations. Further, given the volatility of exchange rates, we may not be able to effectively manage our currency risks, and any volatility in currency exchange rates may increase the price of our products in local currency to our foreign customers or increase the manufacturing cost of our products, which may have an adverse effect on our financial condition, cash flows and profitability.

We pursue acquisitions and investments in new businesses, products, patents or technologies. These involve risks which could disrupt our business and may harm our financial results and condition.

We make acquisitions of and investments in new businesses, products, patents and technologies and expand into new geographic areas, or we may acquire operations, products or technologies that expand our current capabilities. Although we have pursued relatively small acquisitions in the past, we may pursue larger transactions in the future. Acquisitions present a number of potential risks and challenges that could, if not met, disrupt our business operations, increase our operating costs, reduce consolidated margins, cause us to incur impairment charges and reduce the value of the acquired company, asset or technology to us. We may not be able to effectively integrate acquired businesses, business cultures, products, patents or technologies into our existing business and products, or retain key employees. As a result of the rapid pace of technological change in our industry, we may misjudge the long-term potential of an acquired business, product, patent or technology, or the acquisition may not be complementary to our existing business. Furthermore, potential acquisitions and investments, whether or not consummated, may divert our management's attention, require considerable cash outlays at the expense of our existing operations, incur unanticipated costs or liabilities, including the costs associated with improving the internal controls of the acquired company. In addition, to complete future acquisitions, we may issue equity securities, incur debt, assume contingent liabilities or have amortization expenses and write-downs of acquired assets, which could adversely affect our profitability and result in dilution to our existing and future stockholders.

We may incur impairments to goodwill or long-lived assets, which would negatively affect our results of operations.

We review our goodwill for impairment annually and other long-lived assets, including intangible assets identified in business combinations whenever events or changes in circumstances indicate that the carrying amount of these assets may not be recoverable. Negative industry or economic trends, including reduced estimates of future cash flows, disruptions to our business including those from government regulations, sanctions or tariffs, slower growth rates, lack of growth in our relevant business units or differences in the estimated product acceptance rates could lead to impairment charges against our long-lived assets, including goodwill and other intangible assets.

Our valuation methodology for assessing impairment requires management to make significant judgments and assumptions based on historical experience and to rely heavily on projections of future operating performance at many points during the analysis. Also, the process of evaluating the potential impairment of long-lived assets is subjective. We operate in a highly competitive environment and projections of future operating results and cash flows may vary significantly from actual results. Additionally, if our analysis indicates potential impairment to long-lived assets in one or more of our reporting units, we may be required to record additional charges to earnings in our financial statements, which could negatively affect our results of operations. In 2022, long-lived asset impairments related to our Russian operations were $79.0 million.

We are exposed to credit risk and fluctuations in the market values of our cash, cash equivalents and marketable securities.

Given the global nature of our business, we have both domestic and international investments. At December 31, 2022, 76% of our cash, cash equivalents and marketable securities were in the United States and 24% were outside the United States. Credit ratings and pricing of our investments can be negatively affected by liquidity, credit deterioration, prevailing interest rates, financial results, economic risk, political risk, sovereign risk or other factors. Also, our investments may be negatively affected by events that impact the banks or depositories that hold our investments. As a result, the value and liquidity of our cash, cash equivalents and marketable securities may fluctuate substantially. Therefore, although we have not realized any significant losses on our cash, cash equivalents and marketable securities, future fluctuations in their value could result in a significant realized loss.

Our ability to access financial markets to raise capital or finance a portion of our working capital requirements and support our liquidity needs may be adversely affected by factors beyond our control and could negatively impact our ability to finance our operations, meet certain obligations, implement our operating strategy or complete acquisitions.

We occasionally borrow under our existing credit facilities to fund operations, including working capital investments. Our major credit lines in the United States and Germany expire in April 2025 and July 2023, respectively. Uncertainty or disruptions in financial markets may negatively impact our ability to access additional financing or to refinance our existing credit facilities or existing debt arrangements on favorable terms or at all, which could negatively affect our ability to fund current and future expansion as well as future acquisitions and development. These disruptions may include turmoil in the financial services industry, unprecedented volatility in the markets where our outstanding securities trade, changes in reference rates for interest such as the discontinuation of LIBOR in 2023 and general economic downturns in the areas where we do business. If we are unable to access funds at competitive rates, or if our short-term or long-term borrowing costs increase, our ability to finance our operations, meet our short-term obligations and implement our operating strategy could be adversely affected. We also may in the future be required to raise capital through public or private financing or other arrangements. Such financing may not be available on acceptable terms, or at all, and our failure to raise capital when needed could harm our business.

ITEM 1B. *UNRESOLVED STAFF COMMENTS*

None.

ITEM 2. *PROPERTIES*

Our significant facilities at December 31, 2022 include the following:

Location	Owned or Leased	Lease Expiration	Approximate Size (sq. ft.)	Primary Activity
Oxford, Massachusetts	Owned		550,300	Diodes, components, final assembly, complete device manufacturing, R&D, administration
Burbach, Germany	Owned		553,500	Optical fiber, components, final assembly, complete device manufacturing, R&D, administration
	Leased	May 2027	14,348	Complete device manufacturing
Fryazino, Russia	Owned		496,000	Optical fiber, components, final assembly, complete device manufacturing, R&D, administration
	Leased	May 2023 - November 2026	172,300	Components, complete device manufacturing
Marlborough, Massachusetts	Owned		389,800	Components, systems manufacturing, applications, sales, R&D, administration
Minsk, Belarus	Owned		372,100	Manufacturing of cabinets and mechanical subcomponents
Davenport, Iowa	Owned		160,300	Systems integration, sales, administration

Our corporate headquarters is in Marlborough, Massachusetts. As of December 31, 2022, we occupied more than 3.4 million square feet of facilities worldwide. Of this we own 2.9 million square feet and lease 0.5 million square feet of building space, of which the majority is used for manufacturing. We operate four principal manufacturing facilities for fiber lasers, laser systems, fiber amplifiers, and related optical and mechanical components, which are located in the United States, Germany, Russia and Belarus. We conduct our major research and development activities in Oxford and Marlborough, Massachusetts and Burbach, Germany.

We own additional facilities and land for various purposes, such as sales and support and applications labs. We believe the existing facilities are in good operating condition and are suitable for the conduct of our operations. The productive capacity at our current facilities is substantially utilized. We plan to continue the expansion of our manufacturing operations in Germany, the United States, Italy and Poland to meet the demand for our products and our sales and support needs. In response to the risks from the Russia-Ukraine conflict, we have been executing on plans to reduce our reliance on our Russia and Belarus operations by adding capacity in other countries.

ITEM 3. *LEGAL PROCEEDINGS*

From time to time, we are party to various legal claims and legal proceedings and other disputes incidental to our business, such as employment, intellectual property or product issues. For a discussion of the risks associated with such matters, see Item 1A. "*Risk Factors — In the past, we were subject to litigation alleging that we infringed third-party intellectual property rights. Intellectual property claims could result in costly litigation and harm our business*" and "*Risk Factors — We must comply with and could be impacted by various export controls and trade and economic sanctions laws and regulations that could negatively affect our business and may change due to diplomatic and political considerations outside of our control."*

ITEM 4. *MINE SAFETY DISCLOSURES*

Not applicable.

PART II

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

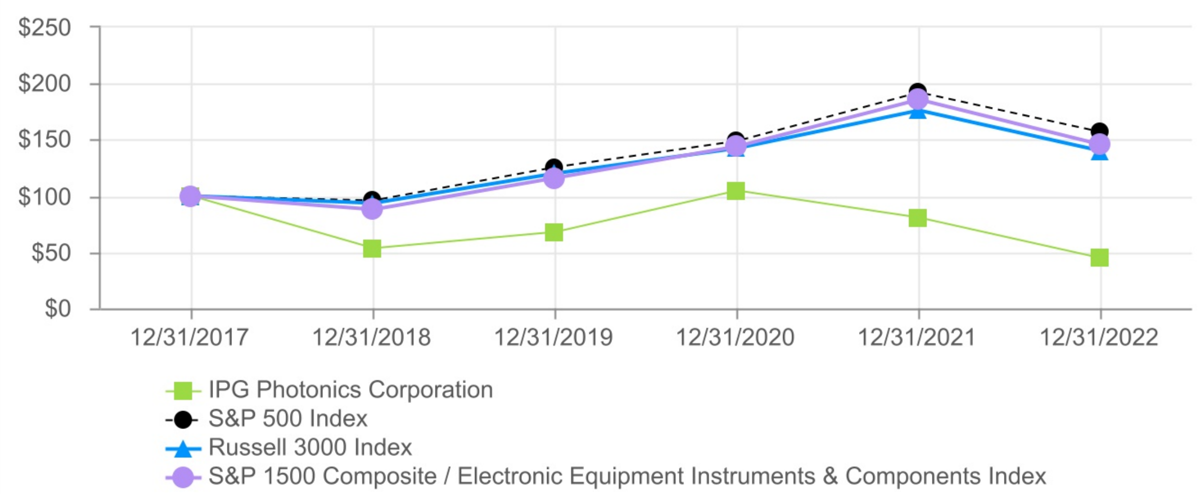
Our common stock is quoted on the Nasdaq Global Select Market under the symbol "IPGP". As of February 24, 2023, there were 47,627,143 shares of our common stock outstanding held by 30 holders of record, which does not include beneficial owners of common stock whose shares are held in the names of various securities brokers, dealers and registered clearing agencies.

Stock Price Performance Graph

The following Stock Price Performance Graph and related information includes comparisons required by the SEC. The graph does not constitute "soliciting material" and should not be deemed "filed" or incorporated by reference into any other filings under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, except to the extent that we specifically incorporate this information by reference into such filing.

The following graph presents the cumulative shareholder returns for our Common Stock compared with the S&P 500 Index, the Russell 3000 Index and the S&P 1500 Composite 1500 / Electronic Equipment Instruments & Components Index. We include the Russell 3000 Index because we ceased being a member of the S&P 500 Index in June 2022. We include the S&P 500 Index because it was the index used in the graph in the 10-K for the immediately preceding fiscal year. We include the S&P Composite 1500 / Electronic Equipment Instruments & Components Index because outstanding performance stock units awarded to executive officers use this index when comparing total shareholder return and due to our being an index member, industry similarities, our internal use to monitor executive compensation, and the fact that it contains several direct competitors.

COMPARISON OF CUMULATIVE TOTAL RETURN
AMONG THE COMPANY, THE S&P 500 INDEX, AND THE S&P 1500 COMPOSITE / ELECTRONIC EQUIPMENT INSTRUMENTS & COMPONENTS INDEX



	Base Period	5-Year Cumulative Total Return				
	12/31/2017	12/31/2018	12/31/2019	12/31/2020	12/31/2021	12/31/2022
IPG Photonics Corporation	$ 100.00	$ 52.91	$ 67.68	$ 104.51	$ 80.39	$ 44.21
S&P 500 Index	$ 100.00	$ 95.62	$ 125.72	$ 148.85	$ 191.58	$ 156.88
Russell 3000 Index	$ 100.00	$ 93.01	$ 119.55	$ 142.06	$ 176.16	$ 140.08
S&P 1500 Composite / Electronic Equipment Instruments & Components Index	$ 100.00	$ 87.48	$ 116.05	$ 143.73	$ 185.67	$ 145.24

The above graph represents and compares the value, through December 31, 2022, of a hypothetical investment of $100 made at the closing price on December 31, 2017 in each of (i) our common stock, (ii) S&P 500 Index, (iii) Russell 3000 Index, and (iv) the S&P 1500 Composite / Electronic Equipment Instruments & Components Index, in each case assuming the reinvestment of dividends. The stock price performance shown in this graph is not necessarily indicative of, and not is intended to suggest, future stock price performance.

Dividends

We currently intend to retain future earnings for use in our business and do not anticipate paying cash dividends in the foreseeable future. Any future determination related to our dividend policy will be made at the discretion of our Board of Directors, taking into account any contractual and legal restrictions on our payment of dividends.

Recent Sales of Unregistered Securities; Use of Proceeds from Registered Securities

None.

Issuer Purchases of Equity Securities

The following table shows repurchases of our common stock in the fiscal quarter ended December 31, 2022:

Date	Total Number of Shares (or Units) Purchased		Average Price Paid per Share (or Unit)	Total Number of Shares (or Units) Purchased as Part of Publicly Announced Plans or Programs	Maximum Number (or Approximate Dollar Value) of Shares (or Units) that May Yet Be Purchased Under the Plans or Programs
October 1, 2022 — October 31, 2022	680,578	(2)	$ 86.67	680,578	$ 169,759
November 1, 2022 — November 30, 2022	286	(1)	87.87	—	169,759
December 1, 2022 — December 31, 2022	618,493	(1), (2)	93.15	618,416	112,153
Total	1,299,357		$ 89.75	1,298,994	$ 112,153

(1) In 2012, our Board of Directors approved "withhold to cover" as a tax payment method for vesting of restricted stock awards for certain employees. Pursuant to the "withhold to cover" method, we withheld from such employees the shares noted in the table above to cover tax withholding related to the vesting of their awards. For the fourth quarter of 2022, the Company withheld 363 shares at an average price of $88.92.

(2) The previously announced stock repurchase programs authorized in May 2020 and February 2022 were completed in the second quarter of 2022. On August 2, 2022, we announced that our Board of Directors authorized the purchase of up to $300 million of IPG common stock (the "August 2022 authorization"), exclusive of any fees, commissions or other expenses. Share repurchases under this purchase authorization were made periodically in open-market transactions using our working capital, and were subject to market conditions, legal requirements and other factors. The share purchase program authorizations did not obligate us to repurchase any dollar amount or number of our shares, and repurchases could be commenced or suspended from time to time without prior notice.

We repurchased 1,298,994 shares in the fourth quarter of 2022 under the August 2022 authorization.

ITEM 6. *RESERVED*

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

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our consolidated financial statements and related notes included in this Annual Report on Form 10-K. This discussion contains forward-looking statements that involve risks and uncertainties. Our actual results could differ materially from those anticipated in these forward-looking statements as a result of certain factors including, but not limited to, those discussed under Item 1A, "Risk Factors." The following analysis generally discusses 2022 and 2021 items and year-to-year comparisons between 2022 and 2021. Discussions of 2020 items and year-to-year comparisons between 2021 and 2020 that are not included in this Form 10-K can be found in "Management's Discussion and Analysis of Financial Condition and Results of Operations" in our Annual Report on Form 10-K for the fiscal year ended December 31, 2021 filed with the SEC on February 22, 2022.

Overview

We develop, manufacture and sell high-performance fiber lasers, fiber amplifiers and diode lasers that are used for diverse applications, primarily in materials processing. We also manufacture and sell complementary products used with our lasers including optical delivery cables, fiber couplers, beam switches, optical processing heads, in-line sensors and chillers. In addition, we offer laser-based and non-laser based systems for certain markets and applications. Our portfolio of laser solutions are used in materials processing, communications, medical and advanced applications. We sell our products globally to original equipment manufacturers ("OEMs"), system integrators and end users. We market our products internationally, primarily through our direct sales force.

We are vertically integrated such that we design and manufacture most of the key components used in our finished products, from semiconductor diodes to optical fiber preforms, finished fiber lasers, amplifiers and complementary products. Our vertically integrated operations allow us to reduce manufacturing costs, control quality, rapidly develop and integrate advanced products and protect our proprietary technology.

Description of Our Net Sales, Costs and Expenses

Net sales. We derive net sales primarily from the sale of fiber lasers, diode lasers, laser and non-laser based systems, amplifiers and complementary products. We sell our products to OEMs that supply materials processing laser systems, communications systems, medical laser systems and other laser systems to end users. With the sale of our telecommunications transmission product lines to Lumentum Holdings Inc. in August 2022, we no longer intend to target communications as a principal market. We also sell our laser products and laser and non-laser based systems to end users. Our scientists and engineers work closely with OEMs, systems integrators and end users to analyze their system requirements and match appropriate fiber laser, amplifier or system specifications to those requirements. Our sales cycle varies substantially, ranging from a period of a few weeks to as long as one year or more, but is typically several months.

Sales of our products are generally recognized upon shipment, provided that no obligations remain and collection of the receivable is reasonably assured. Sales of customized large scale material processing systems are recognized over time. Our sales typically are made on a purchase order basis rather than through long-term purchase commitments.

We develop our products to standard specifications and use a common set of components within our product architectures. Our major products are based upon a common technology platform. We continually enhance these and other products by improving their components and developing new components and new product designs.

Cost of sales. Our cost of sales consists primarily of the cost of raw materials and components, direct labor expenses and manufacturing overhead. We are vertically integrated and currently manufacture all critical components for our products as well as assemble finished products. We believe our vertical integration allows us to increase efficiencies, leverage our scale and lower our cost of sales. Cost of sales also includes personnel costs and overhead related to our manufacturing, engineering and service operations, related occupancy and equipment costs, shipping costs and reserves for inventory obsolescence and for warranty obligations. Inventories are written off and charged to cost of sales when identified as excess or obsolete.

Due to our vertical integration strategy and ongoing investment in plant and machinery, we maintain a relatively high fixed manufacturing overhead. We may not be able to or choose not to adjust these fixed costs to adapt to rapidly changing market conditions. Our gross margin is therefore significantly affected by our sales volume and the corresponding utilization of capacity and absorption of fixed manufacturing overhead expenses.

Sales and marketing. Our sales and marketing expense consists primarily of costs related to compensation, trade shows, professional and technical conferences, travel, facilities, depreciation of equipment used for demonstration purposes and other marketing costs.

Research and development. Our research and development expense consists primarily of compensation, development expenses related to the design of our products and certain components, the cost of materials and components to build prototype devices for testing and facilities costs. Costs related to product development are recorded as research and development expenses in the period in which they are incurred.

General and administrative. Our general and administrative expense consists primarily of compensation and associated costs for executive management, finance, legal, human resources, information technology and other administrative personnel, outside legal and professional fees, insurance premiums and fees, allocated facilities costs and other corporate expenses such as charges and benefits related to the change in allowance for doubtful debt.

Factors and Trends That Affect Our Operations and Financial Results

In reading our financial statements, you should be aware of the following factors and trends that our management believes are important in understanding our financial performance.

Russia-Ukraine Conflict. The Russia-Ukraine conflict and the sanctions imposed in response to this crisis have increased the levels of uncertainty and risks facing the Company due to our manufacturing operations in Russia and Belarus. Sales to third-parties in Russia were approximately 3% of our revenue in 2022 and our Russian subsidiary supplies finished goods for our China market. The total value of product shipped to the Chinese market from Russia was approximately $62 million for the year ended December 31, 2022 of which $8 million was shipped in the fourth quarter. In addition, our Russia facility manufactures certain components that are used in our other manufacturing facilities. Since the start of the conflict, we have navigated complex and evolving regulations, including sanctions and faced increased costs from operating in Russia and Belarus as a result of shipping limitations, logistics challenges and changes in tariffs. The U.S. increased tariffs on Russian and Belarus goods in the second quarter of 2022, impacting the results of operations for the remainder of the 2022.

In response to the risks from the Russia-Ukraine conflict, we have been executing on plans to reduce our reliance on our Russia and Belarus operations by adding capacity in other countries, increasing inventories worldwide, and qualifying third-party suppliers. In 2022, we began hiring and training additional employees, expanding capacity for increased production, and running additional shifts in the U.S. and Germany and adding additional manufacturing capacity in Italy and Poland.

In October 2022, the European Union introduced new sanctions that restrict our ability to ship and receive components from our factory in Russia to the E.U. beginning in January 2023. We believe the contingency measures outlined above that we have already put in place mitigate substantially all the effects of the recent sanctions on our ability to supply finished products to customers. If we have not fully mitigated the effect of these and other trade restrictions, or if new sanctions are adopted, our ability to supply finished products to customers could be impacted. Although we believe our contingency plans mitigate the risk of our ability to supply customers with finished product, these plans require additional investments in facilities outside of Russia and Belarus in the near term as well as additional ongoing operating costs, primarily associated with the higher cost of labor outside of Russia and Belarus. While we have sufficient financial resources to make these investments and expenditures, our gross margins and financial results have been and will be adversely impacted by increased operating costs associated with these transitions. Over time, we intend to mitigate some of these increases by producing components in countries with lower labor costs than the United States and Germany, with ongoing product expense reduction initiatives, higher productivity from automation, improved yields and product specifications. We are also continuing to review our operations in Russia and Belarus.

Given the sanctions introduced by the European Union in October 2022, which imposed further restrictions on our Russian operations, we evaluated the recoverability of certain assets located in Russia during the fourth quarter of 2022. As a result, we recorded $74.1 million of inventory provision and related charges which are included in cost of sales, a $79.0 million charge for the impairment of long-lived assets and a $35.5 million valuation allowance for deferred tax assets which is included in provision for income taxes. We also recorded charges of $8.5 million for restructuring-related costs. The remaining total asset value in Russia is $129.5 million, of which $75.4 million is cash and short term investments. We have $22.2 million of total liabilities. In addition, the net value of assets in Russia has been reduced by $116.9 million due to the cumulative translation affect of the Russian ruble compared to the U.S. dollar, which is included in the accumulated comprehensive loss component of stockholders' equity. Depending upon the outcome of our review of our Russian operations, the cumulative translation affect of foreign exchange fluctuations that is currently included in accumulated comprehensive loss on our consolidated balance sheets may be charged to our consolidated statements of income.

We continue to manufacture laser cabinets and other mechanical components in Belarus. Trade sanctions to date have not significantly affected our ability to supply these items from Belarus to other manufacturing locations. The value of the long-lived assets in Belarus was $39.4 million at December 31, 2022, and we had working capital excluding cash and short-term investments of $4.7 million in Belarus of which $4.9 million is inventory. In addition, we had $4.7 million cash and short-term investments in Belarus. If additional sanctions are imposed on Belarus or Belarus places restrictions on our operations there, it could trigger an asset impairment evaluation and may result in additional impairment charges in the future.

Our Board of Directors has been monitoring and continues to assess and monitor risks to our business associated with the Russia-Ukraine conflict and our Russian and Belarus operations. Our Directors request and receive management reports from management regarding our Russian and Belarus operations, contingency planning and execution, and impacts on our business at its quarterly and special meetings.

COVID-19. Global demand trends have been impacted by the ongoing COVID-19 pandemic and therefore remain uncertain at this time. While business conditions generally improved from the severe contraction experienced in 2020, it is difficult to predict whether conditions could change if there are additional restrictions imposed as a result of a resurgence in

COVID-19 infections. To date, we have been able to accommodate these challenges to our business operations and continue to meet customer demand. If guidelines or mandates from relevant authorities becomes more restrictive due to a resurgence of COVID-19 in a particular region, the effect on our operations could be more significant. This uncertainty continues to make forecasting our business challenging in the near to medium-term.

Supply Chain. We and our customers are experiencing increased lead times and costs for certain components purchased from third party suppliers; particularly electronic components. We, our customers and our suppliers continue to face constraints related to supply chain and logistics, including availability of capacity, materials, air cargo space, sea containers and higher freight rates. Supply chain and logistics constraints are expected to continue for the foreseeable future and could impact our ability to supply products and our customers' demand for our product or readiness to accept deliveries. Supply chain constraints have not significantly affected our business but they have moderately increased our freight costs, caused us to carry higher levels of safety stock for certain inventory items, increased the cost of certain electronic components, pushed out customer deliveries and caused delays in recognizing revenue for certain custom processing systems in our Genesis business due to delays in receiving robots. Notwithstanding these effects, we believe we have the ability to meet the near-term demand for our products, but the situation is fluid and subject to change.

Net sales. Our annual revenue growth rates have varied from year to year. Net sales decreased by 2% in 2022, increased by 22% in 2021 and decreased 9% in 2020. Our growth rates are subject to several factors, many of which are not in our control. These include:

- Macroeconomic conditions including changes in foreign exchange rates compared to the U.S. dollar.
- Competition;
- Our ability to develop new products and new applications for existing or new products;
- Geopolitical conditions in our end markets; and
- Pandemic, plagues, wars, conflicts, natural disasters or other shocks affecting global trade.

In 2022, the decrease in net sales was driven by a weakening macroeconomic environment and increased competition in the Chinese cutting market partially offset by increased sales of new products, such as Adjustable Mode Beam ("AMB") lasers, LightWELD, high power pulsed lasers and green pulsed lasers, and sales of existing products into growing applications, such as welding applications and foil cutting for battery and electric vehicle manufacturing. In 2021, the increase in net sales was driven by improvement in the macroeconomic environment driven by recoveries from the COVID-19 pandemic. In 2020, the decline in net sales was driven by decreased demand for our products related to the COVID-19 pandemic that extended and deepened the weak macroeconomic environment prevailing at the end of 2019.

Our business depends substantially upon capital expenditures by end users, particularly by manufacturers using our products for materials processing, which includes general manufacturing, automotive including electric vehicles (EV), other transportation, aerospace, heavy industry, consumer, semiconductor and electronics. Approximately 90% of our revenues in 2022 were from customers using our products for materials processing. Although applications within materials processing are broad, the capital equipment market in general is cyclical and historically has experienced sudden and severe downturns. For the foreseeable future, our operations will continue to depend upon capital expenditures by end users of materials processing equipment and will be subject to the broader fluctuations of capital equipment spending.

In response to inflation, some global central banks are adopting less accommodating monetary policy and have increased benchmark interest rates in several major global economies with further increases in interest rates expected in 2023. The increase in interest rates is intended to dampen demand that could lead to regional or global recession that may reduce demand for our products. In addition, an increase in interest rates would increase the cost of equipment financed with leases or debt.

In recent years, our net sales and margins have been negatively impacted by tariffs and trade policy. New tariffs and other changes in U.S. trade policy could trigger retaliatory actions by affected countries, and certain foreign governments.

We are also susceptible to global or regional disruptions such as political instability, geopolitical conflicts, acts of terrorism, significant fluctuations in currency values, natural disasters, macroeconomic concerns and the impact of the COVID-19 outbreak that affect the level of capital expenditures or global commerce. With respect to the COVID-19 outbreak specifically, the possible affect over the longer term remains uncertain and dependent on future developments that cannot be accurately predicted at this time, such as the severity and transmission rate of COVID-19 or new variants, the extent and effectiveness of containment actions taken, the approval, effectiveness, timing and widespread vaccination of the global population, and the impact of these and other factors on our customer base and general commercial activity.

The average selling prices of our products generally decrease as the products mature. These decreases result from factors such as increased competition, decreased manufacturing costs and increases in unit volumes. We may also reduce selling prices in order to penetrate new markets and applications. Furthermore, we may negotiate discounted selling prices from time to time with certain customers that place high unit-volume orders.

The secular shift to fiber laser technology in large materials processing applications, such as cutting applications, had a positive effect on our sales trends in the past such that our sales trends were often better than other capital equipment manufacturers in both positive and negative economic cycles. As the secular shift to fiber laser technology matures in such applications, our sales trends are more susceptible to economic cycles, which can broadly affect the demand for capital equipment including machine tools and industrial lasers, and competition from other fiber laser manufacturers.

Gross margin. Our total gross margin in any period can be significantly affected by a number of factors, including net sales, production volumes, competitive factors, product mix, and by other factors such as changes in foreign exchange rates relative to the U.S. dollar. Many of these factors are not under our control. The following are examples of factors affecting gross margin:

- As our products mature, we can experience additional competition, which tends to decrease average selling prices and affects gross margin;
- Our gross margin can be significantly affected by product mix. Within each of our product categories, the gross margin is generally higher for devices with greater average power. These higher power products often have better performance, more difficult specifications to attain and fewer competing products in the marketplace;
- Higher power lasers also use a greater number of optical components, improving absorption of fixed overhead costs and enabling economies of scale in manufacturing;
- The gross margin for certain specialty products may be higher because there are fewer or sometimes no equivalent competing products;
- Customers that purchase devices in greater unit volumes generally are provided lower prices per device than customers that purchase fewer units. In general, lower selling prices to high unit volume customers reduce gross margin although this may be partially offset by improved absorption of fixed overhead costs associated with larger product volumes, which drive economies of scale;
- Gross margin on systems can be lower than gross margin for our laser and amplifier sources, depending on configuration, volume and competitive forces, among other factors;
- Persistent inflation leading to increases in average manufacturing salaries as well as an increase in the purchase price of components including, but not limited to, electronic components and metal parts could negatively impact gross margin if we are not able to pass those increases on to customers by increasing the selling price of our products; and finally,
- Changes in relative exchange rates between currencies we receive when selling our products and currencies we use to pay our manufacturing expenses.

We expect that some new technologies, products and systems will have returns above our cost of capital but may have gross margins below our corporate average. If we are able to develop opportunities that are significant in size, competitively advantageous or leverage our existing technology base and leadership, our current gross margin levels may not be maintained. Instead, we aim to deliver industry-leading levels of gross margins by growing sales, by taking market share in existing markets, or by developing new applications and markets we address, by reducing the cost of our products and by optimizing the efficiency of our manufacturing operations.

We invested $110.1 million, $123.1 million and $87.7 million in capital expenditures in 2022, 2021 and 2020, respectively. Most of this investment relates to expansion of our manufacturing capacity and, to a lesser extent, research and development and sales-related facilities.

A high proportion of our costs is fixed so costs are generally difficult to adjust or may take time to adjust in response to changes in demand. In addition, our fixed costs increase as we expand our capacity. If we expand capacity faster than is required by sales growth, gross margins could be negatively affected. Gross margins generally decline if production volumes are lower as a result of a decrease in sales or a reduction in inventory because the absorption of fixed manufacturing costs will be reduced. Gross margins generally improve when the opposite occurs. If both sales and inventory decrease in the same period, the decline in gross margin may be greater if we cannot reduce fixed costs or choose not to reduce fixed costs to match the decrease in the level of production. If we experience a decline in sales that reduces absorption of our fixed costs, or if we have production issues, our gross margins will be negatively affected.

We also regularly review our inventory for items that are slow-moving, have been rendered obsolete or are determined to be excess. Any provision for such slow-moving, obsolete or excess inventory affects our gross margins. For example, we recorded provisions for slow-moving, obsolete or excess inventory and other inventory related charges totaling $128.0 million, $34.3 million and $45.4 million in 2022, 2021 and 2020, respectively. Inventory provision and related charges of $74.1 million in 2022 are attributable to Russian operations.

Selling and general and administrative expenses. In the past, the Company has invested in selling and general and administrative costs in order to support continued growth in the Company. As the secular shift to fiber laser technology matures, our sales growth becomes more susceptible to the cyclical trends typical of capital equipment manufacturers. Accordingly, our future management of and investments in selling and general and administrative expenses will also be influenced by these trends, although we may still invest in selling or general and administrative functions to support certain initiatives even in economic down cycles. Certain general and administrative expenses are not related to the level of sales and may vary quarter to quarter due to acquisitions, litigation and project related consulting expenses.

Research and development expenses. In 2022 our research and development expenses decreased primarily due to a reduction of expenses associated with our telecommunications transceiver business, which was sold in August 2022. Going forward, we plan to continue to invest in research and development to improve our existing components and products and develop new components, products, systems and applications technology. We believe that these investments will sustain our position as a leader in the fiber laser industry and will support development of new products that can address new markets and growth opportunities. The amount of research and development expense we incur may vary from period to period. As part of the telecommunications transmission product line divestiture mentioned above, we will no longer be incurring research and development expenses attributed to the development of telecommunications transmission products.

Goodwill and long-lived assets impairments. We review our intangible assets and property, plant and equipment for impairment when events or changes in circumstances indicate the carrying value may not be recoverable. Goodwill is required to be tested for impairment at least annually. Negative industry or economic trends, including reduced estimates of future cash flows, disruptions to our business, slower growth rates, lack of growth in our relevant business units, differences in the estimated product acceptance rates, or market prices below the carrying value of long-lived assets evaluated for sale could lead to impairment charges against our long-lived assets, including goodwill and other intangible assets. We are evaluating the sale of certain U.S.-based assets, including land and buildings. If the estimated sales value of any of these assets is below carrying value, then we may need to record an asset impairment charge when they are classified as held-for-sale. We have long-lived assets in Belarus with a carrying value of $39.4 million. If sanctions increase or if the geopolitical situation changes such that we can no longer use Belarus as a source of supply for our laser cabinets and other mechanical components, we may need to evaluate those assets for impairment, which may result in impairment charges.

Our valuation methodology for assessing impairment requires management to make significant judgments and assumptions based on historical experience and to rely heavily on projections of future operating performance at many points during the analysis. Also, the process of evaluating the potential impairment of goodwill is subjective. We operate in a highly competitive environment and projections of future operating results and cash flows may vary significantly from actual results. If our analysis indicates potential impairment to goodwill in one or more of our reporting units, we may be required to record charges to earnings in our financial statements, which could negatively affect our results of operations.

Foreign exchange. Because we are a U.S. based company doing business globally, we have both translational and transactional exposure to fluctuations in foreign currency exchange rates. Changes in the relative exchange rate between the U.S. dollar and the foreign currencies in which our subsidiaries operate directly affects our sales, costs and earnings. Differences in the relative exchange rates between where we sell our products and where we incur manufacturing and other operating costs (primarily in the U.S., Germany, Russia, and Belarus) also affects our costs and earnings. Certain currencies experiencing significant exchange rate fluctuations like the euro, the Russian ruble, Chinese yuan and the Japanese yen have had and could have an additional significant impact on our sales, costs and earnings. Our ability to adjust the foreign currency selling prices of products in response to changes in exchange rates is limited and may not offset the impact of the changes in exchange rates on the translated value of sales or costs. In addition, if we increase the selling price of our products in local currencies, this could have a negative impact on the demand for our products.

Major customers. While we have historically depended on a few customers for a large percentage of our annual net sales, the composition of this group can change from year to year. Net sales derived from our five largest customers as a percentage of our annual net sales were 15%, 19% and 24% in 2022, 2021 and 2020, respectively. One of our customers accounted for 14% and 22% of our net accounts receivable as of December 31, 2022 and 2021, respectively. We seek to add new customers and to expand our relationships with existing customers. We anticipate that the composition of our significant customers will continue to change. We generally do not enter into agreements with our customers obligating them to purchase a fixed number or large volume of our fiber lasers or amplifiers. If any of our significant customers were to substantially reduce their purchases from us, our results would be adversely affected.

Critical Accounting Policies and Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States ("GAAP") requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of net sales and expenses. Refer to Note 1, "Nature of Business and Summary of Significant Accounting Policies," in our consolidated financial statements for additional information. By their nature, these estimates and judgments are subject to an inherent degree of uncertainty. We base our estimates and judgments on our historical experience and on other assumptions that we believe are reasonable under the circumstances, the results of which form the basis for making the judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results could differ from those estimates, which may materially affect our operating results and financial position. We have identified the following items that require the most significant judgment and often involve complex estimation:

Revenue Recognition. Revenue is recognized when transfer of control to the customer occurs (i.e., when our performance obligation is satisfied) in an amount reflecting the consideration that we expect to be entitled. For the majority of our revenue, this typically occurs at a point in time such as shipment or delivery date, but can occur over time for certain of our customized large scale materials processing systems contracts. We also recognize revenue over time for sales of extended warranties. When goods or services have been delivered to the customer, but all conditions for revenue recognition have not been met, deferred revenue and deferred costs are recorded on our consolidated balance sheets.

Judgments and Uncertainties: Recognizing revenue at shipment or delivery involves some judgment, particularly when we receive orders with multiple delivery dates. We allocate the transaction price of the contract to each delivery date based upon the standalone selling price of each distinct product in the contract. We invoice for each scheduled delivery upon shipment and recognize revenue for such delivery when transfer of control has occurred. Recognizing revenue over time for customized large scale materials processing systems contracts is based on our judgment that these systems do not have an alternative use and we have an enforceable right to payment for performance completed to date. Recognizing revenue over time also requires estimation of the progress towards completion based on the projected costs of the contract.

Sensitivity of Estimate to Change: Recognizing revenue at a point in time is sensitive to changes in shipping or delivery dates. Revenue recognition over time is sensitive to the actual costs incurred as compared to the projected total cost of the project. We monitor the actual and projected costs of these contracts closely. A change in the projected cost of a project will affect the estimated percentage of completion, the amount of revenue recognized and estimated gross margin.

Inventory. We maintain a reserve for excess or obsolete inventory items. The reserve is based upon a review of inventory materials on hand, which we compare with historic usage, estimated future usage and age. In addition, we review the inventory and compare recorded costs with estimates of current market value. Write-downs are recorded to reduce the carrying value to the net realizable value with respect to any part with costs in excess of current market value. In the fourth quarter of 2022, we performed a review of the inventory in Russia in light of new sanctions which restricted our Russian factory's ability to supply components and finished goods to other IPG locations. We recorded $74.1 million of additional inventory provision and related charges as a result of that review.

Judgments and Uncertainties: Estimating demand and current market values is inherently difficult, particularly given that we make highly specialized components and products. We determine the valuation of excess and obsolete inventory by making our best estimate considering the current quantities of inventory on hand and our forecast of the need for this inventory to support future sales of our products. We often have limited information on which to base our forecasts. If future sales differ from these forecasts, the valuation of excess and obsolete inventory may change and additional inventory provisions may be required.

Sensitivity of Estimate to Change: Because of our vertical integration, a significant or sudden decrease in sales could result in a significant change in the estimates of excess or obsolete inventory valuation. We recorded provisions for slow-moving, obsolete or excess inventory, and inventory related charges totaling $128.0 million, $34.3 million and $45.4 million in 2022, 2021 and 2020, respectively. Because our calculation of slow-moving, excess or obsolete inventory is based on historical and estimated future use of inventory items, the calculation is affected by sales trends. In 2020, as sales decreased due to the impact of the COVID 19 pandemic and other factors, our provisions for slow-moving, excess and obsolete inventory reserves increased. In 2021, as sales increased due to recovery from the impact of the Covid 19 pandemic and other factors, our provisions for slow-moving, excess and obsolete inventory reserves decreased. As mentioned above, in the fourth quarter of

2022, we recorded inventory provision and related charges of $74.1 million. For the rest of our operations, as safety stock increased excess and obsolete inventory reserves increased.

Long-lived Asset Impairment Definite-lived intangible assets are amortized on a straight-line basis over the estimated useful life. We review definite-lived intangible assets for impairment when conditions exist that indicate the carrying amount of the assets may not be recoverable. Such conditions could include significant adverse changes in the business climate, current-period operating or cash flow losses, significant declines in forecasted operations, or a current expectation that an asset group will be disposed of before the end of its useful life. We perform undiscounted operating cash flow analyses to determine if an impairment exists. When testing for impairment of definite-lived intangible assets held for use, we group assets at the lowest level for which cash flows are separately identifiable. If an impairment is determined to exist, the loss is calculated based on estimated fair value. In the fourth quarter of 2022, we performed a review of the estimated of fair value of the long-lived assets in Russia in light of new sanctions and recorded long-lived asset impairment of $79.0 million as a result of that review.

Judgments and Uncertainties: Estimating undiscounted operating cash flow used to determine if there is indication of impairment of a long lived asset requires us to make assumptions and estimates regarding our future plans, as well as industry, economic, and regulatory conditions. Fair value estimates performed if there is indication of impairment are subject to underlying changes in estimates and market conditions. Assumptions used in long-lived asset impairment are made at a point in time and require significant judgment; therefore, they are subject to change based on the facts and circumstances present at each impairment test date.

Sensitivity of Estimate to Change: Undiscounted cash flow and fair value are sensitive to changes in underlying assumptions, estimates, and market factors. We recorded long-lived asset impairment charge of $79.9 million, nil, and $0.7 million in 2022, 2021 and 2020, respectively.

Income Taxes and Deferred Taxes. Our annual tax rate is based on our income, statutory tax rates and tax planning opportunities available to us in the various jurisdictions in which we operate. We file federal and state income tax returns in the United States and tax returns in numerous international jurisdictions.

Judgments and Uncertainties: We must estimate our income tax expense after considering, among other factors, the pricing of inter-company transactions on an arm’s length basis, differing tax rates between jurisdictions, allocation factors, tax credits, nondeductible items and changes in enacted tax rates. Significant judgment is required in determining our annual tax expense and in evaluating our tax positions. As we continue to expand globally, there is a risk that, due to complexity within and diversity among the various jurisdictions in which we do business, a governmental agency may disagree with the manner in which we have computed our taxes. Additionally, due to the lack of uniformity among all of the foreign and domestic taxing authorities, there may be situations where the tax treatment of an item in one jurisdiction is different from the tax treatment in another jurisdiction or that the transaction causes a tax liability to arise in another jurisdiction.

In addition, we review the deferred tax assets in each jurisdiction and the positive and negative evidence that would support a conclusion that a valuation allowance is or is not needed. Where it is more likely than not that some portion of the deferred tax assets will not be realized, we record a valuation allowance against the deferred tax assets. In 2022, a valuation allowance of $35.8 million was recorded primarily related to deferred tax assets in our Russian subsidiary. The decision to establish a valuation allowance or reverse it is based on management’s judgment based on the weight of available evidence including forecasts of future taxable income and the future reversal of existing taxable temporary differences.

Sensitivity of Estimate to Change: We provide reserves for potential payments of tax to various tax authorities related to uncertain tax positions and other issues. Reserves recorded are based on a determination of whether and how much of a tax benefit taken by us in our tax filings or positions is "more likely than not" to be realized following resolution of any potential contingencies present related to the tax benefit, assuming that the matter in question will be raised by the tax authorities. Potential interest and penalties associated with such uncertain tax positions is recorded as a component of income tax expense. As of December 31, 2022, we had $15.8 million of unrecognized tax benefits, excluding interest and penalties, recorded in deferred income taxes and other long-term liabilities. This tax liability increased by $0.7 million for tax positions taken in the current year offset by reductions of $3.9 million for changes in prior period positions.

Results of Operations

The following table sets forth selected statement of operations data for the periods indicated in dollar amounts and expressed as a percentage of net sales:

	Year Ended December 31,					
	2022		2021		2020	
	(In thousands, except percentages and per share data)					
Net sales	$ 1,429,547	100.0 %	$ 1,460,860	100.0 %	$ 1,200,724	100.0 %
Cost of sales	874,134	61.1	764,462	52.3	661,728	55.1
Gross profit	555,413	38.9	696,398	47.7	538,996	44.9
Operating expenses:						
Sales and marketing	76,643	5.3	78,180	5.4	70,583	5.9
Research and development	116,114	8.1	139,573	9.6	126,898	10.6
General and administrative	131,253	9.2	125,882	8.6	110,005	9.2
Goodwill impairment	—	—	—	—	44,589	3.7
Gain on divestiture and sale of asset	(31,846)	(2.2)	—	—	—	—
Impairment of long-lived assets	79,949	5.6	—	—	671	0.1
Other restructuring charges	9,697	0.7	—	—	506	—
Loss (gain) on foreign exchange	4,103	0.3	(15,120)	(1.0)	(12,915)	(1.1)
Total operating expenses	385,913	27.0	328,515	22.6	340,337	28.4
Operating income	169,500	11.8	367,883	25.2	198,659	16.5
Interest income (expense), net	12,620	0.9	(1,839)	(0.1)	6,270	0.5
Other income, net	1,231	0.1	437	—	763	0.1
Income before provision for income taxes	183,351	12.8	366,481	25.1	205,692	17.1
Provision for income taxes	72,589	5.1	88,615	6.1	45,354	3.8
Net income	110,762	7.7	277,866	19.0	160,338	13.3
Less: net income (loss) attributable to non-controlling interest	853	0.1	(550)	—	766	0.1
Net income attributable to IPG Photonics Corporation common stockholders	$ 109,909	7.6 %	$ 278,416	19.0 %	$ 159,572	13.2 %
Net income attributable to IPG Photonics Corporation per common share:						
Basic	$ 2.17		$ 5.21		$ 3.00	
Diluted	$ 2.16		$ 5.16		$ 2.97	
Weighted average common shares outstanding:						
Basic	50,761		53,410		53,186	
Diluted	50,925		53,930		53,785	

Comparison of Year Ended December 31, 2022 to Year Ended December 31, 2021

Net sales. Net sales decreased by $31.3 million, or 2.1%, to $1,429.5 million in 2022 from $1,460.8 million in 2021. The table below sets forth sales by application:

	Year Ended December 31,				Change	
	2022		2021			
	(In thousands, except for percentages)					
Sales by Application		% of Total		% of Total		
Materials Processing	$ 1,291,262	90.3 %	$ 1,325,404	90.7 %	$ (34,142)	(2.6)%
Other Applications	138,285	9.7 %	135,456	9.3 %	2,829	2.1 %
Total	$ 1,429,547	100.0 %	$ 1,460,860	100.0 %	$ (31,313)	(2.1)%

The table below sets forth sales by type of product and other revenue:

	Year Ended December 31,				Change	
	2022		2021			
	(In thousands, except for percentages)					
Sales by Product		% of Total		% of Total		
High Power Continuous Wave ("CW") Lasers	$ 613,734	42.9 %	$ 687,406	47.1 %	$ (73,672)	(10.7)%
Medium Power CW Lasers	77,079	5.4 %	80,501	5.5 %	(3,422)	(4.3)%
Pulsed Lasers	250,677	17.5 %	240,978	16.5 %	9,699	4.0 %
Quasi-Continuous Wave ("QCW") Lasers	50,212	3.5 %	60,668	4.2 %	(10,456)	(17.2)%
Laser and Non-Laser Systems	153,471	10.8 %	126,642	8.7 %	26,829	21.2 %
Other Revenue including Amplifiers, Service, Parts, Accessories and Change in Deferred Revenue	284,374	19.9 %	264,665	18.0 %	19,709	7.4 %
Total	$ 1,429,547	100.0 %	$ 1,460,860	100.0 %	$ (31,313)	(2.1)%

Materials processing

Sales for materials processing applications decreased due to lower sales volumes of high power lasers, QCW lasers and medium power lasers, offset by higher sales volumes of laser and non-laser systems, other laser products, and pulsed lasers.

- The decrease in high power CW laser sales was due to lower sales for cutting application, partially offset by an increase in sales for welding applications. The decrease in sales of high power CW lasers used in cutting applications was attributable to softer demand and increased competition in China. The increase in sales of high power CW lasers used in welding applications was driven by higher sales into electric vehicle and general manufacturing industries.
- The decrease in medium power CW laser sales related to a decrease in demand for cutting and additive manufacturing applications.
- Pulsed laser sales, including high power pulsed lasers, increased due to growth in sales for cleaning and stripping applications, welding and brazing and foil cutting for EV battery processing applications, and pulsed lasers used for solar cell manufacturing applications.
- QCW laser sales decreased due to lower demand in fine processing for consumer electronics applications.
- Laser and non-laser systems sales increased due to higher demand for laser systems and LightWELD.
- Other revenue for materials processing increased due to higher sales of options and accessories and parts and service.

Other Applications

Sales from other applications increased due to increased demand for lasers used in medical procedures, partially offset by decreased demand for lasers used in advanced applications and decreased sales for telecommunications products mainly due to the business divestiture during the third quarter.

Our net sales were derived from customers in the following geographic regions:

	Year Ended December 31,				Change	
	2022		2021			
	(In thousands, except for percentages)					
Sales by Geography		% of Total		% of Total		
North America [1]	$ 338,713	23.7 %	$ 314,984	21.6 %	$ 23,729	7.5 %
Europe:						
Germany	85,491	6.0 %	101,738	7.0 %	(16,247)	(16.0)%
Other Europe	294,481	20.6 %	289,136	19.8 %	5,345	1.8 %
Asia:						
China	479,926	33.6 %	548,348	37.5 %	(68,422)	(12.5)%
Japan	57,865	4.0 %	54,077	3.7 %	3,788	7.0 %
Other Asia	152,373	10.7 %	139,148	9.5 %	13,225	9.5 %
Rest of World	20,698	1.4 %	13,429	0.9 %	7,269	54.1 %
Total	$ 1,429,547	100.0 %	$ 1,460,860	100.0 %	$ (31,313)	(2.1)%

(1) The substantial majority of sales in North America are to customers in the United States.

Cost of sales and gross margin. Cost of sales increased by $109.6 million, or 14.3%, to $874.1 million in 2022 from $764.5 million in 2021. Our gross margin decreased to 38.9% in 2022 from 47.7% in 2021. Gross margin decreased mainly due to inventory provision and related charges of $74.1 million related to our Russian operations which accounted for 5.2% of the decrease in gross margin. In addition, gross margin decreased due to an increased provision for excess and obsolete inventory other than Russia, an increase in manufacturing costs and an increase in shipping costs and tariffs as a percentage of sales. Expenses related to provisions for excess or obsolete inventory and other valuation adjustments increased by $93.7 million to $128.0 million, or 9% of sales, for the year ended December 31, 2022, as compared to $34.3 million, or 2.3% of sales, for the year ended December 31, 2021.

Sales and marketing expense. Sales and marketing expense decreased by $1.6 million, or 2.0%, to $76.6 million in 2022 from $78.2 million in 2021. This change was primarily a result of a decrease of $1.6 million in personnel and related costs, mainly from reductions in bonus expense. As a percentage of sales, sales and marketing expense was 5.3% and 5.4% of sales in 2022 and 2021, respectively.

Research and development expense. Research and development expense decreased by $23.5 million, or 16.8%, to $116.1 million in 2022 from $139.6 million in 2021. This change was primarily a result of a decrease of $14.4 million in personnel and related costs and a decrease of $5.4 million expense for materials used for research and development projects. These decreases were primarily due to research and development expense associated with the telecommunications transmission product line that we divested in August 2022. As a percentage of sales, research and development expense decreased to 8.1% in 2022 from 9.6% in 2021. We expect to continue to invest in research and development efforts for our continuing products and increase expenses in whole dollars.

General and administrative expense. General and administrative expense increased by $5.4 million, or 4.3%, to $131.3 million in 2022 from $125.9 million in 2021. This change was primarily a result of an increase of $4.7 million in consultants and information systems expense. As a percentage of sales, general and administrative expense increased to 9.2% in 2022 from 8.6% in 2021.

Effect of exchange rates on sales, gross margin and operating expenses. We estimate that if exchange rates had been the same as one year ago, sales in 2022 would have been $79.0 million higher, gross margin would have been $46.5 million higher and sales and marketing, research and development and general and administrative expenses would have been $3.9 million higher. These estimates assume constant exchange rates between fiscal year 2022 and fiscal year 2021 and are calculated using the average exchange rates for the twelve-month period ended December 31, 2021 for the respective currencies, which were US$1=Euro 0.85, US$1=Japanese yen 110, US$1=Chinese yuan 6.45 and US$1=Russian ruble 74.

Gain on divestiture and sale of asset. During third quarter of 2022, we divested our telecommunications transmission product lines for $56.2 million. The divestiture resulted in a gain of $21.9 million for 2022. During the fourth quarter of 2022, we completed the sale of our corporate aircraft and recorded a gain of $9.9 million.

Impairment of long-lived assets. We recorded non-cash long-lived asset impairment charge of $79.9 million in Q4 2022, related to Russian operations as a result of additional sanctions issued by the European Union in October 2022. Those sanctions, coupled with tariffs on Russian product issued by the United States, severely affect our ability to use our Russian manufacturing capacity to supply components to other IPG factories which accounted for a majority of their manufacturing activity prior to sanctions.

Other restructuring charges Other restructuring charges of $9.7 million primarily relate to restructuring costs in Russia due to the change in business after the issuance of additional sanctions as discussed above. In addition, some restructuring charges related to the closure of our office in Lebanon which had supported the telecommunications transmission business which we divested in the third quarter of 2022.

Loss (gain) on foreign exchange. We incurred a foreign exchange loss of $4.1 million in 2022 as compared to a gain of $15.1 million in 2021. The loss was primarily attributable to the depreciation of the Chinese yuan and the appreciation of the Russian ruble, partially offset by the gain from the depreciation of Euro as compared to the U.S. dollar.

Interest income (expense), net. Interest income (expense), net was $12.6 million of income in 2022 compared to $1.8 million of expense in 2021. The change in interest income (expense), net, was due to an increase in yields on cash equivalents and short term investments that resulted in higher market interest rates as compared to prior year rates.

Provision for income taxes. Provision for income taxes was $72.6 million in 2022 compared to $88.6 million in 2021, representing an effective tax rate of 39.6% in 2022 and 24.2% in 2021. The decrease in tax expense was due primarily to a reduction in book income before taxes which was partly offset by discrete items. Discrete adjustments in 2022 resulted in a $23.2 million increase in tax expense, which includes (i) $35.8 million increase in the valuation allowance primarily related to deferred tax assets in our Russian subsidiary which were provided in conjunction with the restructuring and other charges discussed above and (ii) $2.7 million for equity-based compensation deductions reflected in book income in excess of the deductions allowed for tax purposes. These detriments were partly offset by (i) $10.1 million for the acceptance of amended returns and the receipt of cash in foreign jurisdictions; (ii) $3.9 million related to a reversal of tax reserves primarily due to the expiry of the statute of limitations for the year in which the reserve was established. Discrete adjustments in 2021 resulted in a $9.1 million reduction to tax expense, which includes a decrease to tax expense for (i) $5.4 million related to equity-based compensation deductions for tax in excess of the deductions reflected in book income, (ii) $2.4 million for prior year provision to return adjustments and (iii) $2.0 million for a reduction in tax reserves as a result of the expiry of the statute of limitations for the year in which the reserve was established. The 2021 discrete benefits were offset by $1.2 million for an increase to tax expense for the impact of tax losses in subsidiaries for which no benefit was taken.

Net income attributed to IPG Photonics Corporation. Net income attributable to IPG Photonics Corporation decreased by $168.5 million to $109.9 million in 2022 from $278.4 million in 2021. Net income attributable to IPG Photonics Corporation as a percentage of our net sales decreased by 11.4% to 7.6% in 2022 from 19.0% in 2021 due to the factors described above.

Liquidity and Capital Resources

We believe that our existing cash and cash equivalents, short-term investments, our cash flows from operations and our existing lines of credit provide us with the financial flexibility to meet our liquidity and capital needs. We expect to continue making investments in capital expenditures, to assess acquisition opportunities and to repurchase shares of our stock in accordance with our repurchase program. The extent and timing of such expenditures may vary from period to period. Our future long-term capital requirements will depend on many factors including our level of sales, the impact of the economic environment on our growth including any ongoing impact of the COVID-19 pandemic on certain global or regional economies, global or regional recessions, the timing and extent of spending to support development efforts, expansion of global sales and marketing activities, government regulation including trade sanctions, the timing and introductions of new products, the need to ensure access to adequate manufacturing capacity and the continuing market acceptance of our products. As of December 31, 2022, we had no off-balance sheet arrangements that have, or are reasonably likely to have, a current or future material effect on our consolidated financial condition, results of operations, liquidity, capital expenditures or capital resources.

Included in cash and cash equivalents are $68.3 million of cash and cash equivalents and $7.1 million of short-term investments located in Russia, and $4.7 million of cash and cash equivalents located in Belarus, as of December 31, 2022. Cash, cash equivalents and short-term investments in Russia are subject to capital controls that prevent repatriation by dividend or distribution of capital. There are currently no restrictions on our ability to use cash and cash equivalents in Russia for operating purposes including converting cash to foreign currency for the payment of goods received from vendors outside of Russia. The Russian operations are self-funding. Approximately 6% of our consolidated working capital including cash, cash equivalents and short-term investments is located in Russia. We are making no new investments in Russia.

The following table presents our principal sources of liquidity:

	As of December 31, 2022	As of December 31, 2021
	(In thousands)	
Cash and cash equivalents	$ 698,209	$ 709,105
Short-term investments	479,374	805,400
Unused credit lines and overdraft facilities	125,965	128,772
Working capital (excluding cash and cash equivalents and short-term investments)	534,045	519,745

Short-term investments at December 31, 2022 consist of liquid investments including corporate bonds, commercial paper, and U.S. Treasury and agency obligations and term deposits with original maturities of greater than three months but less than one year. See Note 3, "Fair Value Measurements" in the notes to the consolidated financial statements for further information about our short-term investments.

The following table details our line-of-credit facilities and long-term notes as of December 31, 2022:

Description	Total Facility/ Note	Interest Rate	Maturity	Security
U.S. Revolving Line of Credit (1)	$75.0 million	BSBY plus 0.8% to 1.2%, depending on our performance	April 2025	Unsecured
Euro Credit Facility (Germany) (2)	Euro 50.0 million ($53.5 million)	ESTR plus 0.8% or Euribor plus 0.65%	July 2023	Unsecured, guaranteed by parent company and German subsidiary
Other Euro Facilities (3)	Euro 1.5 million ($1.6 million)	2.03%	March 2023	Common pool of assets of Italian subsidiary
Long-term Unsecured Note (4)	$16.0 million	1.20% above LIBOR, fixed using an interest rate swap at 2.85% per annum	May 2023	Unsecured

(1) This facility is available to certain foreign subsidiaries in their respective local currencies. At December 31, 2022, there were no amounts drawn on this line, however, there were $2.4 million of guarantees issued against the line which reduces total availability.

(2) This facility is available to certain foreign subsidiaries in their respective local currencies. At December 31, 2022, there were no drawings, however, there were $1.7 million of guarantees issued against the line which reduces total availability.

(3) At December 31, 2022, there were no drawings. This facility renews annually.

(4) At maturity, the outstanding note balance will be $15.4 million.

Our largest committed credit lines are with Bank of America N.A. and Deutsche Bank AG in the amounts of $75.0 million and $53.5 million (or €50.0 million as described above), respectively, and neither of them is syndicated. The banks have made amendments of our credit agreements to modify LIBOR and EONIA reference rates as these rates are phased out as borrowing reference rates. We do not plan to amend our long-term unsecured note as it matures prior to the final phase-out of LIBOR.

We are required to meet certain financial covenants associated with our U.S. revolving line of credit and long-term debt facility. These covenants, tested quarterly, include an interest coverage ratio and a funded debt to earnings before interest, taxes, depreciation and amortization ("EBITDA") ratio. The interest coverage covenant requires that we maintain a trailing twelve-month ratio of EBITDA to interest on all obligations that is at least 3.0:1.0. The funded debt to EBITDA covenant requires that the sum of all indebtedness for borrowed money on a consolidated basis be less than three times our trailing twelve months EBITDA. Funded debt is decreased by our cash and available marketable securities not classified as long-term investments in the U.S. in excess of $50 million up to a maximum of $500 million. We were in compliance with all such financial covenants as of and for the three months ended December 31, 2022.

The financial covenants in our loan documents may cause us to not take or to delay investments and actions that we might otherwise undertake because of limits on capital expenditures and amounts that we can borrow or lease. In the event that we do not comply with any one of these covenants, we would be in default under the loan agreement or loan agreements, which may result in acceleration of the debt, cross-defaults on other debt or a reduction in available liquidity, any of which could harm our results of operations and financial condition.

See Note 11, "Financing Arrangements" in the notes to the consolidated financial statements for further information about our facilities and term debt.

The following table summarizes our material cash commitments at December 31, 2022 and the effect such commitments are expected to have on our liquidity and cash flow in future periods. We intend to use our existing cash, cash equivalents and short term investments as well as cash generated from operations as sources of funds for these material commitments.

	Payments Due in	
	Total	Less Than 1 Year
	(In thousands)	
Operating lease obligations	$ 25,374	$ 6,019
Purchase obligations	25,070	24,461
Long-term debt obligation (including interest)(1)	16,218	16,218
Total(2)	$ 66,662	$ 46,698

(1) Interest for long-term debt obligation was calculated including the effect of our fixed rate of 2.85%. See Note 11, "Financing Arrangements" to the consolidated financial statements for additional details.

(2) Excludes obligations related to ASC 740, reserves for uncertain tax positions, because we are unable to provide a reasonable estimate of the timing of future payments relating to the remainder of these obligations. See Note 17, "Income Taxes" to the consolidated financial statements.

The following table presents cash flow activities:

	As of December 31,	
	2022	2021
	(In thousands)	
Cash provided by operating activities	$ 212,649	$ 389,700
Cash provided by (used in) investing activities	296,952	(416,282)
Cash used in financing activities	(514,549)	(125,066)

Operating activities. Net cash provided by operating activities decreased by $177.1 million to $212.6 million in 2022 from $389.7 million in 2021 primarily due to a decrease in net income and an increase in cash used by working capital. Our largest working capital items typically are inventory and accounts receivable. Items such as accounts payable to third parties, prepaid expenses and other current assets and accrued expenses and other liabilities are not as significant as our working capital investment in accounts receivable and inventory because of the amount of value added within IPG due to our vertically integrated structure. Accruals and payables for personnel costs including bonuses and income and other taxes payable are largely dependent on the timing of payments for those items. The decrease in cash flow from operating activities in 2022 primarily resulted from:

- a decrease in cash provided by net income after adjusting for amounts to reconcile net income to net cash provided by operating activities, such as the gain on divestiture business and sale of assets, the non-cash impairment of long lived and other assets mainly attributed to our Russian operations and non-cash provisions for inventory, warranty and bad debt;
- an increase in cash used by inventory as the company built safety stock for supply chain disruptions related to third party electronic parts and components internally manufactured by our factory in Russia;
- an increase in cash used by accounts payable due to timing of payments;
- an increase in cash used by accrued expenses and other liabilities due to warranty, bonus payments exceeding bonus accruals and a reduction in customer deposits, partially offset by an increase in restructuring accruals; and,
- an increase in cash used by other taxes payable driven by the requirement to capitalize research and development expenses in the U.S., taxes due on the divestiture of business and sale of assets, and the timing of estimated tax payments made and refunds received from filing tax returns.

The decreases in cash provided by operating activities were partially offset by:

- an increase in cash provided by accounts receivable, including a decrease in days sales outstanding due to increased collection efforts; and,
- an increase in cash provided by prepaid expenses and other assets.

Investing activities. Net cash provided by investing activities was $297.0 million in 2022 as compared to cash used in investing activities of $416.3 million in 2021. The cash provided by investing activities in 2022 primarily related to $329.3 million of net proceeds from short-term investments, $52.9 million of proceeds received from the divestiture of the telecommunications transmission product lines, net of cash sold, and $26.9 million of proceeds from the sale of property, plant and equipment mainly from the sale of corporate aircraft; partially offset by $110.1 million of cash used for property, plant and equipment. The cash used in investing activities in 2021 primarily related to $123.1 million for property, plant and equipment, and $293.1 million of net purchases of investments.

In 2023, we expect to incur approximately $140.0 million to $160.0 million in capital expenditures, excluding acquisitions. Capital expenditures include investments in property, facilities and equipment to add capacity worldwide to support anticipated revenue growth, increase vertical integration, increase redundant manufacturing capacity for critical components and enhance research and development capabilities. The timing and extent of any capital expenditures in and between periods can have a significant effect on our cash flow. If we obtain financing for certain projects, our cash expenditures would be reduced in the year of expenditure. Many of the capital expenditure projects that we undertake have long lead times and are difficult to cancel or defer to a later period. We intend to finance our capital expenditures with existing cash, cash equivalents and short term investments as well as with cash generated from operations.

Financing activities. Net cash used in financing activities was $514.5 million and $125.1 million in 2022 and 2021, respectively. The cash used in financing activities in 2022 was primarily related to the purchase of $499.5 million of treasury stock, $18.1 million of principal payments on our long-term borrowings, the purchase of non-controlling interests of $2.5 million related to the divestiture of the telecommunications transmission product lines; partially offset by net proceeds of $5.6 million from the exercise of stock options net of amounts disbursed in relation to shares withheld to cover employee income taxes due upon the vesting and release of restricted stock units and shares issued under our employee stock purchase plan. The cash used in financing activities in 2021 was primarily related to the purchase of $134.9 million of treasury stock, $3.8 million of principal payments on our long-term borrowings and $2.6 million of payment of a purchase price holdback from a business combination; partially offset by net proceeds of $16.3 million from the exercise of stock options net of amounts disbursed in relation to shares withheld to cover employee income taxes due upon the vesting and release of restricted stock units and shares issued under our employee stock purchase plan.

Recent Accounting Pronouncements

See Note 1, "Nature of Business and Summary of Significant Accounting Policies" in the notes to the consolidated financial statements for a full description of recent accounting pronouncements, including the respective dates of adoption or expected adoption and effects on our consolidated financial statements contained in Part IV of this Annual Report.

ITEM 7A. *QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK*

We are exposed to market risk in the ordinary course of business, which consists primarily of interest rate risk associated with our cash and cash equivalents and our debt and foreign exchange rate risk.

Interest rate risk. Certain interest rates are variable and fluctuate with current market conditions. Our investments have limited exposure to market risk. We maintain a portfolio of cash, cash equivalents and short-term investments, consisting primarily of money market funds and term deposits, commercial paper, corporate bonds, U.S. government and agency securities and term deposits. None of these investments have a maturity date in excess of one year. Because of the short-term nature of these instruments, a sudden change in market interest rates would not be expected to have a material impact on our financial condition or results of operations.

We are also exposed to market risk as a result of increases or decreases in the amount of interest expense we must pay on our bank debt and borrowings on our bank credit facilities. Our interest obligations on our long-term debt are fixed by means of an interest rate swap agreement. Although our U.S. revolving line of credit and our Euro credit facility have variable rates, we do not believe that a 10% change in market interest rates would have a material impact on our financial position or results of operations.

Exchange rates. Due to our international operations, a significant portion of our net sales, cost of sales and operating expenses are denominated in currencies other than the U.S. dollar, principally the Euro, the Russian ruble, and the Chinese yuan. As a result, our international operations give rise to transactional market risk associated with exchange rate movements of the U.S. dollar, the Euro, the Chinese yuan, and the Russian ruble. In 2022 we incurred a loss on foreign exchange transactions of $4.1 million as compared to a gain of $15.1 million in 2021. As our China subsidiary has net U.S. dollar denominated liabilities, the depreciation of the Chinese yuan contributed to most of the foreign exchange loss in 2022, partially off set by the gain from the depreciation of the Euro as our German subsidiary has net U.S. dollar denominated assets. Management attempts to minimize these exposures by partially or fully off-setting foreign currency denominated assets and liabilities at our subsidiaries that operate in different functional currencies. The effectiveness of this strategy can be limited by the volume of underlying transactions at various subsidiaries and by our ability to accelerate or delay inter-company cash settlements. As a result, we are unable to create a perfect offset of the foreign currency denominated assets and liabilities. Furthermore, if we expect a currency movement to be beneficial to us in the short or medium term, we have, on occasions, chosen not to hedge or otherwise offset the underlying assets or liabilities. However, it is difficult to predict foreign currency movements accurately.

At December 31, 2022, our material foreign currency exposure is net U.S. dollar denominated assets at subsidiaries where the Euro or the Russian ruble is the functional currency and U.S. dollar denominated liabilities where the Chinese yuan is the functional currency. The net U.S. dollar denominated assets are comprised of cash, third party receivables and inter-company receivables offset by third party and inter-company U.S. dollar denominated payables. The U.S. dollar denominated liabilities are comprised of inter-company payables. A 5% change in the relative exchange rate of the U.S. dollar to the Euro applied to the net U.S. dollar asset balances as of December 31, 2022, would result in a foreign exchange gain of $2.4 million if the U.S. dollar appreciated and a $2.5 million foreign exchange loss if the U.S. dollar depreciated. A 5% change in the relative exchange rate of the U.S. dollar to the Ruble applied to the net U.S. dollar asset balances as of December 31, 2022, would result in a foreign exchange gain of $2.4 million if the U.S. dollar appreciated and a $2.5 million foreign exchange loss if the U.S. dollar depreciated. A 5% change in the relative exchange rate of the U.S. dollar to the Chinese yuan applied to the net U.S. dollar liability balances as of December 31, 2022, would result in a foreign exchange loss of $2.0 million if the U.S. dollar appreciated and a $2.1 million foreign exchange gain if the U.S. dollar depreciated. Volatility between the U.S. dollar and the currencies to which we are exposed may be increased by the COVID-19 pandemic, sanctions on the Russian government and changes in central bank policy, primarily, related to interest rates.

In addition, we are exposed to foreign currency translation risk for those subsidiaries whose functional currency is not the U.S. dollar as changes in the value of their functional currency relative to the U.S. dollar affect the translated amounts of our assets and liabilities. Changes in the translated value of assets and liabilities due to changes in functional currency exchange rates relative to the U.S. dollar result in foreign currency translation adjustments that are a component of other comprehensive income or loss.

Foreign currency derivative instruments can also be used to hedge exposures and reduce the risks of certain foreign currency transactions; however, these instruments provide only limited protection and can carry significant cost. We have no foreign currency derivative instrument hedges as of December 31, 2022. We will continue to analyze our exposure to currency exchange rate fluctuations and may engage in financial hedging techniques in the future to attempt to minimize the effect of these potential fluctuations. Exchange rate fluctuations may adversely affect our financial results in the future.

ITEM 8. *FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA*

This information is incorporated by reference from pages F-1 through F-32 of this report.

ITEM 9. *CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE*

None.

ITEM 9A. *CONTROLS AND PROCEDURES*

Evaluation of Disclosure Controls and Procedures

Under the supervision of our Chief Executive Officer and our Chief Financial Officer, our management has evaluated the effectiveness of the design and operation of our "disclosure controls and procedures" (as defined in Rules 13a-15(e) and 15d-15(e) promulgated under the Securities Exchange Act of 1934, as amended (the "Exchange Act")), as of the end of the period covered by this Annual Report on Form 10-K (the "Evaluation Date") utilizing the Committee of Sponsoring Organizations of the Treadway Commission's Internal Control - Integrated Framework ("COSO") Updated Framework issued in 2013. Based upon that evaluation, our Chief Executive Officer and our Chief Financial Officer have concluded that, as of the Evaluation Date, our disclosure controls and procedures are effective to ensure that information we are required to disclose in reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by an issuer in the reports that it files or submits under the Exchange Act is accumulated and communicated to the issuer's management, including its principal executive and principal financial officers, or persons performing similar functions, as appropriate to allow timely decisions regarding required disclosure.

Management's Annual Report on Internal Control Over Financial Reporting

Our management, including our Chief Executive Officer and Chief Financial Officer, is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the Company and its subsidiaries. Internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. Our management conducted an assessment of the effectiveness of our internal control over financial reporting as of the Evaluation Date based on criteria established in COSO utilizing the Updated Framework issued in 2013. Based on this assessment, our management concluded that, as of the Evaluation Date, our internal control over financial reporting was effective.

Our independent registered public accounting firm, Deloitte & Touche LLP, has audited our internal control over financial reporting, as stated in their report below.

Changes in Internal Controls

There was no change in our internal control over financial reporting (as defined in Rule 13a-15(f) under the Exchange Act) that occurred during the last fiscal quarter that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Limitations on Effectiveness of Controls

Our management, including our Chief Executive Officer and Chief Financial Officer, does not expect that the disclosure controls and procedures or internal control over financial reporting will prevent or detect all error and all fraud. A control system, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the objectives of the control system are met. Further, the design of a control system must reflect the fact that there are resource constraints, and the benefits of controls must be considered relative to their costs. Due to the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that all control issues, errors and instances of fraud, if any, within the company have been or will be detected.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the shareholders and the Board of Directors of
IPG Photonics Corporation
Marlborough, Massachusetts

Opinion on Internal Control over Financial Reporting

We have audited the internal control over financial reporting of IPG Photonics Corporation and subsidiaries (the "Company") as of December 31, 2022, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by COSO.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated financial statements as of and for the year ended December 31, 2022, of the Company and our report dated February 27, 2023, expressed an unqualified opinion on those financial statements.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Annual Report on Internal Control Over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ Deloitte & Touche LLP

Boston, Massachusetts
February 27, 2023

ITEM 9B. *CONTROLS AND PROCEDURES*

None.

ITEM 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

Not applicable.

PART III

ITEM 10. *DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE*

Certain of the information required hereunder is incorporated herein by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A, which Proxy Statement is anticipated to be filed with the SEC within 120 days after December 31, 2022. Pursuant to General Instruction G(3) of Form 10-K, additional information required hereunder relating to our executive officers is contained in Part I of this Annual Report on Form 10-K under the caption "Executive Officers of the Registrant."

ITEM 11. *EXECUTIVE COMPENSATION*

The information required hereunder is incorporated herein by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A, which Proxy Statement is anticipated to be filed with the SEC within 120 days after December 31, 2022.

ITEM 12. *SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS*

The information required hereunder is incorporated herein by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A, which Proxy Statement is anticipated to be filed with the SEC within 120 days after December 31, 2022.

ITEM 13. *CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE*

The information required hereunder is incorporated herein by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A, which Proxy Statement is anticipated to be filed with the SEC within 120 days after December 31, 2022.

ITEM 14. *PRINCIPAL ACCOUNTING FEES AND SERVICES*

The information required hereunder is incorporated herein by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A, which Proxy Statement is anticipated to be filed with the SEC within 120 days after December 31, 2022.

PART IV

ITEM 15. *EXHIBITS AND FINANCIAL STATEMENT SCHEDULES*

a. The following documents are filed as part of this Annual Report on Form 10-K:

   1. Financial Statements.

      See Index to Financial Statements on page F-1.

   2. Financial Statement Schedules.

      All schedules are omitted because they are not applicable or the required information is shown on the financial statements or notes thereto.

   3. Exhibits.

Exhibit Number	Description
3.1	Form of Second Amended and Restated Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.2 to the Registrant's Registration Statement No. 333-136521 filed with the Securities and Exchange Commission (the "Commission") on August 11, 2006)
3.2	Amended and Restated Bylaws of the Registrant (incorporated by reference to Exhibit 3.2 to the Registrant's Current Report on Form 8-K filed with the Commission on November 10, 2022)
4.1	Specimen Stock Certificate (incorporated by reference to Exhibit 4.1 to the Registrant's Registration Statement No. 333-136521 filed with the Commission on November 14, 2006)
4.2	Description of the Registrant's Securities Registered under Section 12 of the Exchange Act (incorporated by reference to Exhibit 4.2 to the Registrant's Annual Report on Form 10-K filed with the Commission on February 24, 2020)
10.1†	2006 Incentive Compensation Plan, as amended (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K/A filed with the Commission on February 22, 2017)
10.2†	IPG Photonics Corporation Non-Employee Director Compensation Plan, as amended (incorporated by reference to Exhibit 10.1 to the Registrant’s Current Report on Form 8-K filed with the Commission on February 22, 2023)
10.3†	Senior Executive Annual Incentive Plan, as amended and restated April 28, 2020
10.4†	IPG Photonics Corporation 2008 Employee Stock Purchase Plan, as amended and restated effective December 1, 2018 (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed with the Commission on June 3, 2019)
10.5†	Secondment Agreement dated May 4, 2021 among the Registrant, IPG Laser GmbH and Dr. Eugene Scherbakov (incorporated by reference to Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed with the Commission on August 4, 2021)
10.6†	Service Agreement dated May 4, 2021 between IPG Laser GmbH and Dr. Eugene Scherbakov (incorporated by reference to Exhibit 10.3 to the Registrant's Quarterly Report on Form 10-Q filed with the Commission on August 4, 2021)
10.7†	Confidentiality, Non-Competition and Confirmatory Assignment Agreement dated May 4, 2021 between the Registrant and Dr. Eugene Scherbakov (incorporated by reference to Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q filed with the Commission on August 4, 2021)
10.8†	Form of Employment Agreement dated May 30, 2019 between the Registrant and each of Timothy P.V. Mammen, Angelo P. Lopresti and Alexander Ovtchinnikov (incorporated by reference to Exhibit 10.7 to the Registrant's Annual Report Form 10-K filed with the Commission on February 24, 2020)
10.9†	Form of Confidentiality, Non-Competition and Confirmatory Assignment Agreement between the Registrant and each of the named executive officers and certain other executive officers, (incorporated by reference to Exhibit 10.4 to the Registrant's Current Report on Form 8-K filed with the Commission on October 15, 2013)
10.10†	Form of Letter amending Confidentiality, Non-Competition and Confirmatory Assignment Agreements between the Registrant and each of the named executive officers and certain other executive officers (incorporated by reference to Exhibit 10.4 to the Registrant's Current Report on Form 8-K/A filed with the Commission on February 22, 2017)
10.11†	Form of Indemnification Agreement between the Registrant and each of its Directors and Executive Officers (incorporated by reference to Exhibit 10.3 to Registrant's Current Report on Form 8-K/A filed with the Commission on February 22, 2017)
10.12	Second Amended and Restated Loan Agreement, between the Registrant and Bank of America, N.A. dated as of March 25, 2020 (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed with the Commission on March 26, 2020)
10.13	Revolving Credit Note, between the Registrant and Bank of America, N.A., dated March 25, 2020 (incorporated by reference to Exhibit 10.2 to the Registrant's Current Report on Form 8-K filed with the Commission on March 26, 2020)

Exhibit Number	Description
10.14	Credit Facility Agreement between IPG Laser GmbH and Deutsche Bank AG, dated July 27, 2017 (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed with the Commission on August 1, 2017)
10.15	Annex I to Credit Facility Agreement between IPG Laser GmbH and Deutsche Bank AG, dated July 27, 2017 (incorporated by reference to Exhibit 10.2 on Current Report on Form 8-K filed with the Commission on August 1, 2017)
10.16	Guarantee of the Registrant to Deutsche Bank dated July 27, 2017 (incorporated by reference to Exhibit 10.3 on Current Report on Form 8-K filed with the Commission on August 1, 2017)
10.17	First Amendment to Credit Facility Agreement between IPG Laser GmbH and Deutsche Bank AG, dated April 20, 2020 (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed with the Commission on April 23, 2020)
21.1	List of Subsidiaries
23.1	Consent of Deloitte & Touche LLP
31.1	Certification of Chief Executive Officer pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934, as amended
31.2	Certification of Chief Financial Officer pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934, as amended
32.1	Certification of Chief Executive Officer and Chief Financial Officer pursuant to Section 1350
101.INS	XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document
101.SCH	XBRL Taxonomy Extension Schema
101.CAL	XBRL Taxonomy Extension Calculation Linkbase
101.DEF	XBRL Taxonomy Definition Linkbase
101.LAB	XBRL Taxonomy Extension Label Linkbase
101.PRE	XBRL Taxonomy Extension Presentation Linkbase
104	Cover Page Interactive Data File (formatted as inline XBRL and contained in Exhibit 101)

† Identifies management contract or compensatory plans or arrangements required to be filed as an exhibit.

b. Exhibits.

See (a)(3) above.

c. Additional Financial Statement Schedules.

All schedules are omitted because they are not applicable or the required information is shown on the financial statements or notes thereto.

ITEM 16. ***FORM 10-K SUMMARY***

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized, on February 27, 2023.

IPG Photonics Corporation

By: /s/ Eugene A. Scherbakov
Eugene A. Scherbakov
Chief Executive Officer

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the Registrant and in the capacities and on the dates indicated.

Signature	Title	Date
/s/ Eugene A. Scherbakov Eugene A. Scherbakov	Chief Executive Officer and Director (Principal Executive Officer)	February 27, 2023
/s/ Timothy P.V. Mammen Timothy P.V. Mammen	Senior Vice President, Chief Financial Officer (Principal Financial Officer)	February 27, 2023
/s/ Thomas J. Burgomaster Thomas J. Burgomaster	Vice President, Corporate Controller (Principal Accounting Officer)	February 27, 2023
/s/ Gregory Beecher Gregory Beecher	Director	February 27, 2023
/s/ Michael Child Michael Child	Director	February 27, 2023
/s/ Jeanmarie Desmond Jeanmarie Desmond	Director	February 27, 2023
/s/ Gregory Dougherty Gregory Dougherty	Director	February 27, 2023
/s/ Eric Meurice Eric Meurice	Director	February 27, 2023
/s/ Natalia Pavlova Natalia Pavlova	Director	February 27, 2023
/s/ John Peeler John Peeler	Non-Executive Chair of the Board and Director	February 27, 2023
/s/ Thomas Seifert Thomas Seifert	Director	February 27, 2023
/s/ Felix Stukalin Felix Stukalin	Director	February 27, 2023
/s/ Agnes Tang Agnes Tang	Director	February 27, 2023

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the shareholders and the Board of Directors of
IPG Photonics Corporation
Marlborough, Massachusetts

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of IPG Photonics Corporation and subsidiaries (the "Company") as of December 31, 2022 and 2021, the related consolidated statements of income, comprehensive income, equity, and cash flows for each of the three years in the period ended December 31, 2022, and the related notes (collectively referred to as the "financial statements"). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022, in conformity with accounting principles generally accepted in the United States of America.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission and our report dated February 27, 2023, expressed an unqualified opinion on the Company's internal control over financial reporting.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current-period audit of the financial statements that were communicated or required to be communicated to the audit committee and that (1) relate to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the financial statements, taken as a whole, and we are not, by communicating the critical audit matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Long-lived Asset Impairment: Refer to Notes 1 and 8 to the Financial Statements

Critical Audit Matter Description

As a result of changes in business conditions in Russia, the Company completed an impairment analysis of long-lived assets in Russia during the fourth quarter of 2022 and recorded a charge of $79.0 million in the accompanying Consolidated Statement of Income.

We identified this charge as a critical audit matter because of the significant judgments made by management to estimate the charge. This required a high degree of auditor judgment and an increased extent of effort when performing audit procedures to evaluate to the reasonableness of management's estimates and assumptions related to future revenues and cash flows.

How the Critical Audit Matter Was Addressed in the Audit

Our audit procedures related to management’s judgments underlying the calculation of the charge, included the following, among others:

- We tested the effectiveness of controls over recording long-lived asset impairment charges, including those controls related to the forecasts of future revenues and cash flows.
- We evaluated management's ability to estimate future revenues and cash flows by comparing management's projections to the Company's historical results.
- We tested for the appropriate application of accounting guidance related to the impairment of long-lived assets, including judgments made by management related to the asset group subject to impairment and the timing of the related charge.
- We considered the existence of contradictory evidence based on consideration of internal communication to management and the board of directors, Company press releases, and analysts' reports, as well as any changes within the business.

Excess or Obsolete Inventory Reserve: Refer to Notes 1 and 4 to the Financial Statements

Critical Audit Matter Description

The Company evaluates inventory each reporting period for excess quantities and obsolescence, establishing reserves when necessary based upon historic usage, estimated future usage and age. Once recorded, these reserves are considered permanent adjustments to the carrying value of inventory. As of December 31, 2022, the Company has inventories of $509.4 million. This balance reflects inventory provisions and related charges totaling $128.0 million for the year ended December 31, 2022, and includes $74.1 million recorded in the fourth quarter of 2022 related to the restructuring of the Company's Russian operations.

We identified the reserve for excess quantities and obsolete inventory as a critical audit matter because of the significant estimates and assumptions management makes to quantify the reserve, including the determination of expected demand, especially when considering the vertically integrated nature of the Company as well as parts subject to technological obsolescence. This required a high degree of auditor judgment and an increased extent of effort when performing audit procedures to evaluate the policy and the reasonableness of assumptions including expected demand.

How the Critical Audit Matter Was Addressed in the Audit

Our audit procedures related to management's judgments underlying the calculation of excess or obsolete inventory reserve, included the following, among others:

- We tested the effectiveness of controls over inventory, including those over the estimation of reserves for excess quantities and obsolescence.
- We evaluated the reasonableness of the Company's excess and obsolete reserve policy, considering historical experience and the underlying assumptions.
- We tested the calculation of the excess and obsolete reserve pursuant to the Company's policy, including the completeness and accuracy of the data used in the calculation.
- For a sample of inventory parts, we evaluated management's ability to estimate future demand by comparing actual inventory usage to estimates made in prior years.
- We considered the existence of contradictory evidence based on consideration of internal communication to management and the board of directors, Company press releases, and analysts' reports, as well as any changes within the business.

/s/ Deloitte & Touche LLP

Boston, Massachusetts
February 27, 2023

We have served as the Company's auditor since 1999.

IPG PHOTONICS CORPORATION

CONSOLIDATED BALANCE SHEETS

	December 31,			
	2022		2021	
	(In thousands, except share and per share data)			
ASSETS				
Current assets:				
Cash and cash equivalents	$	698,209	$	709,105
Short-term investments		479,374		805,400
Accounts receivable, net		211,347		262,121
Inventories		509,363		460,747
Prepaid income taxes		40,934		36,990
Prepaid expenses and other current assets		47,047		73,320
Total current assets		1,986,274		2,347,683
Deferred income taxes, net		75,152		47,761
Goodwill		38,325		38,609
Intangible assets, net		34,120		52,678
Property, plant and equipment, net		580,561		635,302
Other assets		28,848		48,507
Total assets	$	2,743,280	$	3,170,540
LIABILITIES AND EQUITY				
Current liabilities:				
Current portion of long-term debt	$	16,031	$	18,126
Accounts payable		46,233		55,839
Accrued expenses and other liabilities		202,764		230,826
Income taxes payable		9,618		8,642
Total current liabilities		274,646		313,433
Other long-term liabilities and deferred income taxes		83,274		93,855
Long-term debt, net of current portion		—		16,031
Total liabilities		357,920		423,319
Commitments and contingencies (Note 14)				
IPG Photonics Corporation equity:				
Common stock, $0.0001 par value, 175,000,000 shares authorized; 56,017,672 and 48,138,257 shares issued and outstanding, respectively, at December 31, 2022; 55,788,246 and 53,010,265 shares issued and outstanding, respectively, at December 31, 2021.		6		6
Treasury stock, at cost, 7,879,415 and 2,777,981 shares held at December 31, 2022 and December 31, 2021, respectively.		(938,009)		(438,503)
Additional paid-in capital		951,371		908,423
Retained earnings		2,576,516		2,466,607
Accumulated other comprehensive loss		(204,524)		(189,951)
Total IPG Photonics Corporation stockholders' equity		2,385,360		2,746,582
Non-controlling interests		—		639
Total equity		2,385,360		2,747,221
Total liabilities and equity	$	2,743,280	$	3,170,540

See notes to consolidated financial statements.

IPG PHOTONICS CORPORATION

CONSOLIDATED STATEMENTS OF INCOME

	Year Ended December 31,		
	2022	2021	2020
	(In thousands, except per share data)		
Net sales	$ 1,429,547	$ 1,460,860	$ 1,200,724
Cost of sales	874,134	764,462	661,728
Gross profit	555,413	696,398	538,996
Operating expenses:			
Sales and marketing	76,643	78,180	70,583
Research and development	116,114	139,573	126,898
General and administrative	131,253	125,882	110,005
Goodwill impairment	—	—	44,589
Gain on divestiture and sale of asset	(31,846)	—	—
Impairment of long-lived assets	79,949	—	671
Other restructuring charges	9,697	—	506
Loss (gain) on foreign exchange	4,103	(15,120)	(12,915)
Total operating expenses	385,913	328,515	340,337
Operating income	169,500	367,883	198,659
Other income (expense), net:			
Interest income (expense), net	12,620	(1,839)	6,270
Other income, net	1,231	437	763
Total other income (expense)	13,851	(1,402)	7,033
Income before provision for income taxes	183,351	366,481	205,692
Provision for income taxes	72,589	88,615	45,354
Net income	110,762	277,866	160,338
Less: net income (loss) attributable to non-controlling interests	853	(550)	766
Net income attributable to IPG Photonics Corporation common stockholders	$ 109,909	$ 278,416	$ 159,572
Net income attributable to IPG Photonics Corporation per common share:			
Basic	$ 2.17	$ 5.21	$ 3.00
Diluted	$ 2.16	$ 5.16	$ 2.97
Weighted average shares outstanding:			
Basic	50,761	53,410	53,186
Diluted	50,925	53,930	53,785

See notes to consolidated financial statements.

IPG PHOTONICS CORPORATION

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

	Year Ended December 31,		
	2022	2021	2020
	(In thousands)		
Net income	$ 110,762	$ 277,866	$ 160,338
Other comprehensive (loss) income, net of tax:			
Foreign currency translation adjustments and other	(14,838)	(44,267)	1,367
Adjustment for net gain realized and included in net income	—	—	(232)
Unrealized gain (loss) on derivatives	336	278	(472)
Total other comprehensive (loss) income	(14,502)	(43,989)	663
Comprehensive income	96,260	233,877	161,001
Less: comprehensive income (loss) attributable to non-controlling interest	924	(653)	575
Comprehensive income attributable to IPG Photonics Corporation	$ 95,336	$ 234,530	$ 160,426

See notes to consolidated financial statements.

IPG PHOTONICS CORPORATION

CONSOLIDATED STATEMENTS OF EQUITY

	Year Ended December 31,								
	Common Stock		Treasury Stock		Additional Paid In Capital	Retained Earnings	Accumulated Other Comprehensive (Loss) Income	Non-controlling Interest	Total Stockholders' Equity
(In thousands, except share data)	Shares	Amount	Shares	Amount					
Balance, January 1, 2020	**53,010,875**	**$ 5**	**(1,732,352)**	**$ (265,730)**	**$ 785,636**	**$ 2,028,734**	**$ (146,919)**	**$ 717**	**$ 2,402,443**
Exercise of stock options and vesting of RSUs and PSUs, net of shares withheld for taxes	677,076	1	—	—	27,934	—	—	—	27,935
Common stock issued under employee stock purchase plan	40,943	—	—	—	5,259	—	—	—	5,259
Purchased common stock	(301,660)	—	(301,660)	(37,884)	—	—	—	—	(37,884)
Stock-based compensation	—	—	—	—	35,472	—	—	—	35,472
Recently adopted accounting standards	—	—	—	—	—	(115)	—	—	(115)
Net income	—	—	—	—	—	159,572	—	766	160,338
Foreign currency translation adjustments and other	—	—	—	—	—	—	1,558	(191)	1,367
Unrealized (loss) on derivatives, net of tax	—	—	—	—	—	—	(472)	—	(472)
Adjustment for net gain realized and included in net income	—	—	—	—	—	—	(232)	—	(232)
Balance, December 31, 2020	**53,427,234**	**6**	**(2,034,012)**	**(303,614)**	**854,301**	**2,188,191**	**(146,065)**	**1,292**	**2,594,111**
Exercise of stock options and vesting of RSUs and PSUs, net of shares withheld for taxes	292,849	—	—	—	10,766	—	—	—	10,766
Common stock issued under employee stock purchase plan	34,151	—	—	—	5,492	—	—	—	5,492
Purchased common stock	(743,969)	—	(743,969)	(134,889)	—	—	—	—	(134,889)
Stock-based compensation	—	—	—	—	37,864	—	—	—	37,864
Net income	—	—	—	—	—	278,416	—	(550)	277,866
Foreign currency translation adjustments and other	—	—	—	—	—	—	(44,164)	(103)	(44,267)
Unrealized gain on derivatives, net of tax	—	—	—	—	—	—	278	—	278
Balance, December 31, 2021	**53,010,265**	**6**	**(2,777,981)**	**(438,503)**	**908,423**	**2,466,607**	**(189,951)**	**639**	**2,747,221**
Exercise of stock options and vesting of RSUs and PSUs, net of shares withheld for taxes	167,193	—	—	—	693	—	—	—	693
Common stock issued under employee stock purchase plan	62,233	—	—	—	4,890	—	—	—	4,890
Purchased common stock	(5,101,434)	—	(5,101,434)	(499,506)	—	—	—	—	(499,506)
Stock-based compensation	—	—	—	—	38,302	—	—	—	38,302
Net income	—	—	—	—	—	109,909	—	853	110,762
Foreign currency translation adjustments and other	—	—	—	—	—	—	(14,909)	71	(14,838)
Purchase of non-controlling interests	—	—	—	—	(937)	—	—	(1,563)	(2,500)
Unrealized gain on derivatives, net of tax	—	—	—	—	—	—	336	—	336
Balance, December 31, 2022	**48,138,257**	**$ 6**	**(7,879,415)**	**$ (938,009)**	**$ 951,371**	**$ 2,576,516**	**$ (204,524)**	**$ —**	**$ 2,385,360**

See notes to consolidated financial statements.

IPG PHOTONICS CORPORATION
CONSOLIDATED STATEMENTS OF CASH FLOWS

	Year Ended December 31,		
	2022	2021	2020
	(In thousands)		
Cash flows from operating activities:			
Net income	$ 110,762	$ 277,866	$ 160,338
Adjustments to reconcile net income to net cash provided by (used in) operating activities:			
Depreciation and amortization	90,564	96,330	94,554
Deferred income taxes	(27,575)	(6,885)	(12,813)
Stock-based compensation	38,302	37,864	35,472
Goodwill impairment	—	—	44,589
Impairment of long-lived assets	79,949	—	671
Unrealized gain on foreign currency transactions	(592)	(8,560)	(19,935)
Gain on divestiture and sales of asset	(31,846)	—	—
Other	1,654	8,618	8,642
Provisions for inventory, warranty and bad debt	153,652	68,441	70,572
Changes in assets and liabilities that provided (used) cash, net of acquisitions:			
Accounts receivable	34,100	(2,091)	(13,022)
Inventories	(189,013)	(149,754)	(39,900)
Prepaid expenses and other current assets	22,545	(23,697)	(3,802)
Accounts payable	(12,174)	30,997	(1,942)
Accrued expenses and other liabilities	(43,547)	24,715	(14,752)
Income and other taxes payable	(14,132)	35,856	(23,337)
Net cash provided by operating activities	212,649	389,700	285,335
Cash flows from investing activities:			
Purchases of and deposits on property, plant and equipment	(110,141)	(123,108)	(87,696)
Proceeds from sales of property, plant and equipment	26,862	1,409	889
Proceeds from short-term investments	1,446,355	1,647,537	1,099,224
Purchases of short-term investments	(1,117,022)	(1,940,605)	(1,111,555)
Acquisitions of businesses, net of cash acquired	(2,000)	—	(429)
Proceeds from divestiture, net of cash sold	52,941	—	—
Other	(43)	(1,515)	(7)
Net cash provided by (used in) investing activities	296,952	(416,282)	(99,574)
Cash flows from financing activities:			
Principal payments on long-term borrowings	(18,126)	(3,810)	(3,740)
Proceeds from issuance of common stock under employee stock option and purchase plans less payments for taxes related to net share settlement of equity awards	5,583	16,258	33,194
Purchase of treasury stock, at cost	(499,506)	(134,889)	(37,884)
Payment of purchase price holdback from business combination	—	(2,625)	(1,650)
Purchase of non-controlling interests	(2,500)	—	—
Net cash used in financing activities	(514,549)	(125,066)	(10,080)
Effect of changes in exchange rates on cash, cash equivalents and restricted cash	(5,948)	(17,800)	19,888
Net (decrease) increase in cash, cash equivalents and restricted cash	(10,896)	(169,448)	195,569
Cash, cash equivalents and restricted cash — Beginning of year	709,105	878,553	682,984
Cash, and cash equivalents — End of year	$ 698,209	$ 709,105	$ 878,553
Supplemental disclosure of cash flow information:			
Cash paid for interest	$ 3,214	$ 2,714	$ 2,234
Cash paid for income taxes	$ 113,200	$ 62,998	$ 85,861
Non-cash transactions:			
Demonstration units transferred from inventory to other assets	$ 5,178	$ 5,729	$ 8,117
Property, plant and equipment transferred from inventory	$ 4,172	$ 3,701	$ 4,243
Changes in accounts payable related to property, plant and equipment	$ 1,073	$ 816	$ (75)
Leased assets obtained in exchange for new operating lease liabilities	$ 7,566	$ 7,489	$ 4,035

See notes to consolidated financial statements.

1. NATURE OF BUSINESS AND SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Nature of Business — IPG Photonics Corporation (the "Company" or "IPG") develops, manufactures and sells high-performance fiber lasers, fiber amplifiers, and diode lasers that are used for diverse applications, primarily in materials processing. The Company was incorporated as a Delaware corporation in December 1998. Its world headquarters is located in Marlborough, Massachusetts. It also has facilities and sales offices elsewhere in North and South America, Europe and Asia.

Evaluation of Russian Operations — In October 2022, the European Union ("EU") issued sanctions that restricted the Company's Russian subsidiary from supplying laser components to its other manufacturing facilities beginning in January 2023. These EU sanctions, coupled with increased tariffs in the United States on items imported from Russia, have negatively impacted forecasts for the Russian subsidiary's most significant source of revenue, which is selling components and finished goods to other IPG subsidiaries. As a result of these changes in business conditions in Russia, the Company completed an impairment analysis of assets in Russia during the fourth quarter of 2022 and recorded charges in the accompanying Consolidated Statement of Income. The Company recorded $74,055 of inventory provision and related charges included in Cost of sales, $79,030 impairment of long-lived asset charges included in Impairment of long-lived assets and a $35,518 valuation allowance for deferred tax assets included in provision for income taxes. The long-lived asset impairment charge was based on a probability-weighted average of valuations using the discounted cash flow method under the income approach, the guideline public company method and the guideline transaction method under the market approach, to estimate the fair value of the long-lived assets in Russia. Further, the Company implemented a restructuring program at its Russian subsidiary and recorded restructuring charges of $8,542 for personnel-related restructuring charges and other post employment benefits included in Other restructuring charges.

Principles of Consolidation — The accompanying financial statements include the accounts of the Company and its majority-owned subsidiaries. All intercompany accounts and transactions have been eliminated.

Use of Estimates — The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenue and expenses during the reporting period. The Company bases its estimates on historical experience and on various other assumptions that are believed to be reasonable under the circumstances. Actual results could differ from those estimates.

Foreign Currency — The financial information for entities outside the United States is measured using local currencies as the functional currency. Assets and liabilities are translated into U.S. dollars at the exchange rate in effect on the respective balance sheet dates. Income and expenses are translated into U.S. dollars based on the average rate of exchange for the corresponding period. Exchange rate differences resulting from translation adjustments are accounted for directly as a component of accumulated other comprehensive (loss) income.

Cash and Cash Equivalents and Short-Term Investments — Cash and cash equivalents consist primarily of highly liquid investments, such as money market fund deposits and term deposits, commercial paper, and corporate bonds with maturities of three months or less at the date of purchase with insignificant interest rate risk. Short-term investments consist of liquid investments including commercial paper, corporate bonds, U.S. government and government agency notes, and term deposits with original maturities of greater than three months but less than one year with insignificant interest rate risks. Short-term investments are held-to-maturity and accounted for at amortized cost.

Accounts Receivable and Allowance for Doubtful Accounts — Accounts receivable include $12,977 and $39,720 of bank acceptance drafts at December 31, 2022 and 2021, respectively. Bank acceptance drafts are bank guarantees of payment on specified dates. The weighted average maturity of these bank acceptance drafts is approximately 131 days. The Company maintains an allowance for doubtful accounts to provide for the estimated amount of accounts receivable that will not be collected. The allowance is based upon an estimate of expected credit losses over the life of outstanding receivables. The estimate involves an assessment of customer creditworthiness, historical payment experience, an assumption of future expected credit losses, and the age of outstanding receivables.

IPG PHOTONICS CORPORATION
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(In thousands, except share and per share data)

Activity related to the allowance for doubtful accounts was as follows:

	2022	2021	2020
Balance at January 1	$ 2,108	$ 2,156	$ 2,547
Provision for bad debts, net of (recoveries)	712	434	(156)
Uncollectable accounts written off	(125)	(437)	(114)
Foreign currency translation	(56)	(45)	(121)
Balance at December 31	$ 2,639	$ 2,108	$ 2,156

Inventories — Inventories are stated at the lower of cost and net realizable value on a first-in, first-out basis. Inventories include parts and components that may be specialized in nature and subject to obsolescence. The Company periodically reviews the quantities and carrying values of inventories to assess whether the inventories are recoverable. The costs associated with provisions for excess quantities, technological obsolescence, or component rejections are charged to cost of sales as incurred.

Goodwill — Goodwill is the amount by which the cost of the acquired net assets in a business acquisition exceeded the fair values of the net identifiable assets on the date of purchase. Goodwill is assessed for impairment at least annually, on a reporting unit basis, or more frequently when events and circumstances occur indicating that the recorded goodwill may be impaired. The process of evaluating the potential impairment of goodwill is subjective and requires significant judgment at many points during the analysis. If the carrying value of a reporting unit exceeds its fair value, the implied fair value of goodwill is compared with the carrying value of goodwill. If the carrying value of goodwill exceeds the implied fair value, an impairment loss is recorded in an amount equal to that excess. The results of the goodwill assessments for the years ended December 31, 2022, 2021 and 2020 are discussed in Note 7, "Goodwill and Intangible Assets".

Intangible Assets — Intangible assets result from the Company's various business acquisitions. Intangible assets are reported at cost, net of accumulated amortization, and are amortized on a straight-line basis either over their estimated useful lives of one year to thirteen years or over the period the economic benefits of the intangible asset are consumed.

Property, Plant and Equipment — Property, plant and equipment are stated at cost, less accumulated depreciation. Depreciation is determined using the straight-line method based on the estimated useful lives of the related assets. In the case of leasehold improvements, the estimated useful lives of the related assets do not exceed the remaining terms of the corresponding leases. The following table presents the assigned economic useful lives of property, plant and equipment:

Category	Economic Useful Life
Buildings	20-30 years
Machinery and equipment	5-7 years
Office furniture and fixtures	5-7 years

Expenditures for maintenance and repairs are charged to operating expenses.

Long-Lived Assets — Long-lived assets, which consist primarily of property, plant and equipment and identifiable intangible assets, are reviewed by management for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. When undiscounted expected future cash flows are less than the carrying value, an impairment loss is recorded equal to the amount by which the carrying value exceeds the fair value of assets. The Company incurred $79,949 of non-cash impairment charges related to long-lived assets, with the majority related to Russian operations, during the year ended December 31, 2022. See Note 1, "Nature of Business and Summary of Significant Accounting Policies", section *Evaluation of Russian Operations* for further detail. There were no impairment charges during the year ended December 31, 2021. The Company incurred $671 of non-cash impairment charges related to long-lived assets during the year ended December 31, 2020.

Included in other long-term assets is certain demonstration equipment. The demonstration equipment is amortized over the respective estimated economic lives, generally 3 years. The carrying value of the demonstration equipment totaled $3,686 and $4,624 at December 31, 2022 and 2021, respectively. Amortization expense of demonstration equipment for the years ended December 31, 2022, 2021 and 2020, was $2,387, $3,596 and $4,166, respectively.

Authorized Capital — The Company has authorized capital stock consisting of 175,000,000 shares of common stock, par value $0.0001 per share, and 5,000,000 shares of preferred stock, par value $0.0001 per share. There are no shares of preferred stock outstanding as of December 31, 2022.

Revenue Recognition — Revenue is recognized when transfer of control to the customer occurs in an amount reflecting the consideration that the Company expects to be entitled. In order to achieve this core principle, the Company applies the following five step approach: (1) identify the contract with a customer, (2) identify the performance obligations in the contract, (3) determine the transaction price, (4) allocate the transaction price to the performance obligations in the contract, and (5) recognize revenue when a performance obligation is satisfied.

The Company considers customer purchase orders, which in some cases are governed by master sales agreements, to be contracts with a customer. As part of its consideration of the contract, the Company evaluates certain factors including the customer's ability to pay (or credit risk). For each contract, the Company considers the promise to transfer products, each of which is identified as a distinct performance obligation. In determining the transaction price, the Company evaluates whether the price is subject to refund or adjustment to determine the net consideration to which the Company expects to be entitled. As the Company's standard payment terms are less than one year, the Company has elected the practical expedient under ASC 606-10-32-18 to not assess whether a contract has a significant financing component. The Company allocates the transaction price to each distinct product based on its relative standalone selling price. Revenue is recognized when control of the product is transferred to the customer (i.e., when the Company's performance obligation is satisfied), which typically occurs at shipment but which can occur over time for certain of the Company's systems contracts.

The Company often receives orders with the customer's schedule of delivery dates for products that may extend across several reporting periods. The Company allocates the transaction price of the contract to each delivery based on the product standalone selling price. The Company invoices for each scheduled delivery upon shipment and recognizes revenues for such delivery at that point, when transfer of control has occurred. As scheduled delivery dates are generally within one year, under the optional exemption provided by ASC 606-10-50-14 revenues allocated to future shipments of partially completed contracts are not disclosed.

Rights of return are not generally included in customer contracts. Accordingly, upon application of steps one through five above, product revenue is recognized upon shipment and transfer of control. Returns are infrequent and are recorded as a reduction of revenue.

In certain subsidiaries the Company provides sales commissions to sales representatives based on sales volume. The Company has determined that the incentive portion of its sales commissions qualify as contract costs. The Company has elected the practical expedient in ASC 340-40-25-4 to expense sales commissions when incurred as the amortization period of the asset that would otherwise have been recognized is one year or less.

Revenue Recognition at a Point in Time — Revenues recognized at a point in time consist primarily of product, installation and service sales. The Company sells products to original equipment manufacturers ("OEMs") that supply materials processing laser systems, communications systems, medical laser systems and other laser systems for advanced applications to end users. The Company also sells products to end users that use IPG products directly to build their own systems, which incorporate or use IPG products as an energy or light source. The Company recognizes revenue for laser and spare part sales following the transfer of control of such products to the customer, which typically occurs upon shipment or delivery depending on the terms of the underlying contracts. Installation revenue is recognized upon completion of the installation service, which typically occurs within 90 days of delivery. When sales contracts contain multiple performance obligations, such as the shipment or delivery of products and installation, the Company allocates the transaction price to each performance obligation identified in the contract based on relative standalone selling prices and recognizes the related revenue as control of each individual product or service is transferred to the customer, in satisfaction of the corresponding performance obligations.

Revenue Recognition over Time — Warranties are limited and provide that the product meets specifications and is free from defects in materials and workmanship. The Company also offers extended warranty agreements, which extend the standard warranty periods. Extended warranties are sold separately from products and represent a distinct performance obligation. Revenue related to the performance obligation for extended warranties is recognized over time as the customer simultaneously receives and consumes the benefits provided by the Company. The customer receives the assurance that the product will operate in accordance with agreed-upon specifications evenly during the extended warranty period regardless of whether they make a claim during that period, and therefore, revenue at time of sale is deferred and recognized over the time period of the extended warranty period.

The Company enters into contracts to sell customized large scale materials processing systems through its subsidiary Genesis Systems Group, LLC, for which revenue is generally recognized over time, depending on the terms of the contract. Recognizing revenue over time for these contracts is based on the Company’s judgment that the customized large scale materials processing systems do not have an alternative use and the Company has an enforceable right to payment for performance completed to date.

The determination of the revenue to be recognized in a given period for performance obligations over time is based on the input method. The Company generally uses the total cost-to-cost input method of progress because it best depicts the transfer of control to the customer that occurs as costs are incurred. Under the cost-to-cost method, the extent of progress towards completion is measured based on the proportion of costs incurred to date to the total estimated costs at completion of the performance obligation.

Customer Deposits and Deferred Revenue — When the Company receives consideration from a customer or such consideration is unconditionally due prior to transferring goods or services under the terms of a sales contract, the Company records customer deposits or deferred revenue, which represent contract liabilities. The Company recognizes deferred revenue as net sales after control of the goods or services has been transferred to the customer and all revenue recognition criteria are met.

Warranties — The Company typically provides one to five-year warranties on lasers and amplifiers. Most of the Company's sales offices provide support to customers in their respective geographic areas. The Company estimates the warranty accrual considering past claims experience, the number of units still covered by warranty and the average life of the remaining warranty period. The warranty accrual has generally been sufficient to cover product warranty repair and replacement costs.

Stock-based Compensation — The Company accounts for stock-based compensation expense using the fair value of the awards granted. The Company issues equity incentive awards in the form of time-based restricted stock units ("RSUs") and performance-based restricted stock units ("PSUs"). The fair value for RSUs is based on the closing share price of the Company's common stock on the date of grant. PSUs are aligned to specified performance targets such as financial metrics or the relative return of the Company's common stock compared to an index ("TSR PSUs"). The fair value of PSUs aligned to specified financial performance metrics is determined based on the number of units expected to vest upon achievement of the performance conditions. The fair value for PSUs aligned to the TSR is based on a Monte Carlo simulation model. The Company recognizes stock-based compensation as an expense on a straight-line basis, over the requisite service period. The Company accounts for forfeitures as they occur.

The Company has an employee stock purchase plan ("ESPP") offered to its U.S. and German employees. The Company uses the Black-Scholes model to calculate the purchase date fair value of the shares issued under the employee stock purchase plan and recognize expense related to shares purchased ratably over the offering period. The description of the Company's stock-based compensation plans and the assumptions it uses to calculate the fair value of stock-based compensation is described in Note 15, "Stock-based Compensation."

Advertising Expense — The cost of advertising is expensed as incurred. The Company conducts substantially all of its sales and marketing efforts through trade shows, professional and technical conferences, direct sales and the Company's website. The Company's advertising costs were not material for the periods presented.

Research and Development — Research and development costs are expensed as incurred.

Restructuring — The Company records charges associated with approved restructuring plans to reorganize operations, to remove redundant headcount and infrastructure associated with business acquisitions or to improve the efficiency of business processes. Restructuring charges can include severance costs to eliminate a specific number of positions, infrastructure charges to vacate facilities and consolidate operations and contract cancellation costs. The Company records restructuring charges when they are probable and estimable. The Company accrues for severance and other employee separation costs under these plans when the employees accept the offer and the amount can be reasonably estimated, or when there is legal requirement.

Income Taxes — Deferred tax assets and liabilities are recognized for the future tax consequences of temporary differences between the financial statement carrying amounts and tax basis of assets and liabilities and net operating loss and credit carryforwards using enacted rates in effect when those differences are expected to reverse. Valuation allowances are provided against deferred tax assets that are not deemed to be recoverable. The Company recognizes tax positions that are more likely than not to be sustained upon examination by relevant tax authorities. The tax positions are measured at the greatest amount of tax benefit that is more than 50 percent likely to be realized upon ultimate settlement.

The Company provides reserves for potential payments of tax to various tax authorities related to uncertain tax positions and other issues. The reserves are based on a determination of whether and how much of a tax benefit taken in its tax filings or positions is more likely than not to be realized following resolution of uncertainties related to the tax benefit, assuming that the matter in question will be raised by the tax authorities.

Concentration of Credit Risk — Financial instruments that potentially subject the Company to credit risk consist primarily of cash and cash equivalents, short-term investments and accounts receivable. The Company maintains substantially all of its cash and cash equivalents and short-term investments in various financial institutions, which it believes to be high-credit quality financial institutions. The Company grants credit to customers in the ordinary course of business and provides a reserve for potential credit losses. Such losses historically have been within management's expectations.

One of our customers accounted for 14% and 22% of our net accounts receivable as of December 31, 2022 and 2021, respectively. The Company has historically depended on a few customers for a significant percentage of its annual net sales. The composition of this group can change from year to year. Net sales derived from the Company's five largest customers as a percentage of its annual net sales were 15%, 19% and 24% in 2022, 2021 and 2020, respectively.

Comprehensive Income — Comprehensive income includes charges and credits to equity that are not the result of transactions with stockholders. Included within comprehensive income is the cumulative foreign currency translation adjustment, unrealized gains or losses on derivatives and unrealized gains or losses on available-for-sale securities. These adjustments are accumulated within the consolidated statements of comprehensive income.

(In thousands, except share and per share data)

Total components of accumulated other comprehensive loss were as follows:

	Foreign currency translation adjustments and other	Unrealized gain (loss) on derivatives, net of tax	Unrealized gain (loss) on available-for-sale securities	Total
Balance, January 1, 2020	$ (147,161)	$ 10	$ 232	$ (146,919)
Other comprehensive income (loss), net of tax:				
Foreign currency translation adjustments and other	1,558			1,558
Unrealized (loss) on derivatives, net of tax benefit of $144		(472)		(472)
Adjustment for net gain realized and included in net income			(232)	(232)
Total other comprehensive (loss) income	1,558	(472)	(232)	854
Balance, December 31, 2020	(145,603)	(462)	—	(146,065)
Other comprehensive income (loss), net of tax:				
Foreign currency translation adjustments and other, net of tax benefit of $246	(44,164)			(44,164)
Unrealized (loss) on derivatives, net of tax of $83		278		278
Total other comprehensive (loss) income	(44,164)	278	—	(43,886)
Balance, December 31, 2021	(189,767)	(184)	—	(189,951)
Other comprehensive income (loss), net of tax:				
Foreign currency translation adjustments and other before reclassification, net of tax of $156	(15,117)			(15,117)
Reclassification for foreign currency translation adjustments and other included in net income	208			208
Unrealized gain on derivatives, net of tax of $104		336		336
Total other comprehensive (loss) income	(14,909)	336	—	(14,573)
Balance, December 31, 2022	$ (204,676)	$ 152	$ —	$ (204,524)

Derivative Instruments — The Company's primary market exposures are to interest rates and foreign exchange rates. The Company from time to time may use certain derivative financial instruments to help manage these exposures. The Company executes these instruments with financial institutions it judges to be credit-worthy. The Company does not hold or issue derivative financial instruments for trading or speculative purposes. The Company recognizes all derivative financial instruments as either assets or liabilities at fair value in the consolidated balance sheets.

Business Segment Information — The Company operates in one segment which involves the design, development, production and distribution of fiber lasers, laser and non-laser systems, fiber amplifiers, and related optical components. The Company has a single, company-wide management team that administers all properties as a whole rather than as discrete operating segments. The chief operating decision maker, who is the Company's chief executive officer, measures financial performance as a single enterprise, and not on geography, legal entity, or end market basis. Throughout the year, the chief operating decision maker allocates capital resources on a project-by-project basis across the Company's entire asset base to maximize profitability without regard to geography, legal entity, or end market basis. The Company operates in a number of countries throughout the world in a variety of product lines. Information regarding product lines and geographic financial information is provided in Note 2, "Revenue from Contracts with Customers" and Note 8, "Property, Plant and Equipment."

Earnings Per Share — Basic net income per common share is computed by dividing net income attributable to common shareholders of the Company by the weighted-average number of common shares outstanding during the reporting period. Diluted net income per common share is computed similarly to basic net income per common share, except that it includes the potential dilution that could occur if dilutive securities were exercised. Information about potentially dilutive and antidilutive shares for the reporting period is provided in Note 18, "Net Income Attributable to IPG Photonics Corporation Per Share."

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Leases — The Company determines if an arrangement is a lease at inception. Operating leases are included in other assets, accrued expenses and other liabilities, and other long-term liabilities and deferred income taxes on the Company's consolidated balance sheets.

Right of use ("ROU") assets and lease liabilities are recognized based on the present value of the future minimum lease payments over the lease term at commencement date. As most of the Company's leases do not provide an implicit rate, IPG uses its incremental borrowing rate based on the information available at commencement date in determining the present value of future payments. The ROU assets also include any lease payments made and initial direct costs incurred and exclude lease incentives. Lease terms may include options to extend or terminate the lease when it is reasonably certain that we will exercise that option. Lease expense for minimum lease payments is recognized on a straight-line basis over the lease term. Leases with an initial term of 12 months or less are not recorded on the balance sheet; the Company recognizes lease expense for these leases on a straight-line basis over the lease term. The Company has lease agreements with lease and non-lease components, which are accounted for as a single lease component.

Recent Accounting Pronouncements

Adopted Pronouncements — None.

2. REVENUE FROM CONTRACTS WITH CUSTOMERS

Sales are derived from products for different applications: fiber lasers, diode lasers, systems and accessories for materials processing, fiber lasers, amplifiers and diodes for advanced applications, fiber amplifiers and transceivers for communications applications, and fiber lasers, systems and fibers for medical applications.

The following tables represent a disaggregation of revenue from contracts with customers for the years ended December 31, 2022, 2021 and 2020:

	Year Ended December 31,		
	2022	2021	2020
Sales by Application			
Materials processing	$ 1,291,262	$ 1,325,404	$ 1,082,478
Other applications	138,285	135,456	118,246
Total	$ 1,429,547	$ 1,460,860	$ 1,200,724
Sales by Product			
High Power Continuous Wave ("CW") Lasers	$ 613,734	$ 687,406	$ 646,062
Medium Power CW Lasers	77,079	80,501	50,796
Pulsed Lasers	250,677	240,978	158,448
Quasi-Continuous Wave ("QCW") Lasers	50,212	60,668	50,333
Laser and Non-Laser Systems	153,471	126,642	93,727
Other Revenue including Amplifiers, Service, Parts, Accessories and Change in Deferred Revenue	284,374	264,665	201,358
Total	$ 1,429,547	$ 1,460,860	$ 1,200,724

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	Year Ended December 31,		
	2022	2021	2020
Sales by Geography			
North America	$ 338,713	$ 314,984	$ 246,189
Europe:			
Germany	85,491	101,738	65,646
Other including Eastern Europe/CIS	294,481	289,136	219,540
Asia:			
China	479,926	548,348	502,278
Japan	57,865	54,077	53,180
Other	152,373	139,148	103,785
Rest of World	20,698	13,429	10,106
Total	$ 1,429,547	$ 1,460,860	$ 1,200,724
Timing of Revenue Recognition			
Goods and services transferred at a point in time	$ 1,377,996	$ 1,402,498	$ 1,144,237
Goods and services transferred over time	51,551	58,362	56,487
Total	$ 1,429,547	$ 1,460,860	$ 1,200,724

The Company enters into contracts to sell lasers and spare parts, for which revenue is generally recognized upon shipment or delivery, depending on the terms of the contract. The Company also provides installation services and extended warranties. The Company frequently receives consideration from a customer prior to transferring goods to the customer under the terms of a sales contract. The Company records customer deposits related to these prepayments, which represent a contract liability. The Company also records deferred revenue related to installation services when consideration is received before the services have been performed. The standalone selling price for installation services is determined based on the estimated number of days of service technician time required for installation at standard service rates. The Company recognizes customer deposits and deferred revenue as net sales after control of the goods or services has been transferred to the customer and all revenue recognition criteria are met. The Company bills customers for extended warranties upon entering into the agreement with the customer, resulting in deferred revenue that is recognized over the period of the extended warranty contract. The Company recognizes revenue over time on contracts for the sale of large scale materials processing systems. The timing of customer payments on these contracts generally differs from the timing of revenue recognized. If revenue recognized exceeds customer payments, a contract asset is recorded and if customer payments exceed revenue recognized, a contract liability is recorded. Contract assets are included within prepaid expense and other current assets on the consolidated balance sheets. Contract liabilities are included within accrued expenses and other current liabilities on the consolidated balance sheets. Certain deferred revenues related to extended warranties in excess of one year from the balance sheet date are included within other long-term liabilities and deferred income taxes on the consolidated balance sheets.

The following table reflects the changes in the Company's contract assets and liabilities for the years ended December 31, 2022 and 2021:

	December 31, 2022	January 1, 2022	Change	December 31, 2021	January 1, 2021	Change
Contract assets						
Contract assets	$ 8,620	$ 9,345	$ (725)	$ 9,345	$ 8,999	$ 346
Contract liabilities						
Contract liabilities - current	80,068	89,659	(9,591)	89,659	71,246	18,413
Contract liabilities - long-term	3,142	2,691	451	2,691	2,189	502

During the year ended December 31, 2022 and 2021, the Company recognized revenue of $73,325 and $64,364, respectively, that was included in the contract liabilities at the beginning of the period.

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The Company has elected the practical expedient in ASC 606-10-50-14, whereby the performance obligations for contracts with an original expected duration of one year or less are not disclosed. The following table represents the Company's remaining performance obligations from contracts that are recognized over time as of December 31, 2022:

	Remaining Performance Obligations						
	2023	2024	2025	2026	2027	Thereafter	Total
Revenue expected to be recognized for extended warranty agreements	$ 4,155	$ 1,296	$ 960	$ 608	$ 250	$ 28	$ 7,297
Revenue to be earned over time from contracts to sell large scale materials processing systems	26,091	6,345	—	—	—	—	32,436
Total	$ 30,246	$ 7,641	$ 960	$ 608	$ 250	$ 28	$ 39,733

3. FAIR VALUE MEASUREMENTS

The Company's financial instruments consist of cash equivalents, short-term investments, accounts receivable, accounts payable, long-term debt, interest rate swaps and contingent purchase consideration.

The valuation techniques used to measure fair value are based upon observable and unobservable inputs. Observable inputs reflect market data obtained from independent sources, while unobservable inputs reflect internal market assumptions. These two types of inputs create the following fair value hierarchy: Level 1, defined as observable inputs such as quoted prices for identical instruments in active markets; Level 2, defined as inputs other than quoted prices in active markets that are either directly or indirectly observable; and Level 3, defined as unobservable inputs for which little or no market data exists, therefore requiring an entity to develop its own assumptions. The Company classifies its financial instruments according to the prescribed criteria.

The carrying amounts of money market fund deposits, cash equivalent term deposits, accounts receivable, and accounts payable are considered reasonable estimates of their fair market value due to the short maturity of most of these instruments or as a result of the competitive market interest rates, which have been negotiated. The fair value of the Company's bond securities is based upon quoted prices for instruments with identical terms in active markets. The Company's commercial paper securities reported at fair value are based upon model-driven valuations in which all significant inputs are observable or can be derived from or corroborated by observable market data for substantially the full term of the asset or liability, and are therefore classified as Level 2.

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The following table presents fair value information related to the Company's assets and liabilities measured at amortized cost on the consolidated balance sheets with the exception of the interest rate swap and contingent purchase consideration, which is measured at fair value:

	Fair Value Measurements at December 31, 2022			
	Total	Level 1	Level 2	Level 3
Assets				
Cash equivalents:				
Money market fund deposits	$ 195,654	$ 195,654	$ —	$ —
Commercial paper	94,661	—	94,661	—
Term deposits	68,827	—	68,827	—
Corporate bonds	1,497	—	1,497	—
Short-term investments:				
Commercial paper	363,991	—	363,991	—
Corporate bonds	65,022	—	65,022	—
U.S. Treasury and agency obligations	39,611	—	39,611	—
Term deposits	10,113	—	10,113	—
Other assets:				
Interest rate swap	198	—	198	—
Total assets	$ 839,574	$ 195,654	$ 643,920	$ —
Liabilities				
Term debt	$ 16,031	$ —	$ 16,031	$ —
Total liabilities	$ 16,031	$ —	$ 16,031	$ —

	Fair Value Measurements at December 31, 2021			
	Total	Level 1	Level 2	Level 3
Assets				
Cash equivalents:				
Money market fund deposits and term deposits	$ 279,066	$ 279,066	$ —	$ —
Commercial paper	117,663	—	117,663	—
Corporate bonds	11,459	—	11,459	—
Municipal bonds	3,220	—	3,220	—
Short-term investments:				
Commercial paper	557,955	—	557,955	—
Corporate bonds	215,754	—	215,754	—
U.S. Treasury and agency obligations	21,980	—	21,980	—
Municipal bonds	4,546	—	4,546	—
Term deposit	3,000	—	3,000	—
Foreign government bonds	2,015	—	2,015	—
Total assets	$ 1,216,658	$ 279,066	$ 937,592	$ —
Liabilities				
Term debt	$ 34,226	$ —	$ 34,226	$ —
Contingent purchase consideration	1,371	—	—	1,371
Interest rate swaps	242	—	242	—
Total liabilities	$ 35,839	$ —	$ 34,468	$ 1,371

There were no impairments for the investments considered held-to-maturity at December 31, 2022 and December 31, 2021.

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The following table presents the effective maturity dates of debt investments, which are held-to-maturity:

	December 31, 2022		December 31, 2021	
	Book Value	Fair Value	Book Value	Fair Value
Investment maturity				
Less than 1 year	$ 479,374	$ 478,737	$ 805,400	$ 805,250

The Company entered into an interest rate swap that is designated as a cash flow hedge associated with a long-term note issued during the second quarter of 2016 that will terminate with the long-term note in May 2023. The fair value at December 31, 2022 for the interest rate swap considered pricing models whose inputs are observable for the securities held by the Company.

At December 31, 2022, the Company's long-term note consisted of a variable rate note. The carrying value of the note approximates the estimated fair value of $16,031. At December 31, 2021, the Company's long-term notes consisted of a variable rate note and a fixed rate note. The fair value of the notes were estimated using a discounted cash flow model using observable market interest rates. The fair value of the long-term notes, including the current portion, at December 31, 2021, was $34,226 as compared to the carrying value of $34,157. The long-term notes were reported at amortized cost on the consolidated balance sheets and were classified within Level 2 of the fair value hierarchy.

The fair value of contingent consideration at December 31, 2021 was determined using an income approach at the respective business combination date and at the reporting date. The approach is based on significant inputs that are not observable in the market and include key assumptions such as assessing the probability of meeting certain milestones required to earn the contingent consideration. The contingency period ended during 2022.

The following table presents information about the Company's movement in Level 3 liability measured at fair value:

	2022	2021
Contingent purchase consideration		
Balance at January 1	$ 1,371	$ 1,963
Cash payments	—	(466)
Change in fair value	(1,477)	—
Foreign exchange adjustment	106	(126)
Balance at December 31	$ —	$ 1,371

4. INVENTORIES

Inventories consist of the following:

	December 31,	
	2022	2021
Components and raw materials	$ 322,506	$ 270,146
Work-in-process	18,911	32,506
Finished goods	167,946	158,095
Total	$ 509,363	$ 460,747

The Company recorded inventory provisions and related charges totaling $127,960, $34,285 and $45,375 for the years ended December 31, 2022, 2021 and 2020, respectively. These provisions relate to the recoverability of the value of inventories due to excess quantities and technological changes. These provisions are reported as a reduction to components and raw materials, work-in-process and finished goods. Within the inventory provision and related charges recorded in 2022, $74,055 is related to Russian operations. See Note 1, "Nature of Business and Summary of Significant Accounting Policies", section *Evaluation of Russian Operations* for further detail.

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5. DIVESTITURE AND SALE OF ASSET

During the third quarter of 2022, the Company completed the sale of its telecommunications transmission product line for $56,222. The Company recorded a gain on divestiture of $21,918 for the year ended December 31, 2022, which was included in the Company's consolidated statements of income. As part of and just prior to closing, the Company also acquired the remaining non-controlling interests related to the business that was sold for $2,500.

During the fourth quarter of 2022, the Company completed the sale of its corporate aircraft for $25,693 and recorded a gain of $9,928 which was included in the Company's consolidated statements of income.

6. RESTRUCTURING

In the fourth quarter of 2022, the Company implemented a restructuring program at its Russian subsidiary and closed its Lebanon branch office. These programs resulted in personnel-related restructuring charges of $9,697 for the year ended December 31, 2022. The Company expects to incur approximately $1,600 of additional personnel-related restructuring charges in 2023. All personnel-related restructuring charges are expected to be paid within 12 months. See Note 1, "Nature of Business and Summary of Significant Accounting Policies", section *Evaluation of Russian Operations* for further detail. The Lebanon branch office was closed in conjunction with sale of the telecommunications transmission product line detailed in Note 5, "Divestiture and Sale of Asset". There was no restructuring related activity in 2021.

The restructuring accrual was included in accrued expenses and other liabilities in the Company's consolidated balance sheets. Activity related to the restructuring accrual was as follows:

	Restructuring Charges
Balance at January 1, 2022	$ —
Charges	9,697
Cash payments	(4,493)
Foreign exchange adjustment	(335)
Balance at December 31, 2022	$ 4,869

7. GOODWILL AND INTANGIBLE ASSETS

The following table sets forth the changes in the carrying amount of goodwill for the years ended December 31, 2022 and 2021:

	2022	2021
Balance at January 1	$ 38,609	$ 41,366
Adjustments to goodwill during the measurement period	—	(2,205)
Goodwill arising from business combinations	1,000	—
Goodwill written off related to divestiture	(796)	—
Foreign exchange adjustment	(488)	(552)
Balance at December 31	$ 38,325	$ 38,609

During the first quarter of 2021, the Company finalized the purchase price allocations related to the PiTec acquisition, which resulted in adjustments to goodwill of $2,205.

The Company performed the 2022 and 2021 annual impairment test as of October 1, 2022 and 2021, respectively, and no impairments were recorded as a result of the tests. The carrying balance of goodwill at December 31, 2022, and 2021 was net of accumulated impairments of $81,709.

During the third quarter of 2020, the Company concluded that declines in revenue and order flow for the Genesis custom systems business caused by pandemic-related decreases in capital spending in the aerospace and transportation industries were a triggering event requiring a goodwill impairment evaluation. The Company performed a quantitative assessment using the discounted cash flow method under the income approach as well as the guideline public company analysis and guideline transaction analysis under the market approach to estimate the fair value of the custom systems business. As a result, the

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Company recognized a non-cash impairment loss of $44,589, which was equal to the carrying value of goodwill prior to its impairment. The analysis considered internal forecasts of sales, profitability and capital expenditures, as well as valuation multiples of comparable public companies and valuation multiples of transactions of comparable companies. The Company performed the 2020 annual impairment test as of October 1, 2020, and no additional impairments were recorded as a result of this test. The carrying value of goodwill at December 31, 2020 was net of accumulated impairments of $81,709.

Intangible assets, subject to amortization, consisted of the following:

	December 31, 2022				December 31, 2021			
	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount	Weighted-Average Lives	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount	Weighted-Average Lives
Customer relationships	$ 48,155	$ (21,734)	$ 26,421	11 years	$ 59,729	$ (23,556)	$ 36,173	10 years
Technology, trademark and trade name	30,360	(23,189)	7,171	7 years	40,536	(26,269)	14,267	7 years
Production know-how	9,109	(8,818)	291	7 years	10,384	(8,723)	1,661	7 years
Patents	8,034	(7,797)	237	8 years	8,036	(7,459)	577	8 years
Total	$ 95,658	$ (61,538)	$ 34,120		$ 118,685	$ (66,007)	$ 52,678	

Amortization expense for the years ended December 31, 2022, 2021 and 2020 was $10,454, $12,427 and $11,974, respectively.

The estimated future amortization expense for intangibles as of December 31, 2022 is as follows:

2023	2024	2025	2026	2027	Thereafter	Total
$ 7,894	$ 5,553	$ 4,976	$ 4,216	$ 4,003	$ 7,478	$ 34,120

8. PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment consist of the following:

	December 31, 2022	December 31, 2021
Land	$ 52,618	$ 51,249
Buildings	434,698	433,960
Machinery and equipment	424,197	513,054
Office furniture and fixtures	73,636	77,675
Construction-in-progress	103,655	106,682
Total property, plant and equipment	1,088,804	1,182,620
Accumulated depreciation	(508,243)	(547,318)
Total property, plant and equipment — net	$ 580,561	$ 635,302

The Company recorded depreciation expense of $76,063, $78,563 and $78,414 for the years ended December 31, 2022, 2021 and 2020, respectively.

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Long-lived assets include property, plant and equipment, related deposits on such assets and demonstration equipment. The geographic locations of the Company's long-lived assets, net, based on physical location of the assets, as of December 31, 2022 and 2021 are as follows:

	December 31,	
	2022	2021
United States	$ 388,111	$ 390,255
Germany	111,726	89,017
Russia	—	70,088
Belarus	39,380	46,104
China	5,406	6,997
Other	45,641	47,004
Total	$ 590,264	$ 649,465

During the fourth quarter of 2022, the Company recorded an impairment charge for long-lived assets in Russia. See Note 1, "Nature of Business and Summary of Significant Accounting Policies", section *Evaluation of Russian Operations* for further detail.

9. OTHER LIABILITIES

Accrued expenses and other liabilities consist of the following:

	December 31,	
	2022	2021
Contract liabilities	$ 80,068	$ 89,659
Accrued compensation	78,251	94,857
Current portion of accrued warranty	28,504	26,204
Short-term lease liabilities	5,234	5,454
Other	10,707	14,652
Total	$ 202,764	$ 230,826

Other long-term liabilities and deferred income taxes consist of the following:

	December 31,	
	2022	2021
Accrued warranty	$ 24,358	$ 23,660
Long-term lease liabilities	16,787	18,521
Transition tax related to 2017 U.S. tax reform act	19,874	26,027
Unrealized tax benefits	15,841	19,209
Deferred income taxes	1,469	1,632
Other	4,945	4,806
Total	$ 83,274	$ 93,855

(In thousands, except share and per share data)

10. PRODUCT WARRANTIES

Activity related to the warranty accrual was as follows:

	2022	2021	2020
Balance at January 1	$ 49,864	$ 45,669	$ 48,866
Provision for warranty accrual	22,565	33,289	24,555
Warranty claims	(17,829)	(26,568)	(30,002)
Foreign currency translation	(1,738)	(2,526)	2,250
Balance at December 31	$ 52,862	$ 49,864	$ 45,669

Accrued warranty reported in the accompanying consolidated financial statements as of December 31, 2022 and December 31, 2021 consists of $28,504 and $26,204 in accrued expenses and other liabilities and $24,358 and $23,660 in other long-term liabilities and deferred income taxes, respectively.

11. FINANCING ARRANGEMENTS

The Company's borrowings under existing financing arrangements consist of the following:

	December 31,	
	2022	2021
Total debt	$ 16,031	$ 34,157
Less: current portion	(16,031)	(18,126)
Long-term debt, net of current portion	$ —	$ 16,031

Term Debt:

Long-Term Notes — At December 31, 2022, the Company has an unsecured long-term note with an outstanding principal balance of $16,031, all of which is current. The interest on this unsecured long-term note is variable at 1.20% above LIBOR and is fixed using an interest rate swap at 2.85% per annum. The unsecured long-term note matures in May 2023, at which time the outstanding principal balance will be $15,438. The Company had another long-term note that was secured by its corporate aircraft, which matured and was paid in July 2022, at which time the outstanding principal balance was $15,375.

The future principal payments in 2023 for the Company's Note are $16,031 as of December 31, 2022.

Revolving Line of Credit Facilities:

U.S. Line of Credit — The Company maintains an unsecured revolving line of credit with a principal amount of $75,000, expiring in April 2025. The line of credit bears interest at a variable rate of the Bloomberg Short-term Bank Yield Index ("BSBY") plus 0.80% to 1.20% depending on the Company's financial performance. Part of this credit facility is available to the Company's foreign subsidiaries including those in India, China, Japan and Brazil based on management discretion. At December 31, 2022, there were no outstanding drawings, however, there were $2,396 of guarantees issued against the line which reduced the total availability. At December 31, 2022, the remaining availability under this line was $72,604.

The Company is required to meet certain financial covenants associated with its U.S. revolving line of credit and long-term debt facility. These covenants, tested quarterly, include an interest coverage ratio and a funded debt to earnings before interest, taxes, depreciation and amortization ("EBITDA") ratio. The interest coverage covenant requires that the Company maintains a trailing twelve-month ratio of EBITDA to interest on all obligations that is at least 3.0:1.0. The funded debt to EBITDA covenant requires that the sum of all indebtedness for borrowed money on a consolidated basis be less than three times its trailing twelve months EBITDA. Funded debt is decreased by its cash and available marketable securities not classified as long-term investments in the U.S. in excess of $50,000 up to a maximum of $500,000.

(In thousands, except share and per share data)

Euro Line of Credit — The Company maintains an unsecured revolving line of credit with a principal amount of €50,000 ($53,493 at December 31, 2022), expiring in July 2023. The line of credit bears interest at various rates based upon the type of loan. This credit facility is available to the Company's foreign subsidiaries including those in Germany, China and Italy based on management discretion. At December 31, 2022, there were no drawings, however, there were $1,737 of guarantees issued against the line which reduced the total availability. At December 31, 2022, the remaining availability under this line was $51,756.

Other European Facilities — The Company maintains one Euro credit line in Italy with an available principal of €1,500 ($1,605 as of December 31, 2022), with no expiration date, which bear interest at market rates that reset at the beginning of each quarter. At December 31, 2022, there were no outstanding drawings and the aggregate remaining availability under this line was $1,605. This facility is collateralized by a common pool of the assets of the Company's Italian subsidiary.

12. DERIVATIVE INSTRUMENTS

The Company's only outstanding derivative financial instrument is an interest rate swap that is classified as a cash flow hedge of its variable rate debt. The fair value amounts in the consolidated balance sheets were:

	December 31,	
	2022	2021
Notional amounts [1]	$ 16,031	$ 17,219
Fair values:		
Other assets	198	—
Deferred income taxes and other long-term liabilities	—	242

[1] Notional amounts represent the gross contract/notional amount of the derivative outstanding.

The derivative gains and losses in the consolidated financial statements related to the Company's current and previous interest rate swap contracts were as follows:

	Year Ended December 31,		
	2022	2021	2020
Effective portion recognized in other comprehensive income (loss), pre-tax:			
Interest rate swap	$ 440	$ 361	$ (616)

13. LEASES

The Company leases certain warehouses, office spaces, land, vehicles and equipment under operating lease agreements. The remaining terms of these leases range from less than 1 year to 42 years. The operating lease expense for the years ended December 31, 2022, 2021 and 2020, totaled $8,112, $7,975 and $7,797, respectively. The cash paid for amounts included in the measurement of lease liabilities included in the operating cash flows from operating leases was $7,192, $6,854 and $6,634 for the years ended December 31, 2022, 2021 and 2020, respectively. The Company does not have any finance lease arrangements.

The Company's operating lease assets and lease liabilities consist of the following as of December 31, 2022 and 2021:

		Year Ended December 31,	
Account	Classification	2022	2021
Right-of-use assets	Other assets	$ 15,564	$ 21,688
Short-term lease liabilities	Accrued expenses and other liabilities	5,234	5,454
Long-term lease liabilities	Other long-term liabilities and deferred income taxes	16,787	18,521
Total lease liabilities		$ 22,021	$ 23,975

(In thousands, except share and per share data)

The table below presents the maturities of operating lease liabilities as of December 31, 2022:

2023	$	6,019
2024		4,580
2025		3,817
2026		2,751
2027		1,857
Thereafter		6,350
Total future minimum lease payments		25,374
Less: imputed interest		(3,353)
Present value of lease liabilities	$	22,021

Other information relevant to the Company's operating leases consist of the following as of December 31, 2022 and 2021:

	Year Ended December 31,	
	2022	2021
Weighted-average remaining lease term	7.35 years	7.75 years
Weighted-average discount rate	4.33 %	4.39 %

14. COMMITMENTS AND CONTINGENCIES

Employment Agreements — The Company has entered into employment agreements with certain members of senior management. The terms of these agreements are up to three years and include non-competition, non-solicitation and nondisclosure provisions, as well as provisions for defined severance for terminations of employment under certain conditions and a change of control of the Company. The Company also maintains a severance plan for certain of its senior management providing for defined severance for terminations of employment under certain conditions and a change of control of the Company.

Contractual Obligations — The Company has entered into various purchase obligations that include agreements for construction of buildings, raw materials and equipment. Obligations under these agreements were $25,070 and $19,880 as of December 31, 2022 and 2021, respectively, and the obligations related to raw materials and equipment are generally expected to be fulfilled within one year.

Legal proceedings — From time to time, the Company may be involved in legal disputes and other proceedings in the ordinary course of its business. These matters may include allegations of infringement of intellectual property, commercial disputes and employment matters. As of December 31, 2022 and through the date of the Company's subsequent review period of February 27, 2023, the Company is aware of no ongoing legal proceedings that management estimates could have a material effect on the Company's Consolidated Financial Statements.

The Company has submitted a limited number of voluntary self-disclosures regarding compliance with export control laws and regulations to the Bureau of Industry and Security of the U.S. Department of Commerce ("BIS"). In October 2021, the U.S. Department of Justice advised us it was conducting an investigation into certain shipments of equipment. We believe the DOJ's investigation has concluded however BIS continues its investigation regarding our export practices. At this time, the Company is not able to conclude whether it is probable that BIS will assert a claim or assessment against the Company. Nor can the Company estimate expenses that the Company may incur as a result of the investigation.

(In thousands, except share and per share data)

15. STOCK-BASED COMPENSATION

Stock-based compensation including employee stock purchase plan is included in the following financial statement captions:

	Year Ended December 31, 2022	2021	2020
Cost of sales	$ 11,741	$ 11,245	$ 10,392
Sales and marketing	4,889	4,320	4,395
Research and development	7,585	9,533	9,122
General and administrative	14,120	12,883	11,749
Total stock-based compensation	38,335	37,981	35,658
Tax effect of stock-based compensation	(8,261)	(8,071)	(7,498)
Net stock-based compensation	$ 30,074	$ 29,910	$ 28,160

Incentive Plans — In February 2006, the Company's board of directors adopted the 2006 Incentive Compensation Plan (as amended and restated from time to time, the "2006 Plan"), which provides for the issuance of stock options, PSUs, RSUs, other equity-based awards and cash awards to the Company's directors, employees, consultants and advisors. In June 2006, the Company's board of directors adopted the Non-Employee Directors Stock Plan (the "Directors Plan") for non-employee directors, which was subsequently merged into the 2006 Plan. A total of 10,363,465 shares are reserved under the 2006 Plan. At December 31, 2022, 2,324,889 shares of the Company's stock were available for future grant under the 2006 Plan. The Company may grant stock options only at an exercise price equal to or greater than the fair market value of its common stock on the date of grant. Equity awards generally vest over periods of one to four years and generally expire ten years after the date of the grant. The vesting of awards under the 2006 Plan accelerate following the occurrence of certain change of control events if the participant's employment is terminated within two years by the Company without cause or by the participant for good reason or if an entity acquires control of the Company and does not agree to assume existing awards or replace with equivalent value awards. Awards granted to non-employee directors automatically become vested upon a change of control. All shares issued under the 2006 Plan are registered shares, newly issued by the Company.

The Company granted certain RSUs and PSUs to executive officers and other senior managers. The RSUs provide for time-based vesting of a fixed number of shares over three years. The PSUs provide the holder with the right to receive one share of the Company's common stock after the applicable award vesting period, generally three years. The final number of shares, if any, delivered upon vesting of PSUs are determined over the relevant performance period. The Company has granted two types of PSUs. In the case of TSR PSUs, performance is measured by the Company's total shareholder return over the performance period compared to the S&P 1500 Composite / Electronic Equipment Instruments & Components Index. In the case of all other PSUs, performance is measured against internal financial metrics established by the Company's board of directors. The final number of shares to be delivered under the PSUs range from 0% to 200% of the target award amount.

There were no stock options granted for the years ended December 31, 2022 and 2021. The following table summarizes the option activity for the year ended December 31, 2022:

	Number of Options	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Life	Aggregate Intrinsic Value
Outstanding — January 1, 2022	1,039,372	$ 134.56		
Granted	—	—		
Exercised	(84,060)	65.52		
Forfeited	(73,425)	170.17		
Outstanding — December 31, 2022	881,887	$ 138.16	3.98 years	$ 5,432
Unvested — December 31, 2022	58,907	$ 154.74	6.14 years	$ —
Exercisable — December 31, 2022	822,980	$ 136.98	3.83 years	$ 5,432

The intrinsic value of the options exercised during the years ended December 31, 2022, 2021 and 2020, was $6,069, $28,353 and $52,868, respectively. The total compensation cost related to non-vested option awards not yet recorded at

(In thousands, except share and per share data)

December 31, 2022 was $529 which is expected to be recognized over a weighted-average of 0.3 year. Cash received from option exercises during the year ended December 31, 2022 was $5,507. Tax benefit received from option exercises during the year ended December 31, 2022 was $1,526.

The following table summarizes the RSUs activity for the year ended December 31, 2022:

	Number of Shares	Weighted-Average Grant-Date Fair Value
Outstanding — January 1, 2022	334,107	$ 185.37
Granted	273,711	131.32
Vested	(123,809)	183.98
Canceled	(61,273)	159.49
Outstanding — December 31, 2022	422,736	$ 154.22

The fair value of each restricted stock unit is the market price of Company stock on the date of grant. The weighted average grant date fair value of restricted stock units granted during the years ended December 31, 2022, 2021 and 2020 was $131.32, $229.13 and $145.10, respectively. The intrinsic value of the RSUs that vested during the years ended December 31, 2022, 2021 and 2020, was $14,750, $26,036 and $22,252, respectively. The total compensation cost related to non-vested RSU awards not yet recorded at December 31, 2022 was $43,351 which is expected to be recognized over a weighted-average of 2.1 years. The aggregate fair value of awards vested during the years ended December 31, 2022, 2021 and 2020 was $22,779, $18,042, $19,535, respectively.

The fair value of TSR PSUs was determined using the Monte Carlo simulation model incorporating the following assumptions:

	2021	2020
Performance term (years)	3.0	3.0
Volatility	29% - 51%	19% - 44%
Risk-free rate of return	0.23% - 0.26%	1.39%
Dividend yield	—%	—%
Fair value per share	$248.49 - $165.15	$169.28

The following table summarizes TSR PSUs activity for the year ended December 31, 2022:

	Number of Shares	Weighted-Average Grant-Date Fair Value
Outstanding — January 1, 2022	66,584	$ 195.15
Granted	—	—
Vested	—	—
Canceled	(27,494)	200.95
Outstanding — December 31, 2022	39,090	$ 195.82

For the years ended December 31, 2021 and 2020, the weighted average grant date fair value for new grants was $236.11 and $170.42, respectively. TSR PSUs are included at 100% of target goal. The TSR PSUs granted in 2019 and 2018 did not achieve the performance target upon vesting in 2022 and 2021, respectively, thus no shares became eligible to vest. The Company did not grant TSR PSUs in 2022. The intrinsic value of the TSR PSUs vested during the years ended December 31, 2022, 2021 and 2020 was nil, nil, $6,211. The aggregate fair value of awards vested during the years ended December 31, 2022, 2021 and 2020 was nil, nil, and $5,159, respectively. The total compensation cost related to non-vested awards not yet recorded at December 31, 2022 was $1,734 which is expected to be recognized over a weighted average of 1.2 years.

(In thousands, except share and per share data)

The following table summarizes financial metric-based PSUs activity for the year ended December 31, 2022:

	Number of Shares	Weighted-Average Grant-Date Fair Value
Outstanding — January 1, 2022	40,580	$ 179.60
Granted	62,138	136.64
Vested	—	—
Canceled	(5,166)	153.83
Outstanding — December 31, 2022	97,552	$ 153.56

For the years ended December 31, 2022 and 2021, the weighted average grant date fair value for new grants was $136.64 and $228.62. The financial metric-based PSUs are included at 80% to 100% of target goals. The total compensation cost related to non-vested awards not yet recorded at December 31, 2022 was $7,455, which is expected to be recognized over a weighted average period of 2.0 years.

The Company has an employee stock purchase plan ("ESPP") offered to its U.S. and German employees. The plan allows employees who participate to purchase shares of common stock through payroll deductions at a 15% discount to the lower of the stock price on the first day or the last day of the six-month purchase period. Payroll deductions may not exceed 10% of the employee's compensation and are subject to other limitations.

The assumptions used in the Black-Scholes model for the calculation of the ESPP fair values were as follows:

	2022	2021
Performance term (year)	0.5	0.5
Volatility	41% - 52%	33% - 42%
Risk-free rate of return	0.19% - 2.52%	0.09% - 0.05%
Dividend yield	0.10%	0.10%
Fair value per share	$45.91 - $26.68	$53.09 - $56.43

Compensation expense related to the employee stock purchase plan was $1,924, $1,861 and $2,033 for the years ended December 31, 2022, 2021 and 2020, respectively. During the years ended December 31, 2022, 2021 and 2020, 62,233, 34,151 and 40,943 shares, respectively, were issued at an average price of $78.57, $160.81 and $128.46, respectively, under the employee stock purchase plan. As of December 31, 2022, there were 198,160 shares available for issuance under the employee stock purchase plan.

16. EMPLOYEE BENEFIT PLANS

The Company maintains a defined contribution retirement plan offered to all of its U.S. employees, as well as plans at certain foreign and domestic subsidiaries. The Company makes matching contributions to each plan, which amounted to approximately $6,344, $6,081 and $6,253, respectively, for the years ended December 31, 2022, 2021 and 2020.

17. INCOME TAXES

Income before the impact of income taxes for the years ended December 31 consisted of the following:

	2022	2021	2020
U.S.	$ 135,041	$ 103,980	$ 5,490
Foreign	48,310	262,501	200,202
Total	$ 183,351	$ 366,481	$ 205,692

IPG PHOTONICS CORPORATION
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS - (Continued)
(In thousands, except share and per share data)

The Company's provision for income taxes for the years ended December 31 consisted of the following:

	2022	2021	2020
Current:			
Federal	$ 39,435	$ 13,842	$ 3,871
State	3,697	273	688
Foreign	57,032	81,385	53,608
Total current	100,164	95,500	58,167
Deferred:			
Federal	(25,979)	(179)	(10,300)
State	(2,121)	844	(1,594)
Foreign	525	(7,550)	(919)
Total deferred	(27,575)	(6,885)	(12,813)
Provision for income taxes	$ 72,589	$ 88,615	$ 45,354

A reconciliation of income tax expense at the U.S. federal statutory income tax rate to the recorded tax provision for the years ended December 31, were as follows:

	2022	2021	2020
Tax at statutory rate	$ 38,504	$ 76,955	$ 43,201
Non-U.S. rate differential — net	21,352	18,710	10,968
State income taxes — net	4,904	2,050	697
Stock-based compensation - tax detriment (benefit)	2,736	(5,440)	(9,664)
Foreign derived intangible income benefit ("FDII")	(14,576)	(4,704)	—
Withholding tax on intercompany dividend	1,005	2,883	2,193
Federal and state tax credits	(5,238)	(7,482)	(6,762)
Foreign investment tax credit	(9,559)	(324)	(3,228)
Change in reserves, including interest and penalties	(3,355)	6,041	3,878
Change in valuation allowance	36,993	1,681	2,019
Other — net	(177)	(1,755)	2,052
Provision for income taxes	$ 72,589	$ 88,615	$ 45,354

The tax effects of temporary differences that give rise to significant portions of the deferred tax assets and deferred tax liabilities at December 31, were as follows:

	2022	2021
Property, plant and equipment	$ 6,275	$ (12,117)
Intangible assets	27,044	6,930
Inventory provisions	43,628	25,368
Allowances and accrued liabilities	2,584	5,101
Withholding tax on intercompany dividend	(1,461)	(1,098)
Other tax credits	18,554	17,013
Deferred compensation	27,114	17,365
Net operating loss carryforwards	7,410	11,544
Valuation allowance	(57,465)	(23,977)
Net deferred tax assets	$ 73,683	$ 46,129

(In thousands, except share and per share data)

The Company has recorded $1,461 and $1,098 as a deferred tax liability on December 31, 2022 and 2021, respectively, for certain withholding and dividend taxes related to possible future distributions from subsidiaries to their respective parent companies. With regard to future repatriation of undistributed earnings of other non-U.S. subsidiaries, the Company continues to consider these earnings to be indefinitely reinvested to the extent the cash balance in each subsidiary is less than current needs for operations and expansion. At December 31, 2022 and 2021, the cumulative undistributed earnings in non-U.S. subsidiaries were approximately $967,674 and $949,142, respectively.

In determining the Company's 2022 and 2021 tax provisions, the Company calculated the deferred tax assets and liabilities for each separate tax entity. The Company then considered a number of factors including the positive and negative evidence regarding the realization of deferred tax assets to determine whether a valuation allowance should be recognized with respect to the deferred tax assets.

As of December 31, 2022 and 2021, the Company had state tax credit carryforwards (net of federal tax benefit) of $18,398 and $16,836, respectively. The state tax credit carryforwards begin expiring in 2022. The Company has determined that it is not more likely than not that some of the state credits will be used before the expiration date and recorded a valuation allowance of $15,690 and $13,884 as of December 31, 2022 and 2021, respectively.

The Company has tax loss carryforwards in foreign jurisdictions totaling $22,134 and $38,070 as of December 31, 2022 and 2021, respectively. The Company does not believe it is more likely than not that most of the loss carryforwards can be used and has provided a valuation allowance against the tax benefit of the losses in foreign jurisdictions of $5,942 and $10,093 at December 31, 2022 and 2021, respectively. The decrease in the carryforward losses and related valuation allowance is primarily related to the sale or dissolution of entities that had losses rather than the use of those losses against current taxes. In addition, during the year ended December 31, 2022, the Company recorded a valuation allowance of $35,833 primarily related to deferred tax assets in its Russian subsidiary as it does not believe it is more likely than not that the entities will have future profits sufficient to get the benefit of those deferred assets. The Company's acquisition of Menara Networks, Inc. in 2016 included net operating loss carryforwards of $22,242. As of December 31, 2022 and 2021, the Company had $1,844 and $3,106 of these net operating loss carryforwards remaining, respectively. No valuation allowance has been provided for these carryforwards as the Company expects to be able to fully utilize them to offset future income.

The Company provides reserves for potential payments of tax to various tax authorities related to uncertain tax positions and other issues. Reserves recorded are based on a determination of whether and how much of a tax benefit taken by the Company in the Company's tax filings or positions is "more likely than not" to be realized following resolution of any potential contingencies present related to the tax benefit, assuming that the matter in question will be raised by the tax authorities. The following is a tabular reconciliation of the total amounts of unrecognized tax benefits:

	2022	2021	2020
Balance at January 1	$ 19,209	$ 14,706	$ 11,416
Change in prior period positions	(3,921)	(1,969)	(427)
Additions for tax positions in current period	735	6,400	4,000
Foreign exchange adjustments	(182)	72	(283)
Balance at December 31	$ 15,841	$ 19,209	$ 14,706

The liability for uncertain tax benefits is included in other long-term liabilities and deferred income taxes at December 31, 2022 and 2021. Substantially all of the liability for uncertain tax benefits related to various federal, state and foreign income tax matters, would benefit the Company's effective tax rate, if recognized.

Estimated penalties and interest related to the underpayment of income taxes were a net benefit of $168 and $359 for the years ended December 31, 2022 and 2021, respectively, and are included within the provision for income taxes. Total accrued penalties and interest related to the underpayment of income taxes were $1,476 and $1,641 at December 31, 2022 and 2021, respectively.

(In thousands, except share and per share data)

The Company's uncertain tax positions are related to tax years that remain subject to examination by the relevant taxing authorities. The Company is currently under a tax audit in the U.S. for the years 2017 to 2020. Open tax years by major jurisdictions are:

United States	2017 - 2022
Germany	2021 - 2022
Russia	2018 - 2022

18. NET INCOME ATTRIBUTABLE TO IPG PHOTONICS CORPORATION PER SHARE

The following table sets forth the computation of diluted net income attributable to IPG Photonics Corporation per share:

	Year Ended December 31,		
	2022	2021	2020
Net income attributable to IPG Photonics Corporation common stockholders	$ 109,909	$ 278,416	$ 159,572
Basic weighted average common shares	50,761,096	53,409,673	53,185,733
Dilutive effect of common stock equivalents	163,646	520,554	599,145
Diluted weighted average common shares	50,924,742	53,930,227	53,784,878
Basic net income attributable to IPG Photonics Corporation per common share	$ 2.17	$ 5.21	$ 3.00
Diluted net income attributable to IPG Photonics Corporation per common share	$ 2.16	$ 5.16	$ 2.97

The computation of diluted weighted average common shares excludes certain common stock equivalents, including non-qualified stock options, PSUs, RSUs and the employee stock purchase plan because the effect of including them would be anti-dilutive. The weighted average anti-dilutive shares outstanding for the years ended December 31, 2022, 2021 and 2020, respectively, were as follows:

	Year Ended December 31,		
	2022	2021	2020
Non-qualified stock options	594,290	216,190	536,481
Restricted stock units	344,810	103,998	29,078
Performance stock units	81,348	25,451	—
Total weighed average anti-dilutive shares outstanding	1,020,448	345,639	565,559

On August 2, 2022 and February 15, 2022, the Company announced that its Board of Directors has authorized the purchases of up to $300,000 and $200,000 of IPG common stock, respectively. The authorizations are in addition to the Company's previously authorized stock repurchase programs. Share repurchases may be made periodically in open-market transactions, and are subject to market conditions, legal requirements and other factors. The share repurchase program authorization does not obligate the Company to repurchase any dollar amount or number of its shares, and repurchases may be commenced or suspended from time to time without prior notice.

On May 5, 2020, the Company announced that its Board of Directors authorized the purchase of up to $200,000 of IPG common stock. This authorization is separate from, and in addition to, the Company's $125,000 stock repurchase program authorized in February 2019.

For the years ended December 31, 2022, 2021 and 2020, respectively, the Company repurchased 5,101,434 shares, 743,969 shares, and 301,660 shares of its common stock with an average price of $97.89, $181.28 and $125.58 per share in the open market, respectively. The May 2020 authorization and February 2022 authorization to repurchase common stock were completed in 2022. As of December 31, 2022 the remaining amount authorized under the August 2022 was up to $112,153. The impact on the reduction of weighted average shares for years ended December 31, 2022, 2021 and 2020 was 2,393,478 shares, 244,451 shares and 201,953 shares, respectively.

19. RELATED-PARTY TRANSACTIONS

Dr. Valentin P. Gapontsev, the late Chairman and former CEO of the Company, leased the annual right to use 25% of the Company's corporate aircraft under a lease signed in July 2017. The lease terminated in April 2022. The Company invoiced Dr. Gapontsev's estate or himself $249, $924 and $937 in 2022, 2021, and 2020, respectively, under the aircraft lease. There was $77 due at December 31, 2021. Dr. Gapontsev and his estate directly paid an unrelated flight management firm for the operating costs of his private use including pilot fees, fuel and other costs. Natalia Pavlova, a director, and Angelo Lopresti, an executive officer, are executors of the estate of Dr. Gapontsev.

IPG PHOTONICS CORPORATION

SENIOR EXECUTIVE

ANNUAL INCENTIVE PLAN

ARTICLE I GENERAL

SECTION 1.1 PURPOSE.

The purpose of the IPG Photonics Corporation Senior Executive Annual Incentive Plan (the "Plan") is to benefit and advance the interests of IPG Photonics Corporation, a Delaware corporation (the "Company"), by providing to selected senior executives of the Company and its subsidiaries performance-based incentive compensation ("Awards") that are based upon the level of achievement of financial, business and other performance criteria.

SECTION 1.2 ADMINISTRATION OF THE PLAN.

The Plan shall be administered by a committee (the "Committee") appointed by the Board of Directors of the Company (the "Board"), consisting of at least such number of directors who have qualifications that satisfy the "outside director" requirements of Section 162(m) of the Internal Revenue Code of 1986, as amended (the "Code") and the regulations thereunder. The Committee shall adopt such rules as it may deem appropriate in order to carry out the purpose of the Plan. All questions of interpretation, administration and application of the Plan shall be determined by a majority of the members of the Committee then in office, except that the Committee may authorize any one or more of its members, or any officer of the Company, to execute and deliver documents on behalf of the Committee. The determination of such majority shall be final and binding in all matters relating to the Plan. The Committee shall have authority to designate the eligible persons specified in Section 1.3 below who will receive Awards under, and become participants in, the Plan ("Participants") and to determine the terms and conditions of such Awards.

With respect to any restrictions in the Plan that are based on the requirements of Section 162(m) of the Code or any other applicable law, rule or restriction, to the extent that any such restrictions are no longer required, the Committee shall have the sole discretion and authority to grant Awards that are not subject to such restrictions and/or to waive any such restrictions with respect to outstanding Awards.

SECTION 1.3 ELIGIBLE PERSONS.

Awards may be granted only to employees of the Company or one of its subsidiaries who are at the level of Vice President or employee-Director of the Company or one of its subsidiaries or at a more senior level. An individual shall not be deemed an employee for purposes of the Plan unless such individual is classified and receives compensation from either the Company or one of its subsidiaries for services performed as an employee of the Company or any of its subsidiaries.

ARTICLE II AWARDS

SECTION 2.1 AWARDS.

The Committee may grant Awards to eligible employees with respect to each fiscal year of the Company, subject to the terms and conditions set forth in the Plan.

SECTION 2.2 TERMS OF AWARDS.

Not later than ninety days after the start of each fiscal year of the Company (but not after more than 25% of the Performance Period (as such term is defined below) has elapsed) or, for fiscal 2005, not later than April 15, 2005, the Committee shall (i) determine the Participants from the eligible persons under Section 1.3 above, (ii) establish for such period ("Performance Period") the applicable performance goals and objectives ("Performance Targets") for the Company and the subsidiaries and divisions thereof and for each individual Participant and the percentage allocation to each such Performance Target, and (iii) establish target awards ("Target Awards") for each Participant which shall equal a percentage (up to 200%) of the Participant's Salary (as such term is defined below). Performance Targets under the Plan may include (but shall not be limited to) any of the following: net earnings; operating earnings or income; earnings growth; net income (absolute or competitive growth rates comparative); net income applicable to common stock; gross revenue or revenue by pre-defined business segment (absolute or competitive growth rates comparative); revenue backlog; margins realized on delivered services; cash flow, including operating cash flow, free cash flow, discounted cash flow return on investment, and cash flow in excess of cost of capital; earnings per share of common stock; return on stockholders equity (absolute or peer-group comparative); stock price (absolute or peer-group comparative); absolute and/or relative return on common stockholders equity; absolute and/or relative return on capital; absolute and/or relative return on assets; economic value added (income in excess of cost of capital); customer satisfaction; expense reduction; ratio of operating expenses to operating revenues; product development milestones; debt-to-capital ratio or market share. The Committee may specify any reasonable definition for the Performance Targets that it uses during a Performance Period.

"Salary" shall mean the annual base salary of the Participant for the Performance Period, and (ii) an amount equal to the annual rate of any deferred compensation for such Performance Period; PROVIDED that, if the Participant has an employment agreement as in effect on the "Effective Date" (as defined below) and such employment agreement expires prior to the end of any Performance Period, the amount of base salary and deferred compensation determined hereunder shall relate to the highest annual amounts that were provided for under such employment agreement. Notwithstanding the foregoing, "Salary" determined hereunder shall not include any amounts that would cause the Committee to exercise discretion not otherwise permitted by Section 162(m) of the Code to the extent Section 162(m) of the Code shall be applicable.

SECTION 2.3 DETERMINATION OF AWARDS.

As soon as administratively practicable after the end of the relevant Performance Period, the Committee, or, if applicable, the Committee's delegate, shall determine the amount of the Award for each Participant by: (i) determining the actual performance results for each Performance Target; (ii) determining the amount to which each Participant is entitled based on the percentage allocated by the Committee to each Performance Target against the Target Award for each Participant; and (iii) certifying by resolution duly adopted by the Committee (or equivalent action by the Committee's delegate) the value of the Award for each Participant so determined. The Committee may, in its sole discretion, increase or reduce the amount of any Award to reflect the Committee's assessment of the Participant's individual performance during a Performance Period or for any other reason, to the extent consistent with Section 162(m) of the Code (to the extent Section 162(m) of the Code shall be applicable).

SECTION 2.4 PAYMENT OF AWARDS.

Payment of an Award to a Participant shall be made as soon as practicable after determination of the amount of the Award under Section 2.3 above, and after the Committee has approved the aggregate bonus payout amount for the Performance Period, but in no event later than 2-½ months after the end of the Performance Period. Subject to the requirements of applicable law, a Participant may defer the payment of all or any portion of an Award under a deferred compensation arrangement maintained by the Company by making a timely deferral election pursuant to such rules and procedures as the Committee may establish from time to time with respect to such arrangement.

SECTION 2.5 EMPLOYMENT REQUIREMENT.

The payment of an Award with respect to a specific Performance Period requires that the Participant be on the payroll of the Company or any of its subsidiaries as of the end of such Performance Period, PROVIDED that, if a Participant becomes "permanently disabled" (as determined by the Committee in its sole discretion), retires under the terms of a qualified pension plan maintained by the Company in which such Participant participates, or dies during a Performance Period, or if a Participant is on an approved leave of absence that began prior to the end of the Performance Period, such Participant or his estate shall be awarded, unless his employment agreement provides otherwise, a pro rata portion of the amount of the Award earned for such Performance Period, except that the Committee may, in its sole discretion, reduce the amount of such Award to reflect the Committee's assessment of such Participant's individual performance prior to such Participant's becoming permanently disabled, retirement or such Participant's death or approved leave as the case may be, or for any other reason.

ARTICLE III ADJUSTMENT OF AWARDS

SECTION 3.1 ADJUSTMENTS.

In the event that, during a Performance Period, any recapitalization, reorganization, merger, acquisition, divestiture, consolidation, spin-off, combination, liquidation, dissolution, sale of assets, or other similar corporate transaction or event, any other extraordinary item or event not foreseen at the time of the grant of the Award, any unusual or non-recurring event or item the Committee deems not reflective of the Company’s core operating performance or any other event that distorts the applicable Performance Targets, occurs involving the Company or a subsidiary or division thereof, the Committee shall, to the extent consistent with Section 162(m) of the Code (to the extent Section 162(m) of the Code shall be applicable), adjust or modify, as determined by the Committee in its sole and absolute discretion, such Performance Targets, to the extent necessary to prevent reduction or enlargement of Participants' Awards under the Plan for such Performance Period attributable to such transaction or event. Such adjustments shall be conclusive and binding for all purposes.

SECTION 3.2 PAYMENT UPON CHANGE IN CONTROL.

Anything to the contrary notwithstanding, within five days following the occurrence of a Change in Control (as defined below), the Company shall pay to each Participant an interim lump-sum cash payment (the "Interim Payment") with respect to his or her participation in the Plan. For each Participant, the amount of the Interim Payment shall equal the product of (x) the number of months, including fractional months, that have elapsed until the occurrence of the Change in Control in the Performance Period in which the Change of Control occurs and (y) one-twelfth of the greater of (i) the amount of most recently paid

Award to the Participant for a full calendar year, or (ii) the Target Award for the Participant for the Performance Period in which the Change in Control occurs. The Interim Payment shall not reduce the obligation of the Company to make a final payment under the terms of the Plan, but any Interim Payment made shall be offset against any later payment required under the terms of the Plan for the calendar year in which a Change in Control occurs. No Participant may be required to refund to the Company, or have offset against any other payment due any participant from or on behalf of the Company, all or any portion of the Interim Payment.

"Change in Control" means:

(i) The acquisition by any individual, entity or group (within the meaning of Section 13(d)(3) or 14(d)(2) of the Securities Exchange Act of 1934, as amended (the "Exchange Act")), of beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of 50% or more of the combined voting power of the then outstanding voting securities of the Company entitled to vote generally in the election of directors (the "Outstanding Company Voting Securities"); PROVIDED, HOWEVER, that the following acquisitions shall not constitute a Change of Control: (A) any acquisition directly from the Company (other than by exercise of a conversion privilege), (B) any acquisition by the Company or any of its subsidiaries, (C) any acquisition by any employee benefit plan (or related trust) sponsored or maintained by the Company or any of its subsidiaries or (D) any acquisition by any corporation with respect to which, following such acquisition, more than 50% of the then outstanding combined voting power of the then outstanding voting securities of such corporation entitled to vote generally in the election of directors is then beneficially owned by all or substantially all of the individuals and entities who were the beneficial owners of the Outstanding Company Voting Securities immediately prior to such acquisition in substantially the same proportions as their ownership, immediately prior to such acquisition, of the Outstanding Company Voting Securities; or

(ii) Approval by the shareholders of the Company of a reorganization, merger or consolidation, or a sale or other disposition of all or substantially all of the assets of the Company, in each case, with respect to which all or substantially all of the individuals and entities who were the beneficial owners of the Outstanding Company Voting Securities immediately prior to such reorganization, merger, consolidation or sale, do not, following such reorganization, merger, consolidation or sale, beneficially own, directly or indirectly, more than 50% of, respectively, the then outstanding shares of common stock and the combined voting power of the then outstanding voting securities entitled to vote generally in the election of directors, as the case may be, of the corporation resulting from such reorganization, merger, consolidation or sale in substantially the same proportions as their ownership, immediately prior to such reorganization, merger, consolidation or sale of the Outstanding Company Voting Securities.

ARTICLE IV MISCELLANEOUS

SECTION 4.1 NO ADDITIONAL PARTICIPANT RIGHTS.

The selection of an individual as a Participant in the Plan shall not give such Participant any right to be retained in the employ of the Company or any of its subsidiaries, and the Company and any such subsidiary specifically reserve the right to dismiss the Participant or to terminate any arrangement pursuant to which any such Participant provides services to the Company, with or without cause. No person shall have claim to an Award under the Plan, except as otherwise provided for herein, or to continued participation under the Plan. There is no obligation for uniformity of treatment of Participants under the Plan. The benefits provided for Participants under the Plan shall be in addition to and shall in no way preclude other forms of compensation to or in respect of such Participants. It is expressly agreed and understood that the employment of the Participant is terminable at the will of either party and, if such Participant is a party to an employment contract with the

Company or one of its subsidiaries, in accordance with the terms and conditions of the Participant's employment contract.

SECTION 4.2 NO ASSIGNMENT.

The rights of a Participant with respect to Awards granted under the Plan shall not be transferable by the Participant, otherwise than by will or the laws of descent and distribution prior to the payment thereof.

SECTION 4.3 TAX WITHHOLDING.

The Company or a subsidiary thereof, as appropriate, shall have the right to deduct from all payments made under the Plan to a Participant or to a Participant's beneficiary or beneficiaries any federal, state or local taxes required by law to be withheld with respect to such payments.

SECTION 4.4 NO RESTRICTION ON RIGHT OF COMPANY TO EFFECT CHANGES.

The Plan shall not affect in any way the right or power of the Company or its stockholders to make or authorize any recapitalization, reorganization, merger, acquisition, divestiture, consolidation, spin-off, combination, liquidation, dissolution, sale of assets, or other similar corporate transaction or event involving the Company or a subsidiary thereof or any other event or series of events, whether of a similar character or otherwise.

SECTION 4.5 SOURCE OF PAYMENTS.

The Company shall not have any obligation to establish any separate fund or trust or other segregation of assets to provide for payments under the Plan. To the extent any person acquires any rights to receive payments hereunder from the Company, such rights shall be no greater than those of an unsecured creditor.

SECTION 4.6 AMENDMENT AND TERMINATION.

The Board may at any time and from time to time alter, amend, suspend or terminate the Plan in whole or in part; PROVIDED, HOWEVER, that no alteration or amendment will be effective without stockholder approval if such approval is required by law. In the case of Participants employed outside the United States, the Committee or its designees may vary the provisions of the Plan as deemed appropriate to conform with local laws, practices and procedures. In addition, the General Counsel of the Company is authorized to make certain minor or administrative changes required by or made desirable by government regulation.

SECTION 4.7 GOVERNMENTAL REGULATIONS.

The Plan, and all Awards hereunder, shall be subject to all applicable rules and regulations of governmental or other authorities.

SECTION 4.8 HEADINGS.

The headings of articles and sections herein are included solely for convenience of reference and shall not affect the meaning of any of the provisions of the Plan.

SECTION 4.9 GOVERNING LAW AND SEVERABILITY.

The Plan and all rights and Awards hereunder shall be construed in accordance with and governed by the laws of the State of Delaware without regard to conflicts of law principles and applicable federal law. If any portion of this Plan is deemed to be in conflict with local law, that portion of the Plan, and that portion only, will be deemed null and void under that local law. All other provisions of the Plan will remain in full effect.

SECTION 4.10 EFFECTIVE DATE.

The Plan shall become effective upon its adoption by the Board. The Plan shall be effective, unless amended or terminated in accordance with Section 4.6 above.

Adopted April 6, 2005, Amended April 28, 2020

Exhibit 21.1

Subsidiaries of Registrant

Name	State or Jurisdiction of Incorporation	Ownership by Registrant as of December 31, 2022
IPG Laser GmbH	Germany	100%

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We consent to the incorporation by reference in Registration Statement Nos. 333-139509, 333-151571, 333-167381, 333-177818, 333-206931, and 333-223045 each on Form S-8 of our reports dated February 27, 2023, relating to the financial statements of IPG Photonics Corporation and the effectiveness of IPG Photonics Corporation's internal control over financial reporting appearing in this Annual Report on Form 10-K for the year ended December 31, 2022.

/s/ Deloitte & Touche LLP

Boston, Massachusetts
February 27, 2023

Exhibit 31.1

CERTIFICATION OF CHIEF EXECUTIVE OFFICER
PURSUANT TO RULE 13a-14(a) OR RULE 15d-14(a)
OF THE SECURITIES EXCHANGE ACT OF 1934

I, Eugene A. Scherbakov, certify that:

1. I have reviewed this Annual Report on Form 10-K of IPG Photonics Corporation for the year ended December 31, 2022;

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

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

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

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

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

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

   d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

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

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

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

Date: February 27, 2023

/s/ Eugene A. Scherbakov
Chief Executive Officer
(Principal Executive Officer)

Exhibit 31.2

CERTIFICATION OF CHIEF FINANCIAL OFFICER
PURSUANT TO RULE 13a-14(a) OR RULE 15d-14(a)
OF THE SECURITIES EXCHANGE ACT OF 1934

I, Timothy P.V. Mammen, certify that:

1. I have reviewed this Annual Report on Form 10-K of IPG Photonics Corporation for the year ended December 31, 2022;

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

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

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

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

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

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

   d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

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

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

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

Date: February 27, 2023

/s/ Timothy P.V. Mammen

Timothy P.V. Mammen
Senior Vice President and Chief Financial Officer
(Principal Financial Officer)

Exhibit 32.1

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the filing of the Annual Report on Form 10-K for the fiscal year ended December 31, 2022 (the "Report") by IPG Photonics Corporation (the "Company"), Eugene A. Scherbakov, the Chief Executive Officer of the Company, and Timothy P.V. Mammen, the Chief Financial Officer of the Company, each hereby certifies pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that:

1 the Report fully complies with the requirements of Section 13(a) or Section 15(d) of the Securities Exchange Act of 1934; and

2 the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: February 27, 2023

/s/ EUGENE A. SCHERBAKOV
Eugene A. Scherbakov
Chief Executive Officer

/s/ TIMOTHY P.V. MAMMEN
Timothy P.V. Mammen
Senior Vice President and Chief Financial Officer

A signed original of this written statement required by 18 U.S.C. Section 1350 has been provided to IPG Photonics Corporation and will be retained by IPG Photonics Corporation and furnished to the Securities and Exchange Commission or its staff upon request.