Crawford Capital Partners, LP

Manual of Ideas
Best Ideas 2019 Conference
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Best Ideas Prior Years' Update

Idea Presented	Date	Price	Performance 6-Months	Performance 1-year	Performance (TR) Since Inception or over life
2014: Myriad Genetics (MYGN)	1/8/14	$21.05	+58.5%	+101.0%	+90.8%[1]
2015: Ubiquiti Networks (UBNT)	1/12/15	$28.05	+18.3%	+0.2%	+258.3%[2]
2016: Ritchie Brothers (RBA)	1/12/16	$21.89	+60.5%	NA	+41.6%[3]
2017: Amerco (UHAL)	1/10/17	$368.23	-3.8%	+2.5%	-4.9%[4]
2018: Diamond Hill (DHIL)	1/12/18	$203.70	-9.3%	NA	-19.4%
2019: IPG Photonics (IPGP)	1/10/19	126.27			

[1] MYGN Investment closed out early 2016 after reaching targeted fair value
[2] UBNT Investment closed out late 2018 after reaching targeted fair value
[3] RBA Investment exited during 2016 after quickly reaching targeted fair value
[4] UHAL and DHIL Investments still open

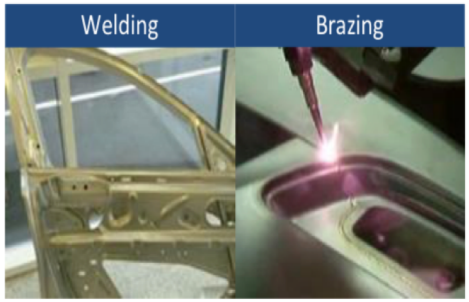
IPGP (NYSE--$126.27)

- Dominant #1 laser company with durable competitive advantages
- Innovative company pursuing large long-term secular growth opportunities
- Superior owner-operator founder CEO with operational focus and shareholder orientation
- Stock out of favor recently (-50%+) due to fears over tariffs and an industrial slowdown
- Attractive 45% upside to our $182/share appraisal; Fair value poised to grow over time

What Are Industrial Lasers used For?

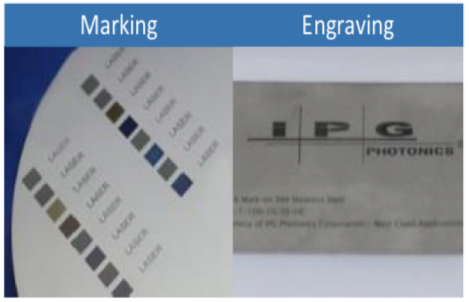
54% of revenue

Lasers cut and drill material not through mechanical grinding, but by focusing a high-powered beam and rapidly heating the material, which either melts or vaporizes it. There is no contact between the machinery and the item, with the laser working at a distance. There is still a kerf (material removed through cutting) as with traditional methods, but the kerf can be greatly reduced in size by using a laser.



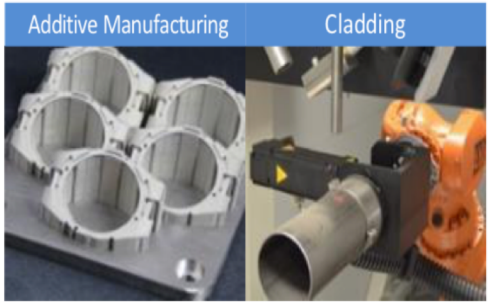
20% of revenue

The ability of a laser to rapidly heat a small section of material makes it more efficient than traditional materials processing methods, even more so in the case of welding and brazing where consumables are used and heat transfer to the workpiece is an important concern. The high power density provided by a laser system allows welding of: (1) different alloys together; (2) high-strength and multi-layered steel; and (3) aluminum, which was traditionally riveted.

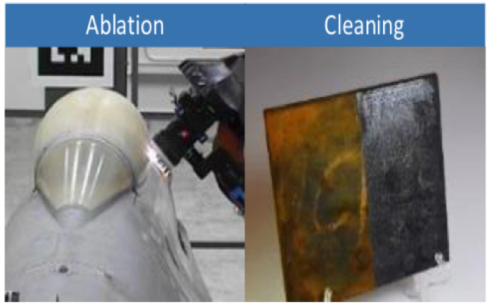


9% of revenue

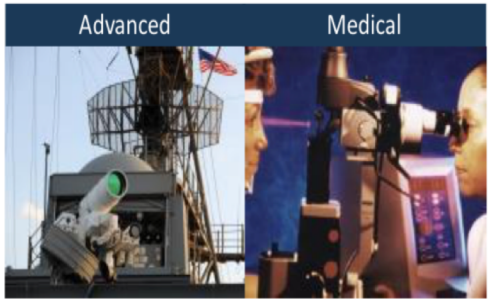
Fiber lasers can be used to oxidize surfaces, darkening sections to form a design. Different colors can be attained through the addition of powders, which when heated bind to the workpiece and create the intended shape. Engraving involves the vaporization of a shallow layer, leaving behind a permanent and low maintenance mark.



Cladding and additive manufacturing function in largely the same way, heating metallic powders until they bind to one another or to the workpiece when cladding. Additive manufacturing enables the construction of unique, completely metallic parts and cladding allows for repair and increased functionality of components through the addition of a protective layer.



In ablation, the exterior coating absorbs the energy and vaporizes, leaving behind only the underlying material which has a higher vaporization temperature. Lasers can also be used to clean rust, paint and other coatings from surfaces without any chemicals through pulsed laser emissions which vaporize the surface damage or coating but keep the underlying material intact.



Our products are used in a variety of advanced applications including obstacle warning and light detecting and ranging, directed energy applications for security and defense, scientific projects and research and cinema projection systems. We also produce multiple laser types for medical applications including general surgery and urology, dental and skin rejuvenation and wrinkle removal.

IPG Products

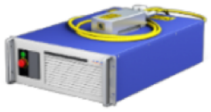
Products

High Power CW

1. ~60% of revenue

High Powered Continuous Wave ytterbium fiber lasers make up the majority of IPG revenue and have average powers from 1 to 120 kW, ideal for materials processing applications like cutting and welding. They present a flexible manufacturing solution since they not only operate at their peak power, but can also be used for low power applications with ease. Their modular design enables redundancy as failure of any one module can be compensated by the others, decreasing service time significantly. IPG high power lasers are the most efficient on the market with wall plug efficiencies from 40-50%-plus, reducing cooling needs significantly. In addition, we also produce single-mode ytterbium fiber lasers with power levels up to 10 kW for advance applications.

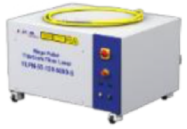
Mid/Low Power CW



2. ~8% of revenue

Mid and low power lasers have output ranges below 1 kW, and those under 500 W are generally air cooled, further reducing costs. They have the same leading efficiency as high powered ytterbium fiber lasers and the same high beam quality. IPG produces these units as OEM modules or as easily integrated rack units directly for the end consumer. These lasers present an economic choice for additive manufacturing, R&D, scientific and commercial uses with a wide range of wavelengths available, from .5-5 µm, including erbium and thulium fiber lasers with output power levels up to 500 W.

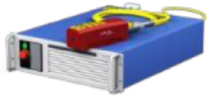
Pulsed



3. 10-15% of revenue

Pulsed lasers deliver high peak power with much lower average power use, making them very useful for applications where material integrity is important. Pulsed lasers allow for applications like ablation, marking, trimming, drilling. Pulsed lasers are offered in a wide range of wavelengths: .36 - 5 µm with adjustable repetition and peak power rates making a single laser flexible for many different uses with lower energy consumption and a smaller footprint than a CW laser.

Ultrafast



4. <5% of revenue

A fast growing range of advanced applications require ultra-short pulse durations in the 10^{-11} (picosecond) to 10^{-13} (femtosecond) range. Based on a master oscillator power amplifier (MOPA) architecture, IPG ultrafast fiber lasers generate very short pulses at extremely high power, which are particularly well suited for micro materials processing since they enable drilling and dicing with no thermal damage to surrounding materials. Our ultrafast lasers can also be used in a variety of medical and scientific applications.

QCW

5. 5-7% of revenue

Quasi-continuous wave lasers produce pulses in the millisecond to microsecond range, similar to Nd:YAG lasers but with greater power efficiency and flexible beam delivery. Even the relatively long pulses of a QCW laser enable a peak power ~10x higher than average power. The smaller variation in output compared to other pulsed lasers makes them practical for fine welding, percussion hole drilling and fine cutting in the consumer electronics and aerospace industries.

Systems

6. <5% of revenue

IPG not only produces laser modules for OEMs and end users, but also manufactures complete machine tool systems, integrating laser modules with motion systems, optics, beam switches, processing heads and software. These integrated precision systems allow for easy automation and are customizable to meet consumer needs as well as providing unified readymade solutions suitable for most typical needs.

Accessories

7. <5% of revenue

In order to expand the capabilities of fiber laser technology, IPG manufactures a complete set of optical beam delivery components. Products include state-of-the-art welding heads, cutting heads and scanning-based processing systems. In addition, IPG sells delivery fiber and optics, beam couplers, switches and sharers, collimators and process control and tooling solutions.

Telecom

8. <5% of revenue

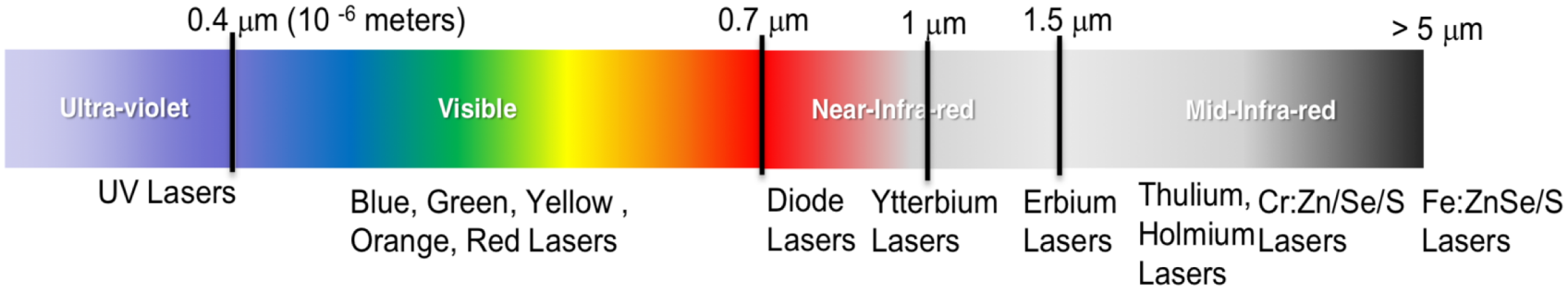
IPG produces fiber amplifiers, Raman pump lasers and optical transceivers for the telecom and datacom markets. IPG's fiber amplifiers are deployed in some of the world's largest broadband and fiber-to-the-home networks. In addition, we design and manufacture transceivers and transponders featuring proprietary mixed signal ASIC and DSP technology for interconnecting electronic equipment within telco, cable and data center networks.

9. Service and other — 5-10% of revenue

The Power to Transform®

IPG In Every Laser Segment

(1) Any Wavelength



(2) Any Pulse Duration

CW (Continuous Wave): laser is on all the time
% of Laser Sales = Majority

QCW (Quasi-Continuous Wave): laser is modulated
% of Laser Sales = <10%

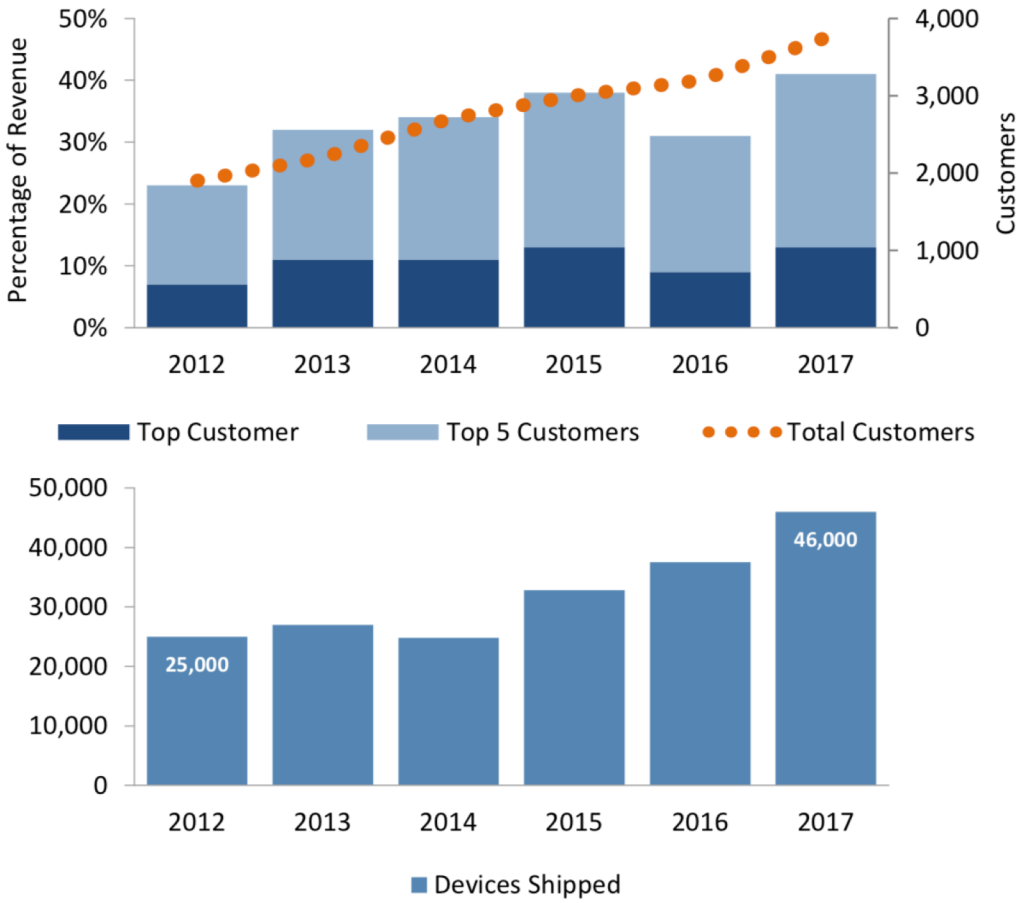
Pulsed: laser switched on for 10^{-9} seconds
Includes ultrafast picosecond 10^{-12} and femtosecond 10^{-15}
% of Laser Sales = 10% to 15%

(3) Any Power

Laser power: from several watts to hundreds of KW

% of CW Laser Sales by power level: **<1 KW = 15% to 20%**
1 to 5 KW = ~50%
>6 KW = 30% to 35%

IPG Customer Base



General Manufacturing & OEM

Automotive

Heavy Industry

Aerospace

Additive Manufacturing

Semiconductor & Electronics

Customer Benefits

- A 6 kW fiber laser cuts 0.25-inch think steel at 200 inches per minute (IPM), about double the speed of a 6 kW CO_2 laser, which cuts at 110 IPM. Moreover, a 10 kW fiber laser cuts 0.25-inch thick steel at 500 IPM, about five times faster than a 6 kW CO_2 laser.

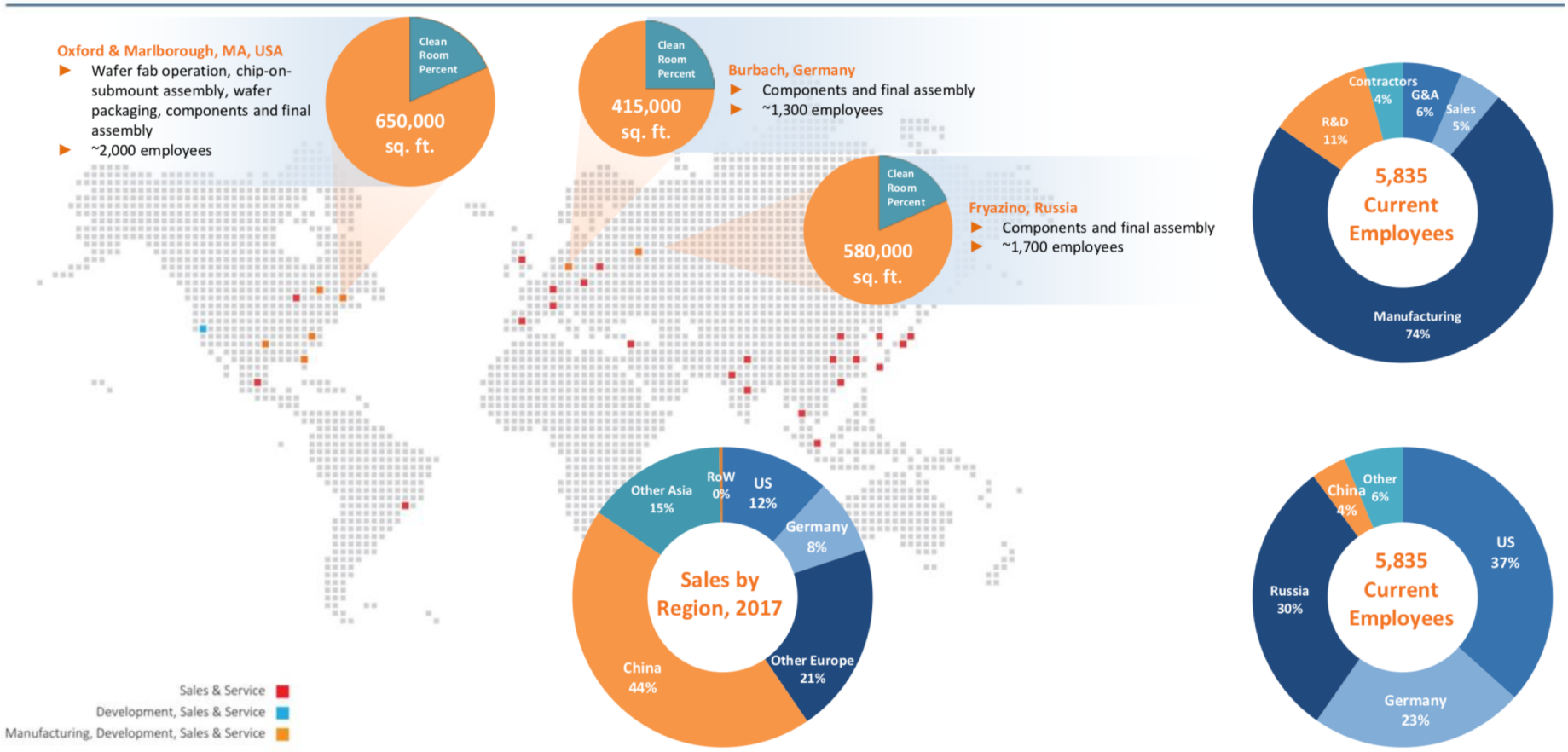
- Fiber laser hourly operating costs are >50% lower than CO_2.
- CO_2 maintenance tasks consuming several hours per month, such as beam alignments, are not required for fiber lasers.
- In addition, CO_2 consumable costs such as mirrors, lasing gases and beam delivery bellows are not incurred with fiber lasers.

- Fiber laser light is transmitted through a flexible cable, delivering much better beam quality and allowing for easy integration with robotics and other automated manufacturing processes since there are no mirrors that need to be aligned and no free space optical transmission.
- In a simple process the cable can be attached to a wide variety of automated systems.

- Fiber lasers are incredibly compact because they convert diode energy into useful laser beams within a fiber no thicker than a human hair, as opposed to the bulkier gas-filled chambers of CO_2 lasers.
- Thanks to our leading-edge component technologies, IPG fiber lasers are significantly smaller than competing fiber and solid state lasers, taking up less space within a factory setting.

- IPG fiber lasers utilize smaller-form-factor cooling elements because of the: (1) efficiency of our laser diodes and (2) small diameter of our optical fiber combined with its looping, which more effectively dissipates heat due to the high surface area to volume ratio.
- Our rack-mounted and lower-power fiber lasers dissipate heat so efficiently they can be air cooled instead of water cooled.

IPG Global Footprint

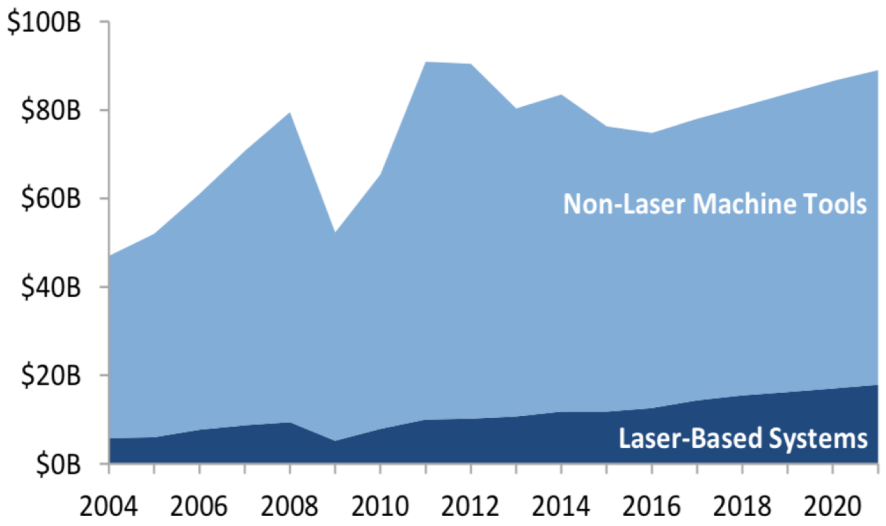


Growth Drivers

Long runway for penetration of laser application and fiber laser conversion

(1) Conversion from Non-Laser to Laser Technologies

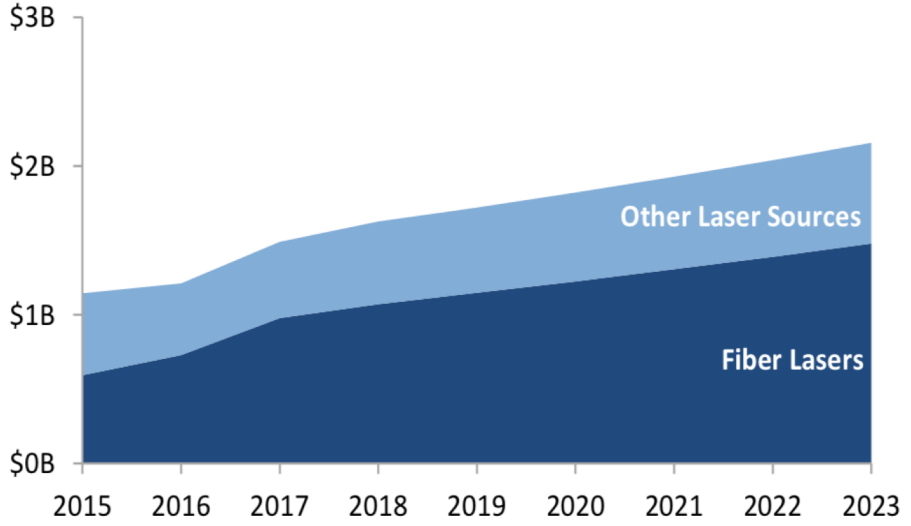
Global Machine Tool Consumption in 2017: ~$78B
Global Laser Systems for Materials Processing in 2017: ~$14B
Laser Systems 18% of Worldwide Machine Tools and Growing



Source: Oxford Economics, Optech Consulting and IPG Photonics Corporation

(2) Conversion from Traditional Lasers to Fiber Lasers

Fiber Lasers a Growing Percentage of Annual Demand for High-Power Industrial Laser Sources

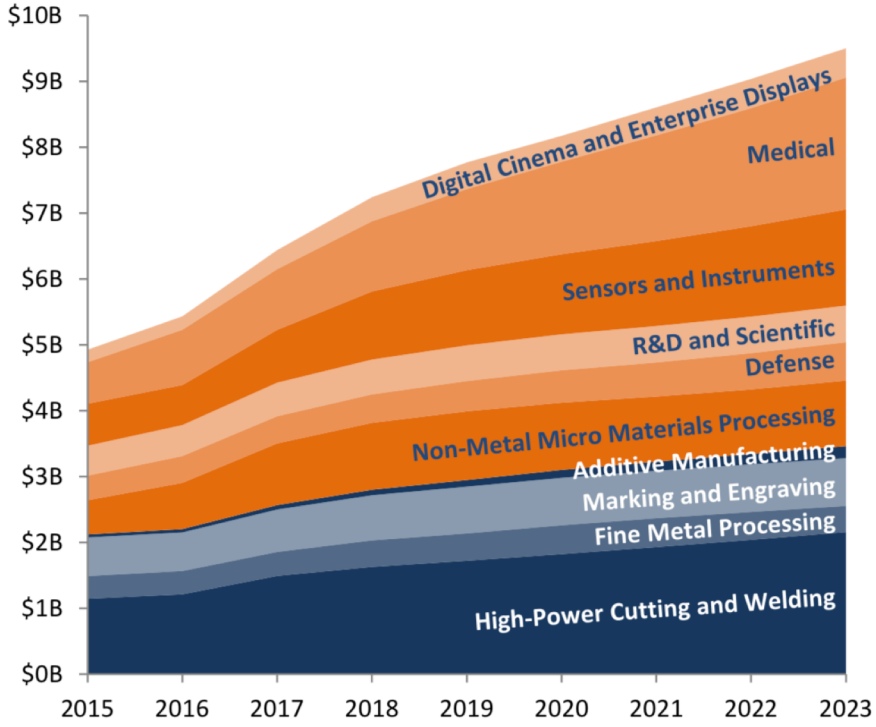


Source: Optech Consulting and IPG Photonics Corporation

Laser Market Applications

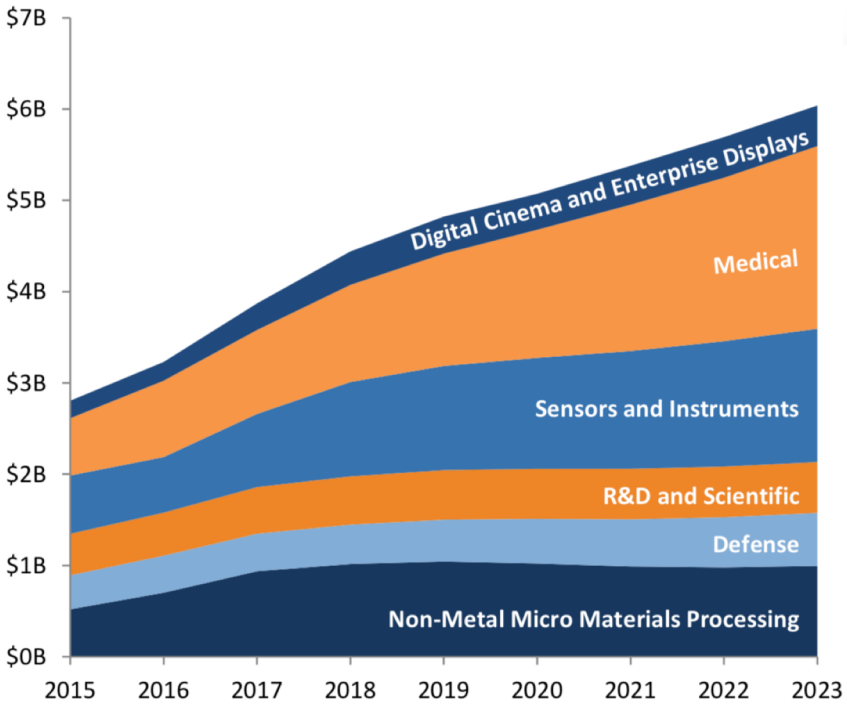
Total Addressable Market

Source: Optech Consulting, Strategies Unlimited and IPG Photonics Corporation



New Growth Markets

New Laser Applications



Source: Strategies Unlimited and IPG Photonics Corporation

Ultrafast: ~$300M+ addressable opportunity across: (1) micro processing applications, including dicing and scribing of semi wafers, scribing and cutting of sapphire and glass and fine hole drilling; (2) medical, including laser eye surgery; and (3) scientific applications. IPG ultrafast solutions offer higher wall-plug efficiency, smaller footprint, more consistent energy per pulse, faster cold start time and lower cost of ownership compared with competing products.

Ultraviolet Fiber Laser: ~$100M+ addressable opportunity for UV laser marking module with two-axis scanner for marking of white plastics and cabling. IPG UV solutions offer high performance and reliability at a competitive cost point.

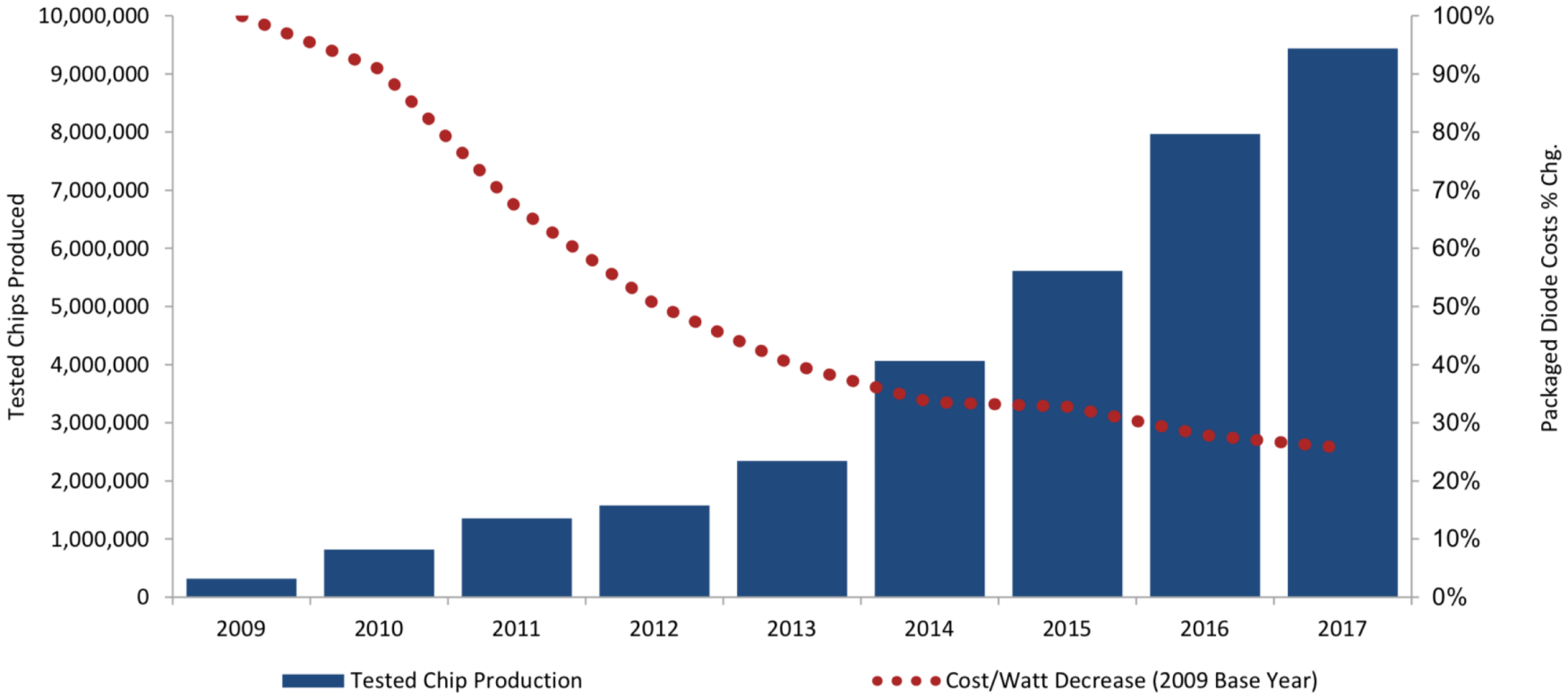
Systems: IPG's systems provide precise laser and beam delivery components tailored to customer-specific application needs. Our systems include multi-function workstations for precision welding, cutting and drilling, small form 2D cutting machines, microsystems for a variety of micromachining applications, a laser seam stepper combining clamping with a laser welding tool, laser cladding, annealing & welding cells and coating & cladding workstations, among others.

Medical: IPG Medical develops lasers and laser-based medical systems. Our thulium-doped fiber lasers can be used in surgical (urology) and skin resurfacing applications, our mid-IR lasers for diagnostic imaging, ablative skin resurfacing and dental (hard tissue) applications, and our diode lasers for tissue regeneration (dental and dermatological) and surgical (tissue cutting) applications.

Projection Display: leveraging IPG lasers in the visible light spectrum, our laser-based projection system provides a high brightness and color purity solution for the digital cinema and laser projection industries. With 55,000 medium to premium cinema screens, we see potential for a >$1B addressable opportunity over 8-10 years, with additional opportunities in signage and entertainment.

Highes Scale/Lowest Cost Diode Producer

Highest Volume, Lowest Cost Diode Producer



IPG's Durable franchise

- Dominant 80% market share accumulated over many years
- Low cost position versus competitors
  - Fiber lasers 2-4x the speed and half the cost of CO2 lasers
  - Advantage in diode production and other cost elements via experience curve & scale
  - 2-4 year Tech/R&D/Quality advantage; only viable supplier of QCW lasers
- Vertically integrated—make their own diodes so competitors can't easily replicate/disrupt
- IP patent portfolio (240 patents/380 pending), Trade secrets and lots of manufacturing know-how
- Powerful brand name with broad awareness and trust, supported by services organization and product warrantees
- Strong balance sheet with no dependence on capital markets to fund business

IPG's Leadership

"My dream is to see lasers — like computers — become a tool of choice in mass production." *-Valentin Gapontsev*

- CEO Gapontsev: Owner-operator, founder, brilliant scientist, serious, dedicated, uncompromising on core principles
- Super lean management structure—barely any middle management—everyone expected to work long hours
- Hard-nosed skeptical managers who think and act long term
- Culture of as few meetings as possible so people don't get bogged down in endless discussion/debate
- Reasonable compensation and low option issuance for senior management

IPG's Leadership

Valentin P. Gapontsev, Ph.D.

Chairman and CEO

Dr. Gapontsev founded IPG in 1990. He was previously a senior scientist in laser material physics and was the head of the laboratory at the Soviet Academy of Sciences' Institute of Radio Engineering and Electronics in Moscow. He holds a Ph.D. in Physics from the Moscow Institute of Physics and Technology.

Eugene Scherbakov, Ph.D.

Managing Director, SVP and COO

Dr. Scherbakov was previously Technical Director from 1995-2000 at IPG Laser in Germany, he was also senior scientist and head of the optical communications laboratory at the Russian Academy of Science, Moscow. He has an M.S. in physics from the Moscow Physics and Technology Institute, a Ph. D in Quantum Electronics and a D.Sc. in Laser Physics from the Lebedev Physical Institute.

Timothy P. V. Mammen

SVP and CFO

Between 1999 and 2000, Mr. Mammen served as the Group Finance Director and General Manager for IPFD a commodities trading firm in the UK. In addition, Mr. Mammen was Finance Director and General Manager of United Partners Plc from 1995 to 1999 and 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 LSE. He is also a member of the Institute of Chartered Accountants of Scotland.

Igor Samartsev

CTO, Board Member and Deputy General Manager and Director of NTO IRE-Polus

Mr. Samartsev previously served in a variety of technical leadership roles at NTO IRE-Polus before becoming Deputy General Manager. He also holds an M.S. in Physics from the Moscow Institute of Physics and Technology and is one of the founders of IPG.

Angelo P. Lopresti

General Counsel, Secretary and SVP

Mr. Lopresti was partner at the law firm of Winston & Strawn LLP from 1999-2001 before coming to IPG. He was also a partner at Herzog, Calamari & Gleason between 1998-1999 and an associate between 1991-1998. He has a Bachelor's in Economics from Trinity College and a J.D. from New York University School of Law.

Alexander Ovtchinnikov, Ph.D.

SVP, Components

Dr. Ovtchinnikov was Director of Material Science at IPG since 2001 before becoming Vice President. He was previously Material Science Manager at Lasertel, Inc. from 1999-01 and developed high power diode pump technology at the Ioffe Institute, Tampere Institute of Technology, Coherent Inc. and Spectra-Physics Corporation for 15 years. He has an M.S. in Electrical Engineering from the Electrotechnical University of St. Petersburg and a Ph. D from the Ioffe Institute at the Russian Academy of Sciences.

Trevor D. Ness

SVP, World Wide Sales

Mr. Ness has served as Senior Vice President of World Wide Sales since 2013. He became Vice President of Asian Operations in 2011. Prior to joining IPG, he was Director of GSI Precision Technologies China between 2005 and 2010. He has a B.S. in Geology from Imperial College, a H.N.C. from Bournemouth University and an M.B.A. from the Open University.

Felix Stukalin

SVP, U.S. Operations

Mr. Stukalin was VP, Devices from 2009 and became SVP of US Operations in 2013. He previously was VP, Business Development of GSI Group from 2002-2008 and VP, Components and President of Wave Precision at GSI Lumonics from 2000-02. He has a B.S. in Mechanical Engineering from the University of Rochester and graduated from the Harvard Business School General Management Program.

Oxford, Massachusetts Headquarters

IPGP Corporate Governance

The Board of Directors:

- is comprised of 70% independent directors
- has a presiding independent director
- is comprised of directors with a broad range of leadership, professional skills and experiences which, when taken as a whole, is invaluable in evaluating our opportunities and executing them
- meets in executive session at each regularly scheduled Board meeting
- is elected annually
- complies with stock ownership guidelines it adopted to align the interests of directors with stockholders
- adopted a policy that prohibits hedging and limits pledging of Company stock by directors and officers
- engages in an annual self-evaluation process
- oversees risk management with a focus on the most significant risks facing IPG
- regularly considers succession planning to ensure boardroom skills are aligned with IPG's long-term strategic plan

The Audit, Compensation and Nominating and Corporate Governance Committees:

- are comprised entirely of independent directors; The Audit Committee is comprised of four "financial experts"
- annually review charters to ensure alignment with evolving Committee responsibilities
- engage in a bi-annual self-evaluation process
- have active Committee member engagement with each director participating in more than 75% of the applicable Committee meetings

The Compensation Committee:

- is comprised entirely of independent directors who oversee the executive compensation program
- retains an independent compensation consultant to advise the Committee on the executive compensation program and other compensation matters
- annually reviews the executive compensation program to align it with the stockholder interests
- aligns executive pay with performance consistent with our pay-for-performance philosophy
- balances short-term and long-term incentives including multiple measures of performance
- links executive pay to IPG performance with long-term equity incentives
- designs the compensation program to maximize stockholder value while mitigating short-term risk taking
- caps the maximum amount that can be earned for annual incentives

Named Executive Officers:

- have a majority of total direct compensation tied to performance, thereby aligning a significant portion of executive compensation payouts with the interest of stockholders
- have no retirement benefits and limited perquisites
- do not receive excise tax gross-up protections
- may not hedge Company stock and are permitted limited pledging
- do not receive single-trigger change of control provisions
- comply with stock ownership guidelines to align the interests of officers with stockholders
- are subject to clawback provisions

IPGP: Core Investment Tenets

- **Substantial growth opportunity**
  - Rapidly expanding industrial applications for laser based systems—gaining share of $80 bil machine tool industry
  - Fiber lasers gaining share from traditional lasers-driven by strong payback for customers
  - New products invented to attack new $4-$6 bil (and growing) market segments (medical, sensors, ultraviolet, ultrafast, projection, EVs)
- **Dominant market position**
  - 80% market share--driven by technology leadership
  - Low cost position driven by scale and vertical integration
- **Alignment of interests/Governance**
  - CEO (and trusts) own 35% of the company; fair & reasonable comp
  - Strong governance and shareholder orientation
  - Excellent communicators who are honest, transparent, detail-oriented and proactively up front about challenges
- **Superior business economics**
  - Strong and growing ROIC despite capital intensity of the business
  - Most profitable laser company—allows self-funding of attractive internal reinvestment opportunities
- **Attractive valuation across a variety of methods**
- **1.2 bil in cash, no debt; can fully fund growth with no dependence on capital markets-history of using financial strength to continue investing during downturns when others cut back**
- **Attractive takeout for a large industrial conglomerate seeking growth—could pay high multiple in strategic deal**
- **Strong Governance/ESG platform—saves energy, eliminates materials waste, lower CO2**

IPGP: Investment Risks/Concerns

- Exposed to many global industrial end markets—not recession proof despite growth story
- Exposure to potential trade war with China--44% of sales—approx. 1/3 end market in China & 2/3 sold on externally
- Increasing competition at the low (commodity, pulsed laser) end of the market—many Chinese competitors appear to be selling below cost in the current market
- Risk of IP theft or copying—segregate manufacturing activities as one measure to protect-they are paranoid in a good way
- Heavy investment in working capital required due to vertical integration strategy—reflected in financial model
- Currency exposure to strengthening dollar with 80%+ of sales outside U.S.
- Exposure to Russia—only 5% of sales but valuable assets and mfg; has operated smoothly through decades of U.S.-Russia relationship paradigms; declining Ruble lowers costs
- 3D printing market has not yet lived up to hype, but is a long-term opportunity
- CEO unjustifiably placed on "Russian Oligarch List"—seems to be well understood but could create headlines

IPGP: Valuation Summary

- Our blended cases of three valuation methods suggests a fair value of: **$182/share**

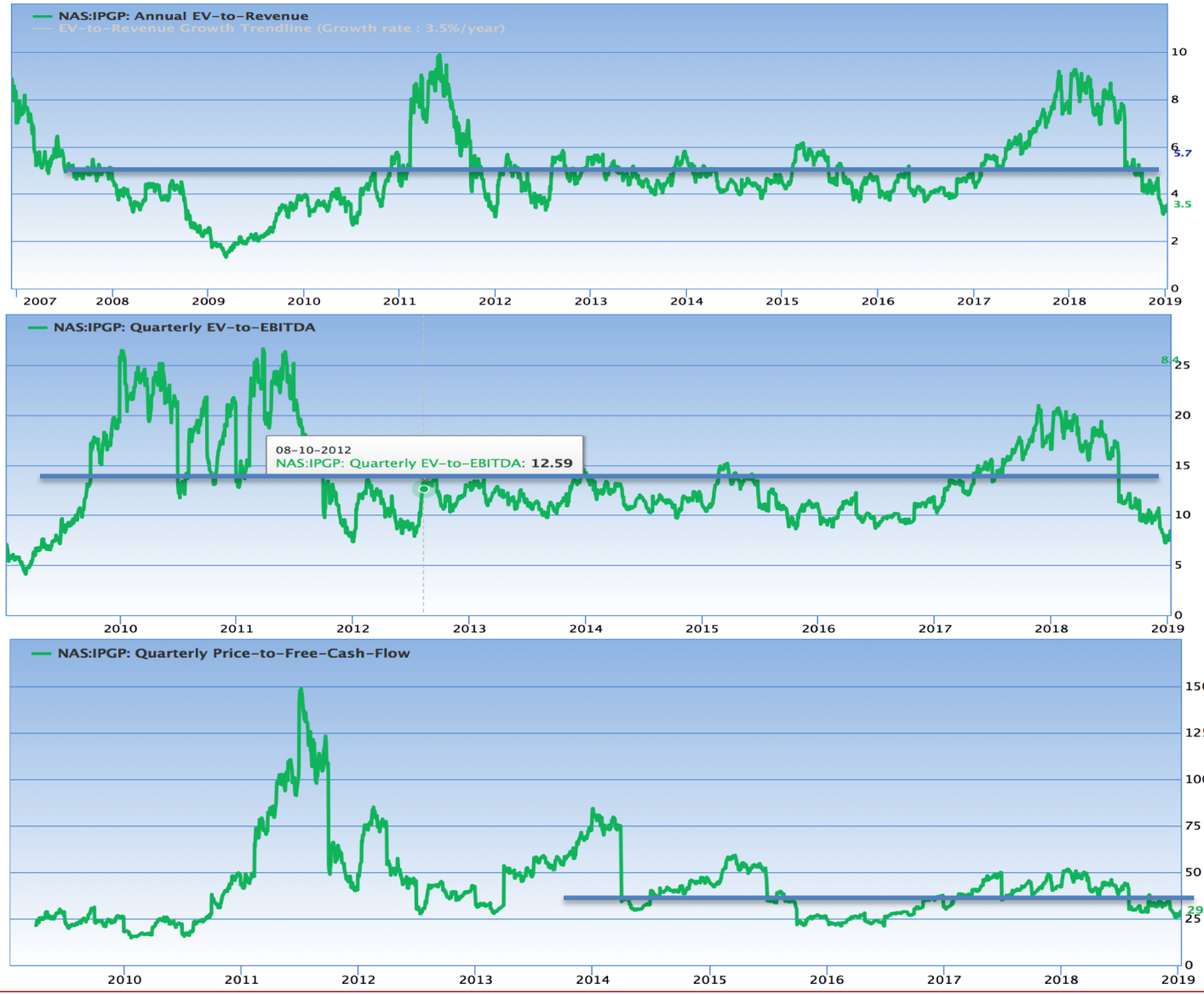
  - Method 1: Blended DCF valuation with 3 scenarios yields appraisal of: **$183/share**
    - Base Case (60%): -8% Tariff dip in '19 followed by recovery and resumption of prior growth fade pattern; no further op margin scale; 7% terminal growth: **$189/share**
    - Upside Case (20%): -4% Tariff dip; growth extends 5 years before fading; op margin scales another 4 pts from growth before leveling off; CapEx higher to fuel growth; 9% terminal growth: **$230/share**
    - Downside Case (20%): -12% Tariff dip; slight recovery, fast fade to industry growth; op margin drops 4pts due to Chinese competition/commoditization; Working capital intensity increases; 4% terminal growth: **$121/share**

  - Method 2: Apply ave 14.5x EV/EBITDA x $650 mil TTM EBITDA plus excess cash gives: **$193/share**
  - Method 3: Apply P/B of 3.0x (5 year average 20% ROE) gives 3.0*$40.59 gives: **$122/share**
  - Method 4: Holt Scenario with faded CFROI relative to market implied gives: **$219/share**

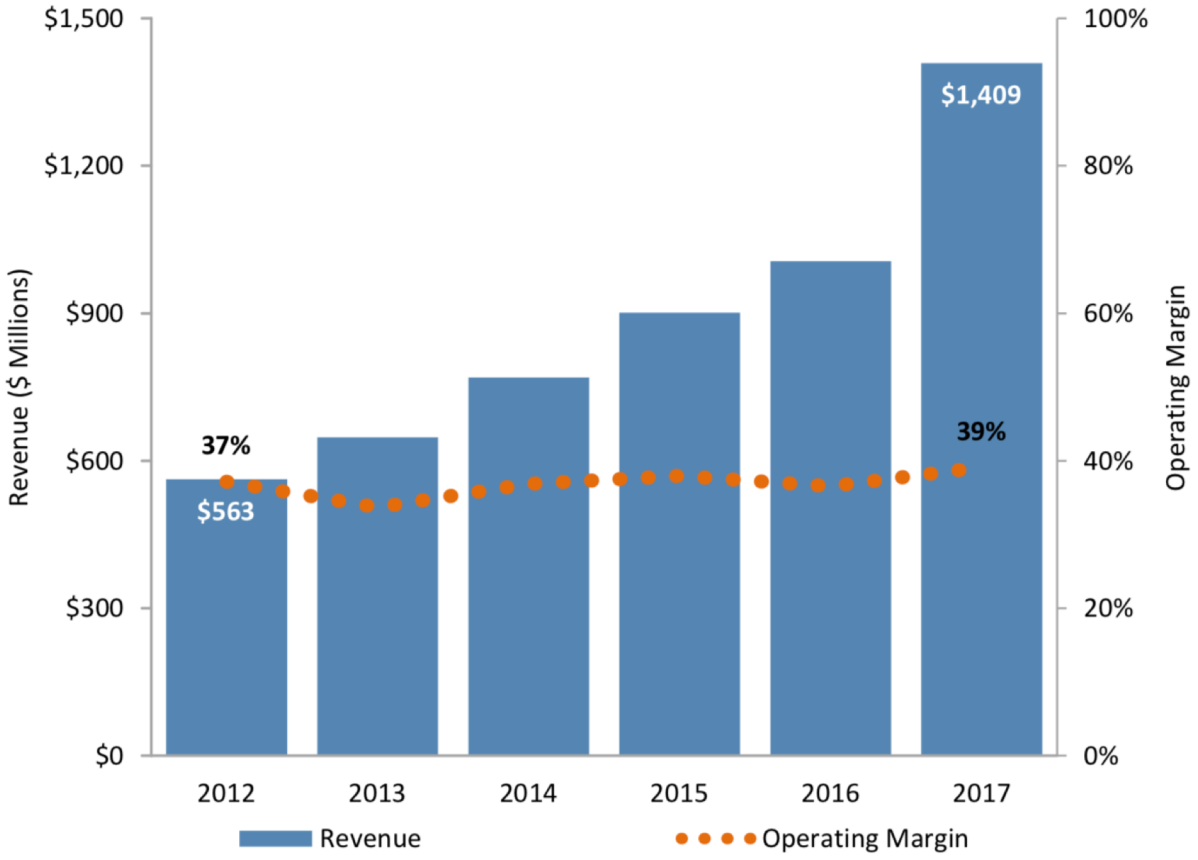
  Weighted average of methods: 70% #1, 10% #2, 10% #3, 10% #4

- **No credit for continued value-accretive tuck-in deals**
- **No credit for takeout optionality; large mature industrial conglomerate would potentially pay up for niche dominance and growth**

IPGP: Valuation Historical Ranges



Operating Margin: Stable and Gradual Scale



Sales and Marketing Expenses

- Target: 3% to 5% of revenue
- Primarily compensation, trade shows, professional and technical conferences, travel, facilities and depreciation of demonstration equipment.

Research and Development Expenses

- Target: 6% to 8% of revenue
- Primarily compensation, product and component design development, cost of prototype materials, testing and facilities costs.

General and Administrative Expenses

- Target: 6% to 7% of revenue
- Primarily compensation, executive management, finance, legal, IT, professional services, facilities costs and charges and benefits related to the change in allowance for doubtful debt.

Appendix 1a: IPGP Base Case

IPG Photonics	1/9/19																	
Base Case																		
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Total Revenue	229	186	299	474	563	648	770	901	1,006	1,409	1,460	1,343	1,612	1,854	2,095	2,325	2,557	
Growth Rate		-19%	61%	59%	19%	15%	19%	17%	12%	40%	4%	-8%	20%	15%	13%	11%	10%	Tariff impact '19; resume fade traj.
EBITDA	73	28	101	197	236	252	313	382	420	630	650	537	661	779	880	976	1,074	
EBITDA %	32%	15%	34%	41%	42%	39%	41%	42%	42%	45%	45%	40%	41%	42%	42%	42%	42%	Revert down & no further scale assumed
Pretax Income	57	8	79	175	209	218	284	342	367	552	582	463	571	673	758	839	925	
Taxes	(18)	(2)	(25)	(54)	(61)	(63)	(84)	(100)	(106)	(204)	(200)	(139)	(160)	(182)	(197)	(218)	(241)	
Tax %	32%	32%	31%	31%	29%	29%	30%	29%	29%	37%	34%	30%	28%	27%	26%	26%	26%	Blended global/U.S. benefit
Op WC % Sales	45%	37%	27%	35%	33%	41%	37%	33%	35%	35%	41%	36%	36%	36%	36%	36%	36%	Revert after '18 surge year
Operating Working Cap	104	69	82	164	186	263	285	295	350	490	594	484	580	667	754	837	921	
Op WC Investment		(35)	13	83	22	76	23	10	55	140	104	(111)	97	87	87	83	59	Steady state 7% terminal W/C inv.
CapEx	(37)	(10)	(28)	(53)	(68)	(71)	(88)	(70)	(126)	(111)	(159)	(121)	(145)	(148)	(168)	(186)	(179)	
CapEx %	-16%	-6%	-9%	-11%	-12%	-11%	-11%	-8%	-13%	-8%	-11%	9.0%	9.0%	8.0%	8.0%	8.0%	7.0%	Must keep investing but scale
Depreciation	16	19	22	24	26	32	36	42	51	65	77	74	90	106	121	137	149	
Depreciation %	6.9%	10.3%	7.3%	5.1%	4.6%	4.9%	4.6%	4.7%	5.1%	4.6%	5.3%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	Fades up to CapEx as growth slows
Stock Comp % Sales	0.6%	1.0%	0.7%	1.2%	1.1%	1.3%	1.4%	1.5%	1.5%	1.0%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	Stable
Pre-Tax Stock Comp	2	3	3	8	9	12	15	19	22	23	27							
Aft-Tax Stock Comp	1	2	2	6	6	8	11	13	15	14	18	16	19	22	25	28	31	
FCF		48	33	2	79	34	107	189	118	161	168	372	240	339	403	461	565	
											Discounted:	*372*	*218*	*280*	*303*	*315*	*351*	

PV (1-5):	1,488		
PV (Term):	7,717	22	Term Multiple
Excess Cash:	1,122		7% LT growth
Option Value:	-		
Total PV:	10,327		
Shs Outst:	54.7		

Value/Share:	**$ 188.80**
Current Share Price:	$ 126.27
Upside (Downside):	**50%**

Appendix 1b: IPGP Upside Case

Upside Case	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Total Revenue	229	186	299	474	563	648	770	901	1,006	1,409	1,460	1,431	1,717	2,009	2,310	2,634	2,950	
Growth Rate		-19%	61%	59%	19%	15%	19%	17%	12%	40%	4%	-2%	20%	17%	15%	14%	12%	Mild dip; slower fade
EBITDA	73	28	101	197	236	252	313	382	420	630	650	572	704	844	993	1,159	1,327	
EBITDA %	32%	15%	34%	41%	42%	39%	41%	42%	42%	45%	45%	40%	41%	42%	43%	44%	45%	Gradual scale gains resume with growth
Pretax Income	57	8	79	175	209	218	284	342	367	552	582	494	608	725	850	988	1,178	
Taxes	(18)	(2)	(25)	(54)	(61)	(63)	(84)	(100)	(106)	(204)	(200)	(148)	(170)	(196)	(221)	(257)	(306)	
Tax %	32%	32%	31%	31%	29%	29%	30%	29%	29%	37%	34%	30%	28%	27%	26%	26%	26%	Blended global/U.S. benefit
Op WC % Sales	45%	37%	27%	35%	33%	41%	37%	33%	35%	35%	41%	36%	36%	35%	35%	35%	35%	Revert after '18 surge year
Operating Working Cap	104	69	82	164	186	263	285	295	350	490	594	515	618	703	809	922	1,032	
Op WC Investment		(35)	13	83	22	76	23	10	55	140	104	(79)	103	85	105	113	81	Steady state 9% terminal W/C inv.
CapEx	(37)	(10)	(28)	(53)	(68)	(71)	(88)	(70)	(126)	(111)	(159)	(129)	(155)	(201)	(231)	(263)	(265)	
CapEx %	-16%	-6%	-9%	-11%	-12%	-11%	-11%	-8%	-13%	-8%	-11%	9.0%	9.0%	10.0%	10.0%	10.0%	9.0%	Must invest more to sustain higher growth
Depreciation	16	19	22	24	26	32	36	42	51	65	77	79	96	119	143	171	149	
Depreciation %	6.9%	10.3%	7.3%	5.1%	4.6%	4.9%	4.6%	4.7%	5.1%	4.6%	5.3%	5.5%	5.6%	5.9%	6.2%	6.5%	7.0%	Fades up to CapEx as growth slows
Stock Comp % Sales	0.6%	1.0%	0.7%	1.2%	1.1%	1.3%	1.4%	1.5%	1.5%	1.0%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	Stable
Pre-Tax Stock Comp	2	3	3	8	9	12	15	19	22	23	27							
Aft-Tax Stock Comp	1	2	2	6	6	8	11	13	15	14	18	17	21	24	28	32	35	
FCF		48	33	2	79	34	107	189	118	161	168	357	256	338	408	494	639	
										Discounted:		*357*	*232*	*279*	*307*	*337*	*397*	

PV (1-5):	1,513		
PV (Term):	9,921	25	Term Multiple
Excess Cash:	1,122		9% LT Growth
Option Value:	-		
Total PV:	12,556		
Shs Outst:	54.7		

Value/Share:	**$ 229.54**
Current Share Price:	$ 126.27
Upside (Downside):	**82%**

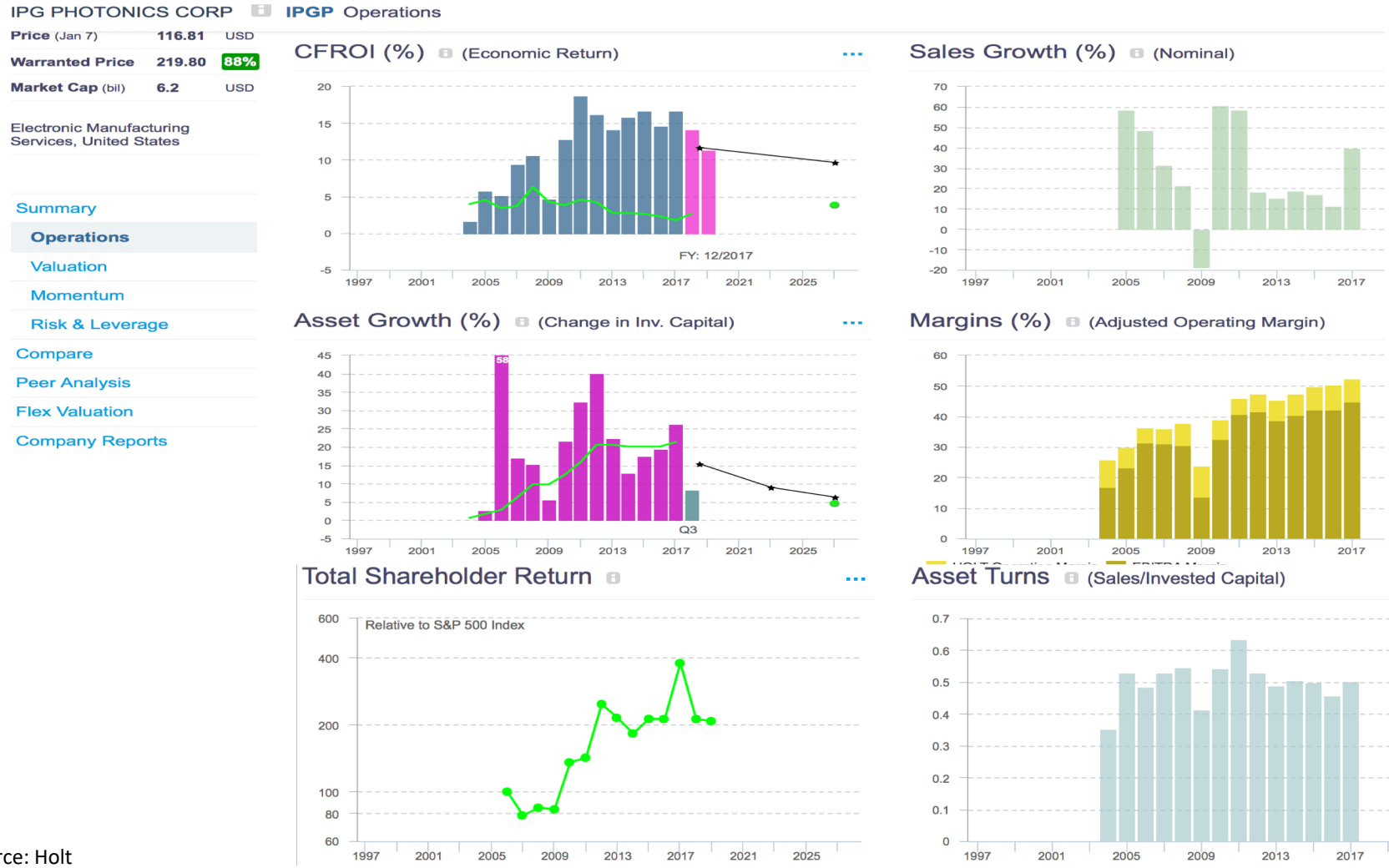
Appendix 1c: IPGP Downside Case

IPG Photonics	1/9/19																	
Downside Case																		
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Total Revenue	229	186	299	474	563	648	770	901	1,006	1,409	1,460	1,285	1,349	1,551	1,738	1,894	2,008	
Growth Rate		-19%	61%	59%	19%	15%	19%	17%	12%	40%	4%	-12%	5%	15%	12%	9%	6%	Deeper tariff impact; growth opp mostly gone
EBITDA	73	28	101	197	236	252	313	382	420	630	650	514	553	621	678	720	763	
EBITDA %	32%	15%	34%	41%	42%	39%	41%	42%	42%	45%	45%	40%	41%	40%	39%	38%	38%	Permanent commodization-competition
Pretax Income	57	8	79	175	209	218	284	342	367	552	582	443	478	532	577	608	614	
Taxes	(18)	(2)	(25)	(54)	(61)	(63)	(84)	(100)	(106)	(204)	(200)	(133)	(134)	(144)	(150)	(158)	(160)	
Tax %	32%	32%	31%	31%	29%	29%	30%	29%	29%	37%	34%	30%	28%	27%	26%	26%	26%	Blended global/U.S. benefit
Op WC % Sales	45%	37%	27%	35%	33%	41%	37%	33%	35%	35%	41%	36%	37%	38%	39%	40%	40%	Biz becomes more inventory intensive
Operating Working Cap	104	69	82	164	186	263	285	295	350	490	594	463	499	590	678	758	803	
Op WC Investment		(35)	13	83	22	76	23	10	55	140	104	(132)	37	90	88	80	32	Steady state 4% terminal W/C inv.
CapEx	(37)	(10)	(28)	(53)	(68)	(71)	(88)	(70)	(126)	(111)	(159)	(116)	(121)	(124)	(139)	(152)	(141)	
CapEx %	-16%	-6%	-9%	-11%	-12%	-11%	-11%	-8%	-13%	-8%	-11%	9.0%	9.0%	8.0%	8.0%	8.0%	7.0%	Must keep investing at base case level
Depreciation	16	19	22	24	26	32	36	42	51	65	77	71	76	88	101	112	149	
Depreciation %	6.9%	10.3%	7.3%	5.1%	4.6%	4.9%	4.6%	4.7%	5.1%	4.6%	5.3%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	Fades up to CapEx as growth slows
Stock Comp % Sales	0.6%	1.0%	0.7%	1.2%	1.1%	1.3%	1.4%	1.5%	1.5%	1.0%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	Stable
Pre-Tax Stock Comp	2	3	3	8	9	12	15	19	22	23	27							
Aft-Tax Stock Comp	1	2	2	6	6	8	11	13	15	14	18	15	16	19	21	23	24	
FCF		48	33	2	79	34	107	189	118	161	168	382	245	244	280	307	407	
											Discounted:	*382*	*223*	*201*	*210*	*210*	*252*	

PV (1-5):	1,226					
PV (Term):	4,292	17	Term Multiple	**Value/Share:**	**$ 121.40**	
Excess Cash:	1,122		4% LT growth	**Current Share Price:**	$ 126.27	
Option Value:	-			**Upside (Downside):**	**-4%**	
Total PV:	6,641					
Shs Outst:	54.7					

Appendix 2: IPGP ROIC Components

- Op margin increase the primary driver of CFROI, asset turns erosion the primary offset; large spread to COC



Source: Holt

IPG Acquisition History

Nearly all of IPG's growth has been driven by organic investment in our business. From time to time, we have supplemented this investment with the acquisition of emerging technology groups to expand our technology breadth, vertical integration capabilities and product offering.