Wohlers Report 2017 Service Provider Survey Results

July 2017

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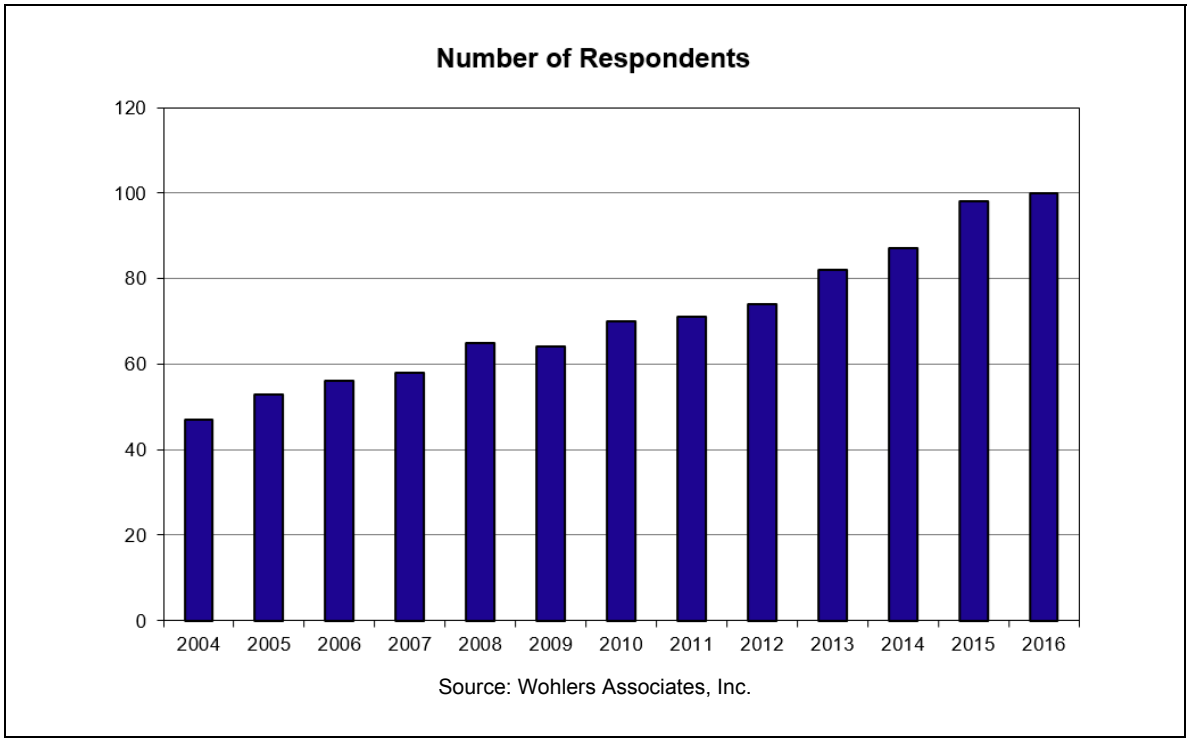
Introduction

Wohlers Associates sends a questionnaire to service providers each year to help identify trends in the additive manufacturing (AM) service industry. The results of the questionnaire are used in the preparation of the annual *Wohlers Report*. The service provider (SP) questionnaire is relatively short and does not require a large commitment of time. Participation is voluntary, and participants are not required to answer any questions that they do not feel comfortable answering. Only composite (summary) information is published. Company data is not made available in the report or in any other Wohlers Associates' publications. When comments from the surveys are used, they are published anonymously.

In exchange for their support, each of the participants receives this report, which summarizes the responses. None of the companies that respond are identified in this report, and no one outside of Wohlers Associates sees any of the responses. This report is distributed only to those who participate in the survey.

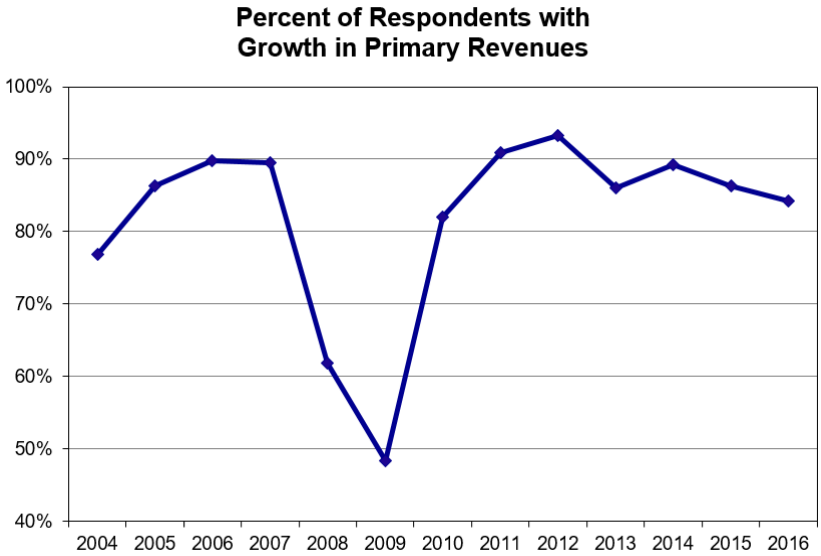
The 2017 survey asked for information about the respondents' experiences in the 2016 calendar year. The number of respondents continues to increase nearly every year. This year, 100 companies in 26 countries participated. Thirty-eight are from the U.S., eight from Germany, five each from Canada, Sweden and Italy, four each from France and India, and three each from the UK, China, and New Zealand. Furthermore, two each are from Australia, the Netherlands, Belgium, Israel, Switzerland, and Turkey, and one each from Austria, the Czech Republic, Denmark, Ireland, Japan, Portugal, South Africa, Spain, Taiwan, and Thailand.



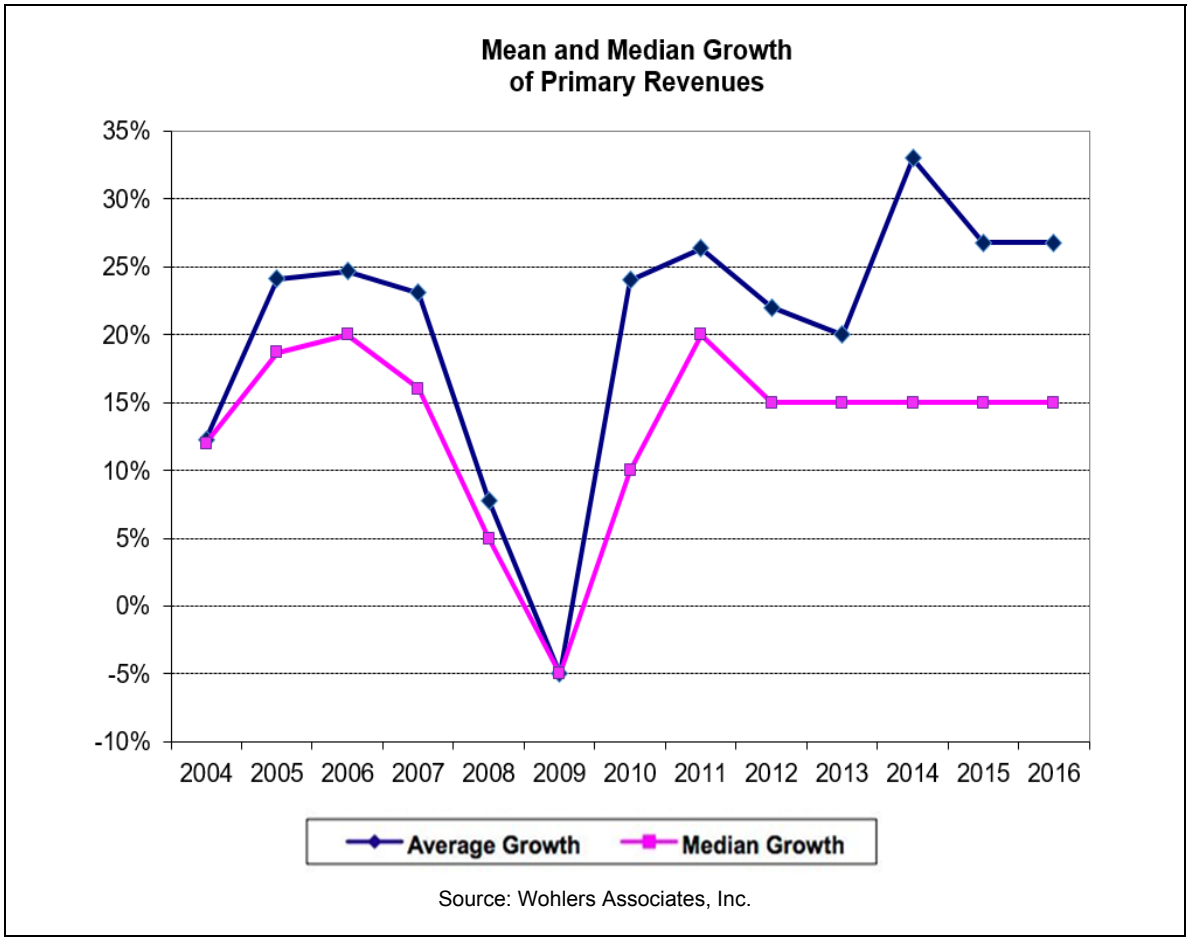
The survey included nine questions. The following pages summarize the responses to each of them.

Question 1. Primary Business
In 2016, what was the percentage growth (or decline) in revenues at your company from producing parts and patterns on your additive manufacturing (AM) systems?

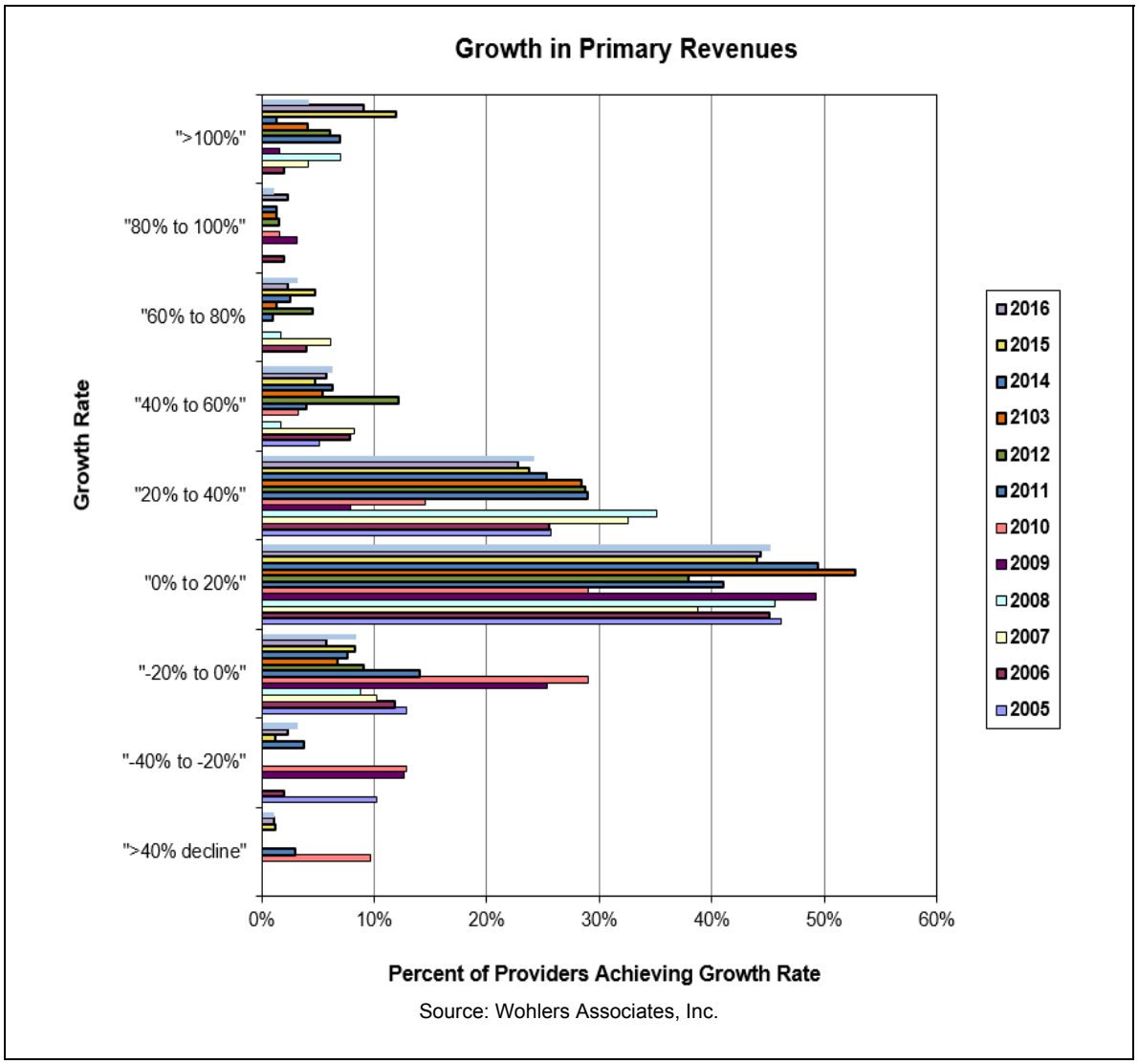
For 2016, 84% of service providers indicated revenue growth in their primary AM business. (The "primary business" consists of revenues from producing parts on AM systems.) This follows primary revenue growth of 86% in 2015, 89% in 2014, 86% in 2013, and 93% in 2012. As shown in the following chart, more than 80% of respondents have reported growth in each of the past seven years. This data continues to reflect stability and vitality in the AM service industry.



The mean (average) growth rate in primary AM revenues fell to 27% in 2016. This small decrease follows a slight decline to 31% in 2015 and a rise to 33% in 2014 after declines in 2013 and 2012. The median growth rate of the primary AM business has been identical for the past four years at 15%. In the years 2010 and 2011, the service industry experienced strong growth in mean and median rates. In the past four years, that strong growth has been replaced by sustained, stable growth. The extremely consistent median value over the past four years is an indicator of stability in the service provider segment. The following chart shows mean and median growth in primary revenues since 2004.



The following chart details the growth rate distribution of the primary business revenue among survey respondents from 2004 through 2016. As can be seen, the majority of service providers have experienced growth between 0% and 40% for most of the 12 years. The only exceptions are in 2008 and 2009, when more than a third of respondents experienced declines in primary revenues. For 2016, growth rates generally followed the pattern of the previous five years. Only 12.6% of respondents experienced a decline in primary revenue growth in 2016, while 14.7% reported growth of 40% or higher.

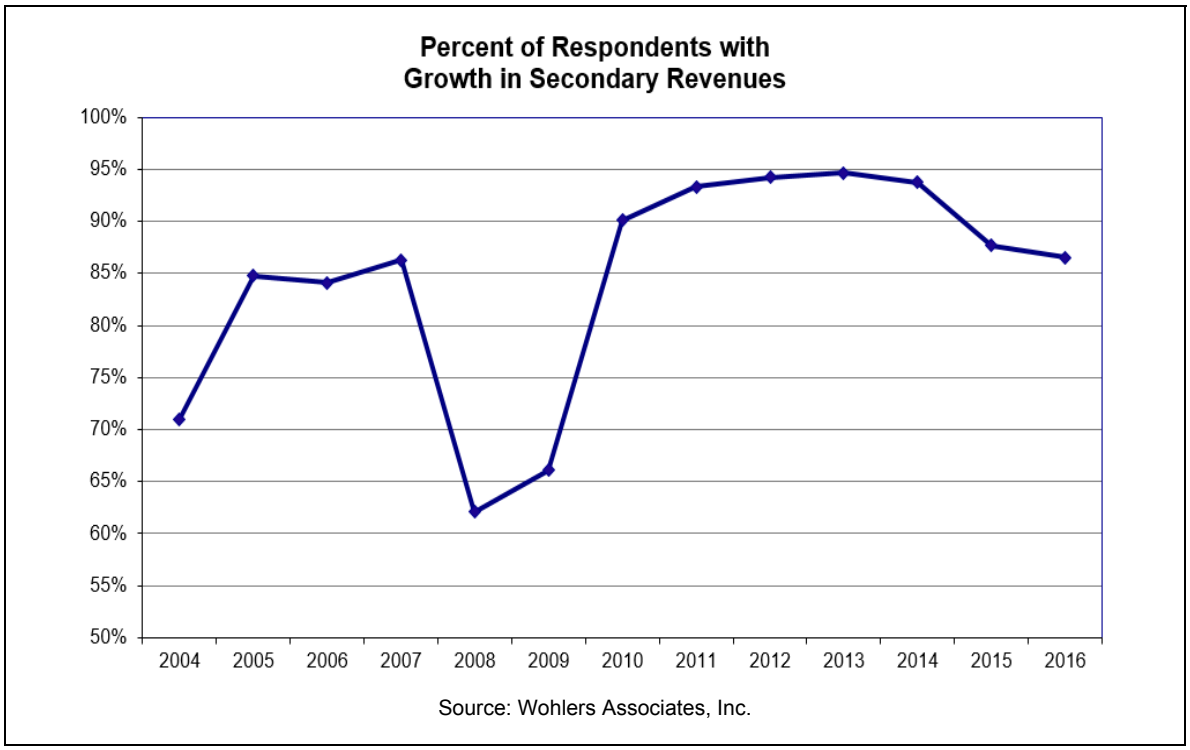


Overall, the responses to this question indicate ongoing stability for primary revenues in the service provider sector. The industry is maintaining a very healthy pace of growth.

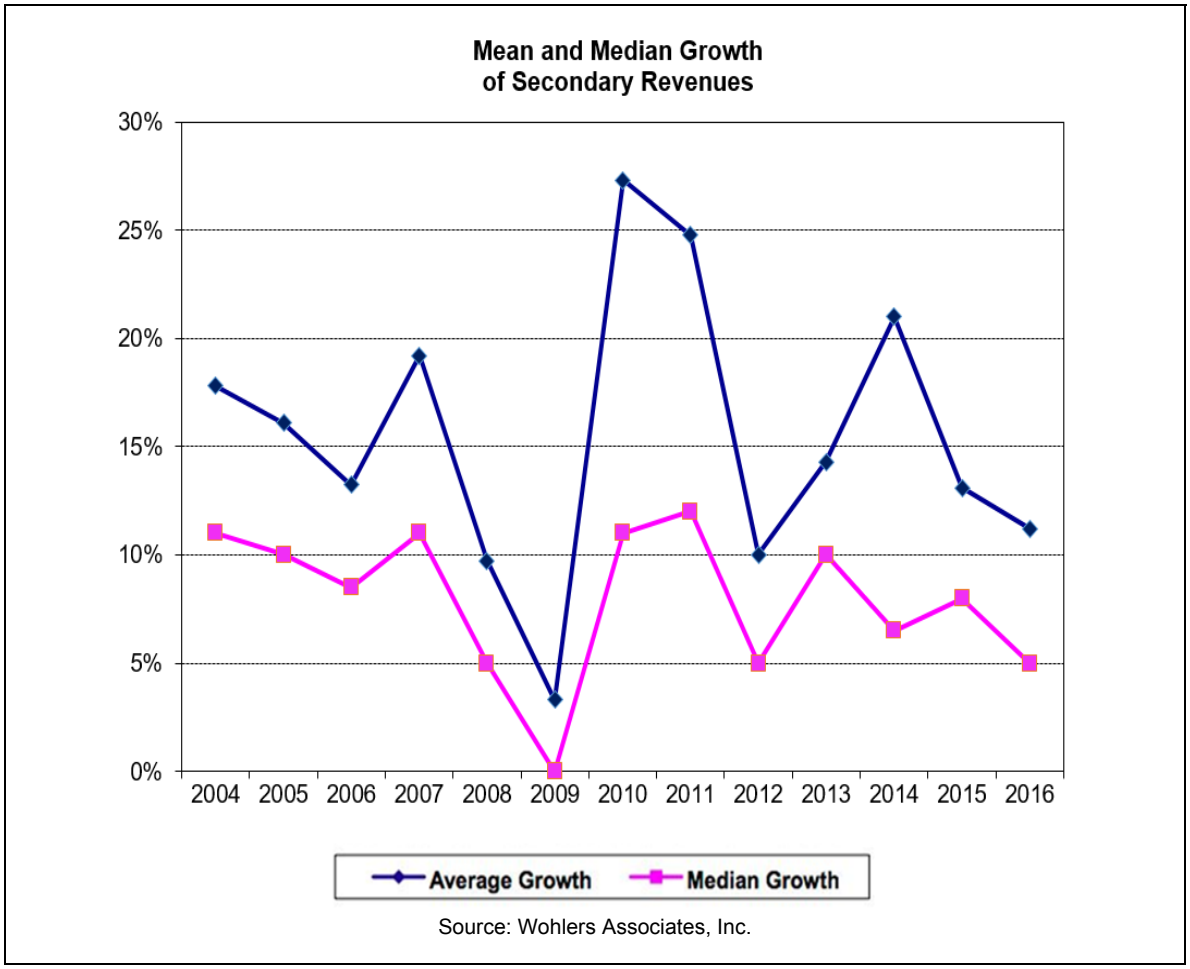
Question 2. Secondary Business

In 2016, what was the percentage growth (or decline) in revenues at your company from secondary work? "Secondary" includes tooling produced from AM patterns, tooling components produced directly using AM, and molded parts and castings from this tooling.

The percentage of service providers with revenue growth in the secondary business tends to mirror the percentage of companies with revenue growth in the primary business. The following chart demonstrates this correlation. In 2016, 87% of respondents reported growth in secondary business revenues.



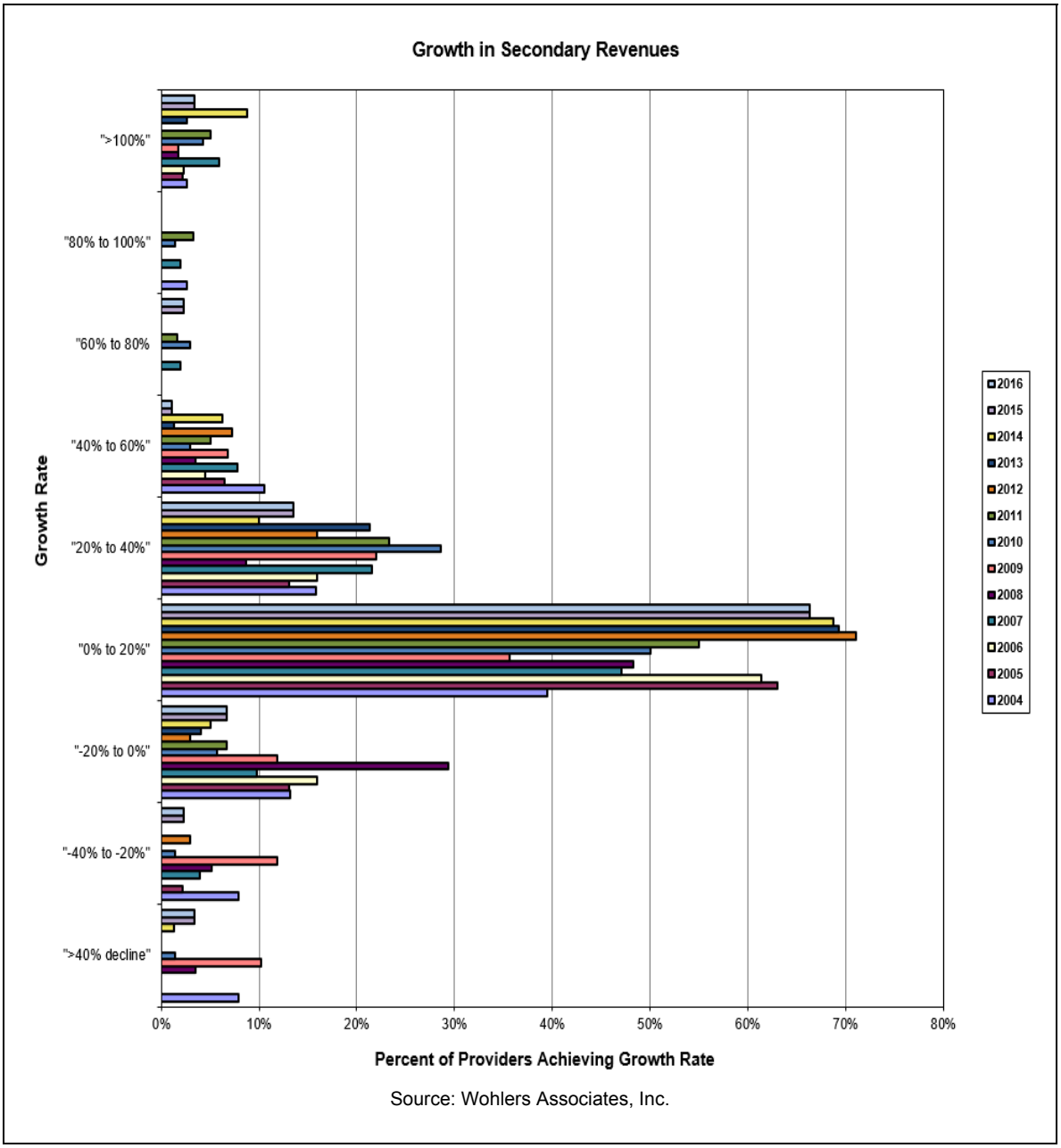
The mean and median growth rates for secondary services have been rising and falling over the past several years. The mean (average) growth rate in 2016 was 11%, down from 13% in 2015 and 21% in 2014. The average growth rate was 14% in 2013, 10% in 2012, and 25% in 2011. The median growth rate for 2016 was 5%, and has been between 5% and 10% the past four years. The following chart shows mean and median growth rates in secondary revenues since 2004.



These fluctuations in mean and median growth in secondary revenues reflect more volatility in the secondary market compared to the primary market. The drops in 2008–2009 correlate closely to the global recession and the overall decline in the AM industry. The declines in 2012 and 2015 are more difficult to interpret. The steep declines from the 2012 survey may be a slight statistical anomaly. The 2014 decline in median growth may also be insignificant, since 94% of survey respondents reported growth. Overall, the data continues to show that the secondary business in the service provider industry remains strong through 2016.

The following detailed chart shows the distribution of growth rates from secondary services. In 2016, growth in secondary services again paralleled the growth in primary services. In 2016, 66% of respondents reported growth between 0% and 20%. This compares to the previous four years when about 70% of survey respondents reported growth between 0% and 20%. Our research shows that 6.7% of respondents reported growth of 40% or greater. The number of respondents reporting declines increased slightly to 12.4%. In comparison, 10% of respondents reported negative growth in 2015, following 6% in 2014 and 5% in 2013.

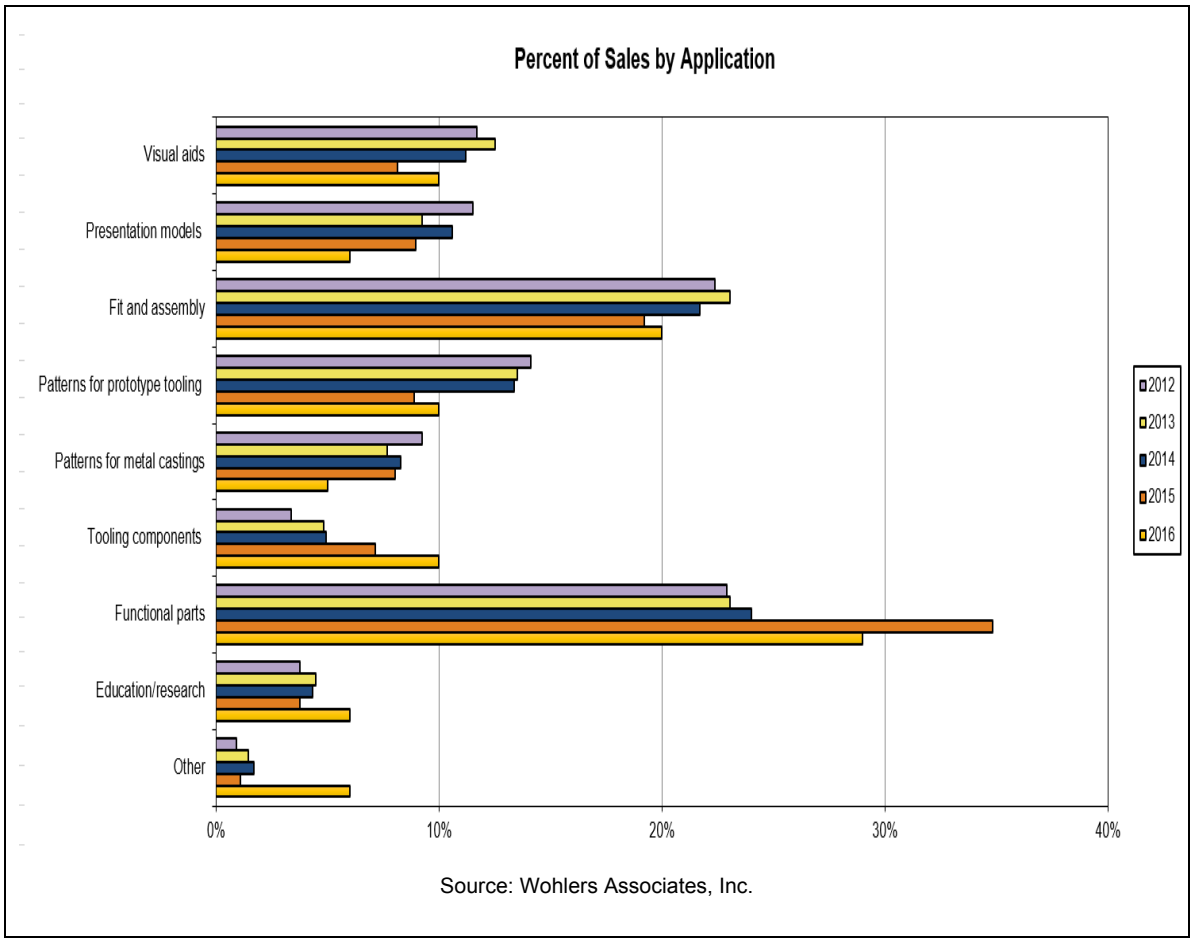
Overall, the responses to this question reflect stability for secondary revenues in the service provider sector. However, they also indicate that the secondary market segment is slightly more volatile and unsettled than the primary market. The wide variety of secondary services may be the reason for this volatility.



Source: Wohlers Associates, Inc.

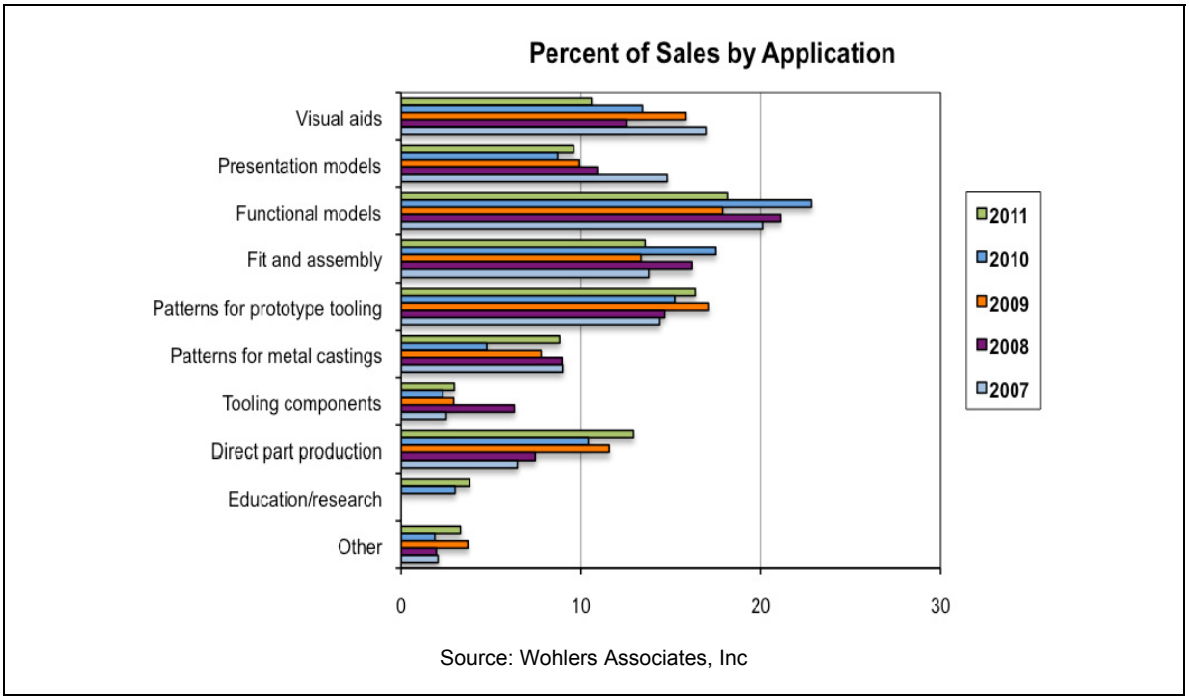
Question 3. Additive Manufacturing Services
How do your customers use the AM parts that you provide? Please provide a percentage for each of the nine categories listed below. If you do not have hard data, estimate these percentages. Please do not create new categories.

The way that customers use the parts they purchase from service providers, and if that use changes over time, is relevant to the AM industry. The following chart shows the average responses for eight application categories. The format for this question was changed in the 2013 survey (based on results from the 2012 calendar year). Previously, functional models and direct part production were treated separately. Starting with the 2013 survey, the two were combined into a single category named "functional parts." This change in the collected data necessitated the creation of a new chart.



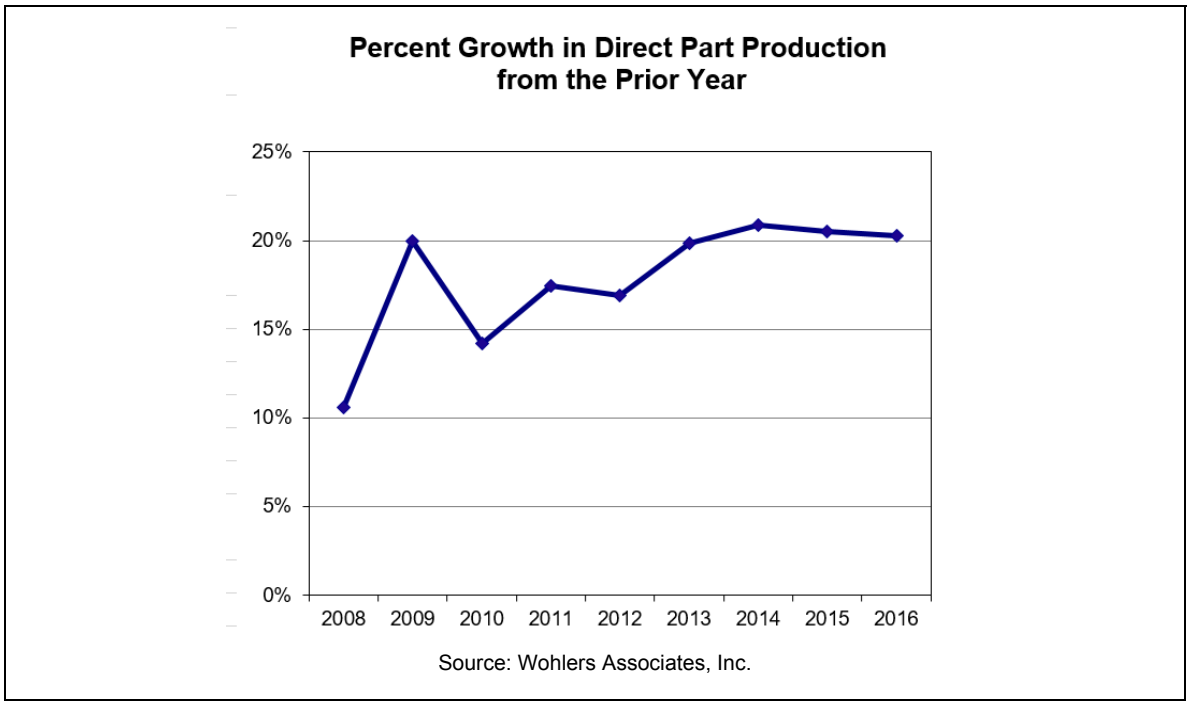
As indicated in the chart, functional parts (which includes functional prototypes) were 29% of all applications in 2016, declining from 35% in 2015, but growing from about 23% in each of the previous three years. This may be significant, continuing to indicate that service providers are producing more functional parts than ever before. It will be interesting to see if the data from 2017 supports this development. Tooling components is the only other application category that grew on a statistical basis.

The following chart was taken from the 2012 survey and is provided for reference and continuity. The category "Education/research" was added in 2010, so no data is available for previous years. Since other categories have changed over the history of the report, results are shown for the years 2007–2011 of the survey only.



Question 4. Final Part Production
Companies are using AM increasingly for the production of parts that go into final products. What percentage did this segment of your business grow in 2016? (Note that growth rates are often overestimated, and that compounded growth rates can lead to deceptively fast growth. For example, a growth rate of 35% means a doubling in about two years. A growth rate of 20% means a doubling in about 3.5 years.)

The following chart is a sign that service providers have continued to experience growth in final part production. For 2016, average growth was 20.3%, which is consistent with growth of 20.5% in 2015, 20.9% in 2014, and 19.9% in 2013. The data shows that final part production applications at service providers doubled from 2012 through the end of 2016.



Final part production requires an elevated level of process control, repeatability, and quality assurance. In the 2013 service provider survey report (based on results from the 2012 calendar year), we stated our belief that a select number of service providers would develop this application as opportunities arise. We anticipated that a relatively small number of service providers would move aggressively into final part production and work as contract manufacturers to develop reliable production processes. We believe this scenario is occurring in the service provider segment, although consolidation continues to skew the survey data somewhat. We also now believe that a larger number of service providers (rather than a "select number") are developing final part production capabilities.

We anticipate this application category will continue to grow, if only from the simple fact that the ratio of production parts to prototypes is typically 1,000:1 or greater. In other words, for every 1,000 end-use parts manufactured, only one prototype is produced, although this ratio varies widely among products, companies, and industries. We believe the opportunity for more commercial production activity from AM over the coming years is immense.

Question 5. Other Services

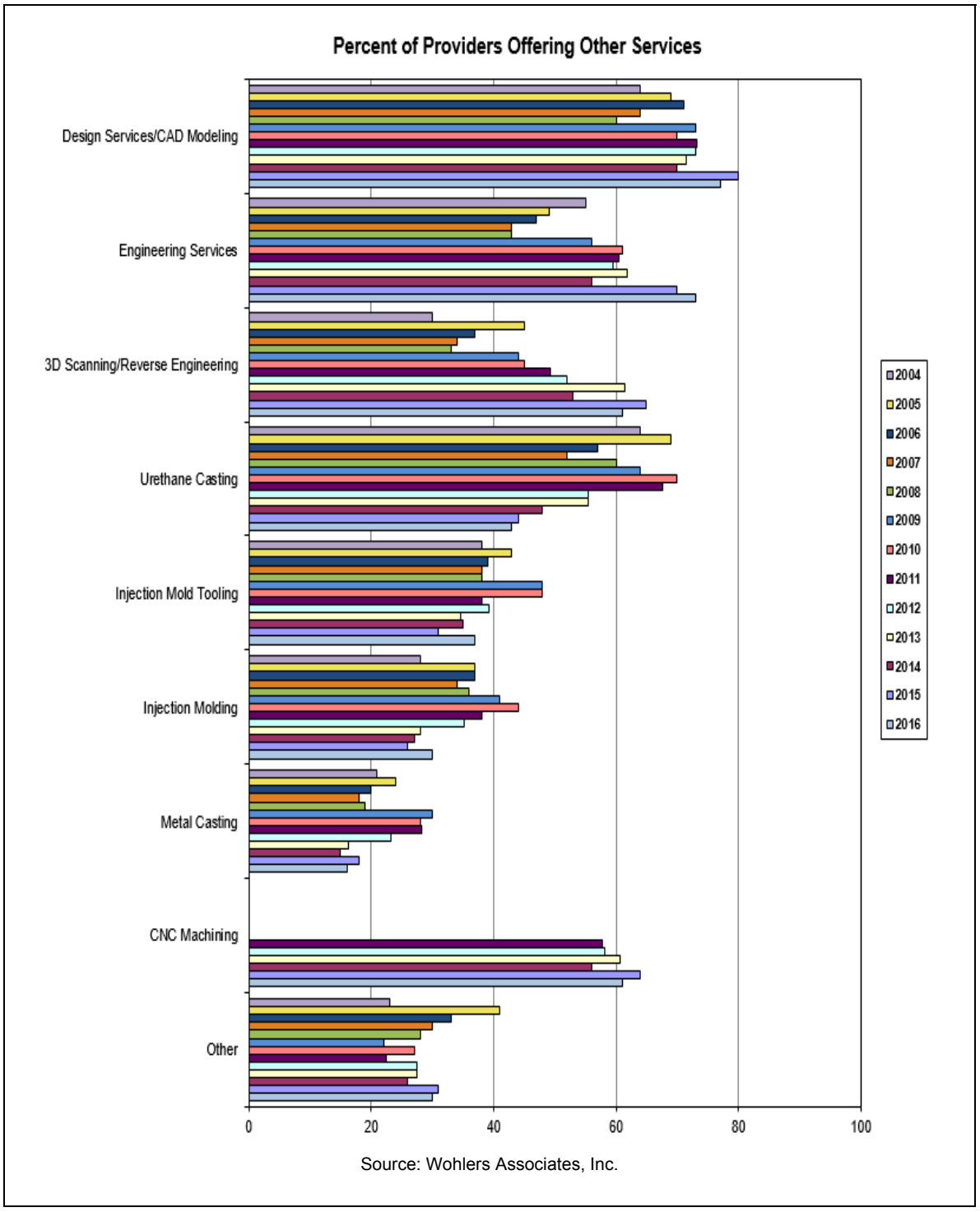
Do you provide other services in-house? Please indicate which of the following services you provide (in-house) by answering Yes or No.

Service providers offer many services in addition to parts built on additive manufacturing systems. This mix of "other" services changes from year to year, and this information is important to the SP segment. The following chart tracks the

categories of these other services over the past 12 years. This year's survey results were fairly consistent with trends from prior years, although many categories increased from 2014 levels.

Urethane casting, injection mold tooling, and injection molding services have been declining for the past five years or so. This suggests that AM service providers may have become more reluctant to include the challenges of injection mold tooling and molding to their services. Urethane casting, which was once a staple of "other services," has faded some in importance as AM systems a) become faster and b) support polymers with a greater variety of mechanical properties and colors.

Note that the "CNC Machining" category was added for 2011, so no data is available in previous years for this category. The majority of service providers with metal AM systems also offer CNC machining as a service, which may point to the importance of being able to do in-house post-processing of metal parts.



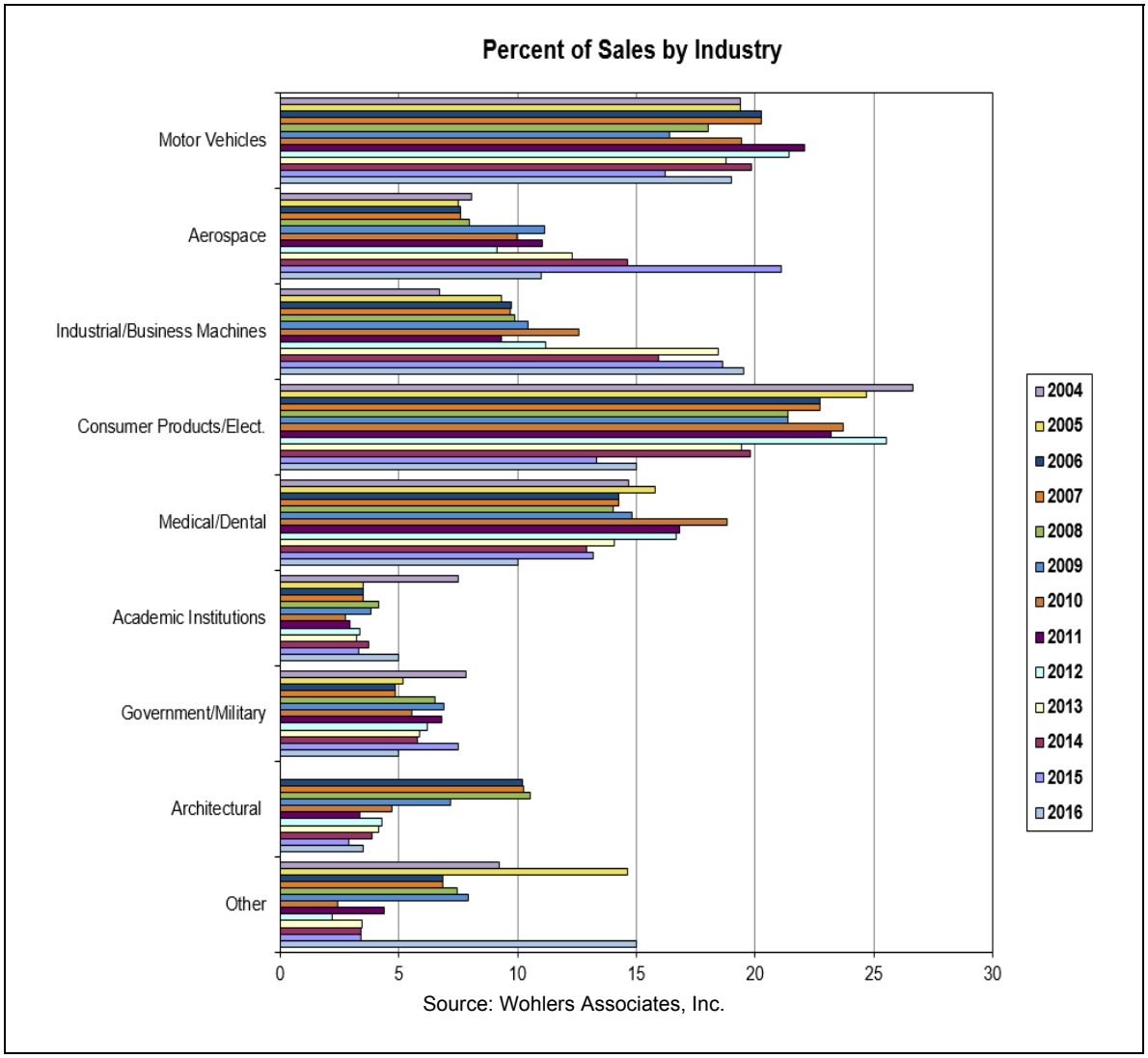
Year-to-year changes may be partly due to the evolving population of service providers responding to the survey, rather than service providers actually dropping these services from one year to the next. The population changed considerably in all of the past three years.

Question 6. Industries Served
Please indicate which industries you serve and the approximate percentage of your revenue from each. Please use the provided categories and do not create new ones.

The following chart shows the industries served over the past 13 years. The four industries that have received the most service from AM are motor vehicles, aerospace, industrial/business machines, and consumer products, followed closely by medical/dental.

Note, once again, that year-to-year changes may be partly due to the changing population of service providers responding to the survey, rather than service providers actually changing the industries they serve from one year to the next.

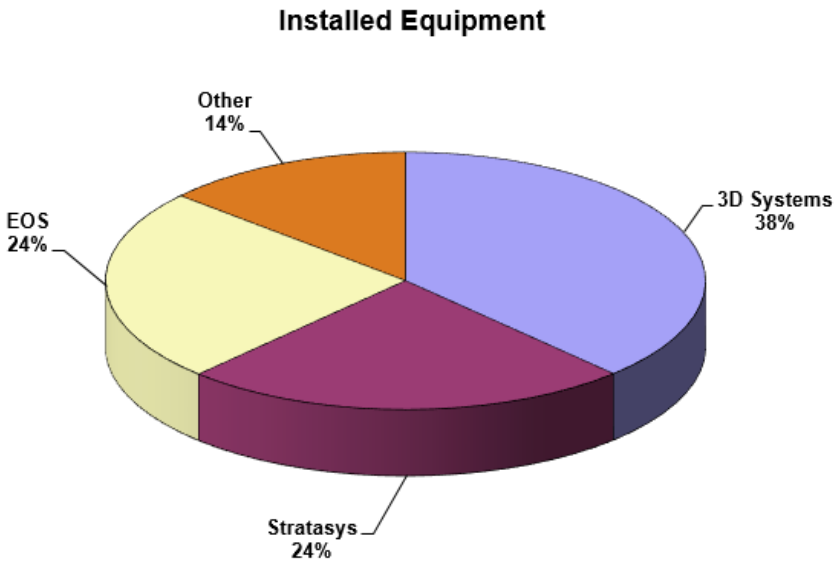
A category for the oil and gas industry was added in 2011, but dropped in 2012 and added back into the "Other" category. Note the large increase in the "Other" category in 2016, which may suggest that users are finding new applications that do not fit into the established categories.



Question 7. Equipment Used
Please indicate the AM equipment you have in-house, grouped by the manufacturer and technology, so that we can estimate the growth in capacity. In the first column, indicate the number of systems that were added last year. In the second column, indicate the total number of machines you had in-house at the end of last year. (Be sure to include the new machines from the first column to the total in the second column.)

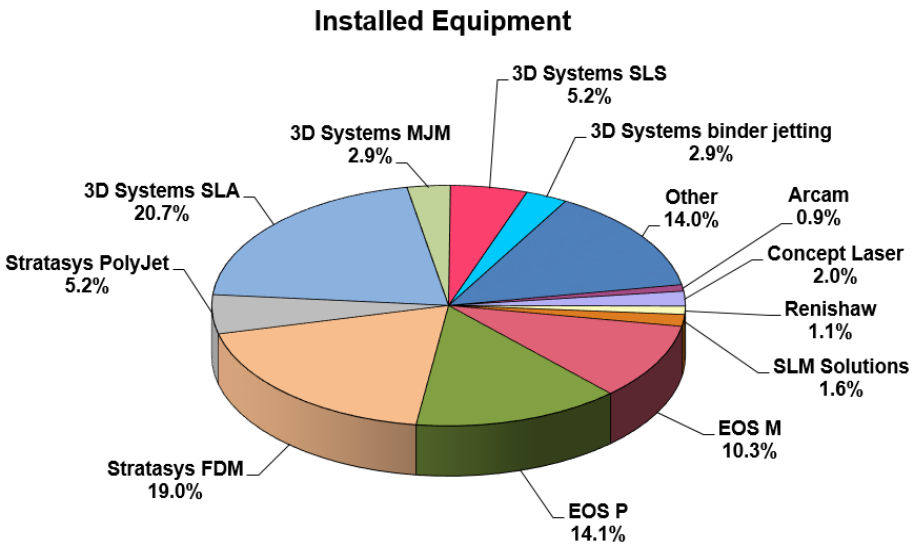
AM equipment manufactured by 3D Systems was the most commonly installed equipment at the companies responding to the survey. Of the 1,258 cumulative systems installed, 476 (38%) were from 3D Systems. The total includes 261 vat photopolymerization (stereolithography), 36 binder jetting systems, 66 polymer powder bed fusion (laser sintering), 37 material jetting (multi-jet modeling) systems, and 10 metal powder bed fusion (PBF) systems. Respondents told us that

305 system installations (24%) were from Stratasys, down from 27% in 2014. In that group, 239 are FDM material extrusion systems and 66 are PolyJet material jetting systems. EOS manufactured 307 (24%) of the systems. This total is comprised of 178 EOS P (polymer) machines and 129 EOS M (metal) machines. The following chart shows this information graphically.



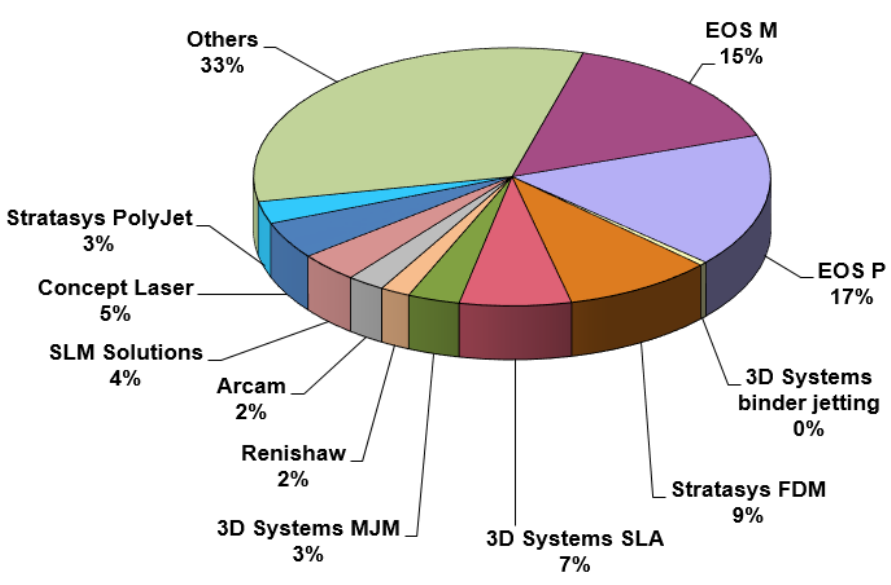
Source: Wohlers Associates, Inc.

The following chart provides more detail on the 1,258 cumulative installed systems. Each of the pie segments for 3D Systems, Stratasys, and EOS are divided by AM process. Companies with 12 or more installed systems are also listed. The "Other" category includes in-house/proprietary machines, as well as machines from Aspect, BeAM, Bright Laser Technologies, Envisiontec, ExOne, Lithoz, Mcor, Prodways, Solidscape, TPM, Trumpf, Union Technology, and Voxeljet. Due to some rounding, percentages may not add up to exactly 100%.



Source: Wohlers Associates, Inc.

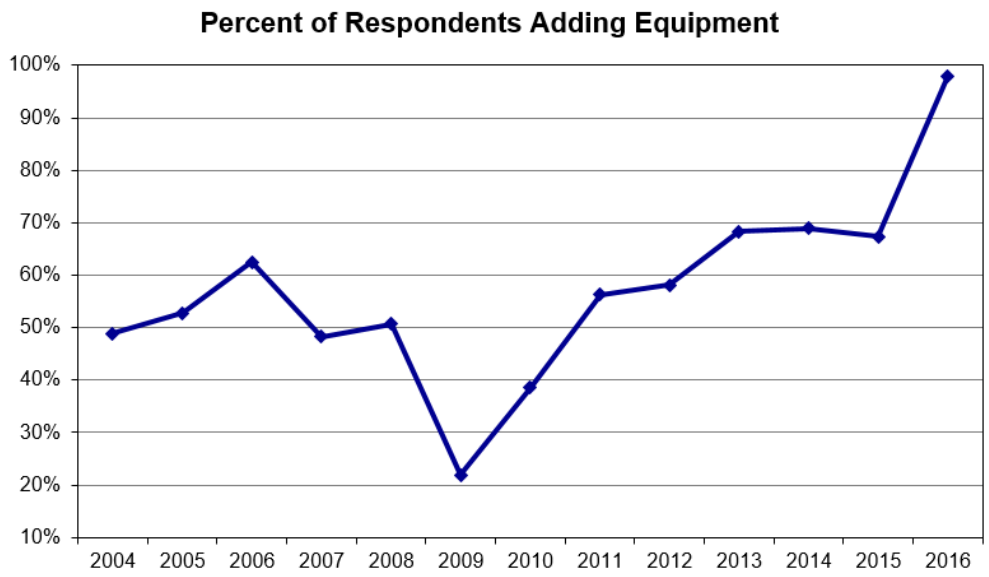
The following chart shows the equipment added to the survey respondents' operations in 2016. The systems most frequently added were from EOS, 3D Systems, and Stratasys. Of the 215 systems added, 69 were from EOS, 23 from 3D Systems, and 26 from Stratasys. The "Others" category includes systems from Aspect, Prodways, Solidscape, and Trumpf, 3D Systems' polymer and metal PBF systems, in-house/proprietary systems, and a small quantity of other equipment.



Source: Wohlers Associates, Inc.

The following chart tracks the percentage of respondents that added equipment over the past 10 years. In 2016, 98 of the 100 survey respondents (98%) added equipment, involving a total of 215 industrial systems. In 2015, 66 of the 98 survey respondents (67%) added equipment, involving a total of 217 industrial systems. In 2014, 60 of the 87 survey respondents (69%) added equipment, purchasing a total of 206 systems.

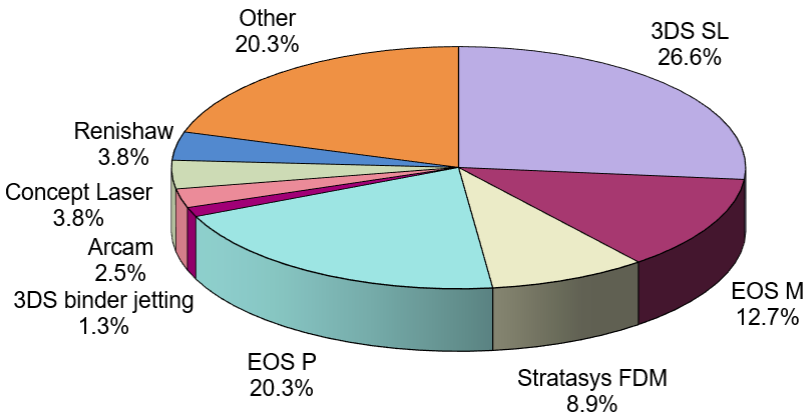
In contrast, in 2009, only 22% of survey respondents added equipment. This percentage rose steadily for four years, and then stabilized near 70% from 2013 to 3015, before climbing to 98% in 2016. This trend reflects the confidence and optimism of service providers in the growth and stability of their businesses.



Question 8. AM System Performance
8a. Which AM technology is making your company the most money?

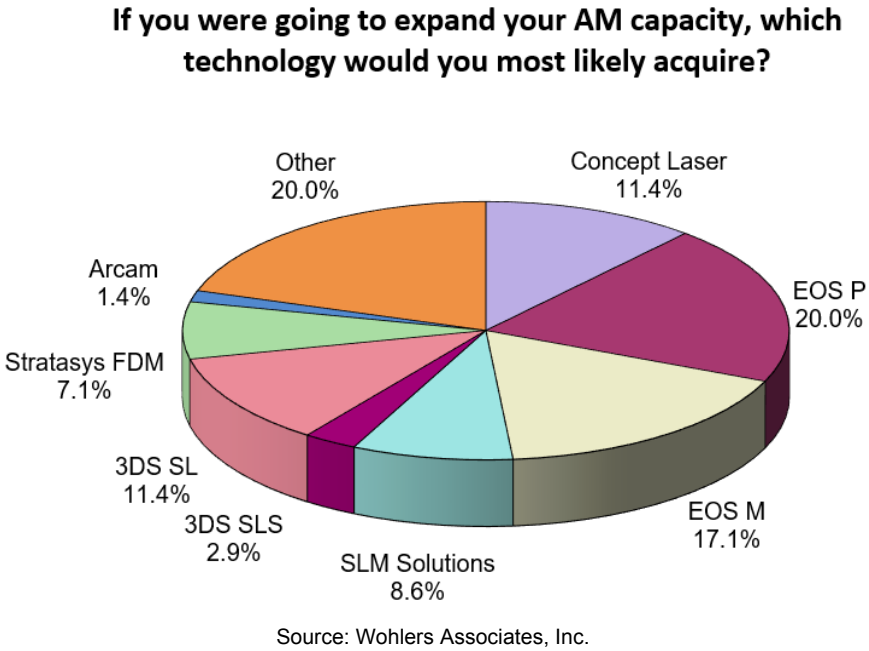
Question 8 was modified for the survey that was sent in 2014. Previously, this question had three parts. The first part asked which system is making the most money, and the second part asked which technology was making the most money. We felt this was redundant, so we simplified the question. For the past three surveys, we have asked which technology is making the most money.

As has been the case for many years, 3D Systems' stereolithography (SL) systems continue to make the most money for survey respondents. One-quarter (26.6%) reported SL made the most money in 2016, up from 24.5% in 2015. Polymer PBF from EOS ranked second at 20.3%. Metal PBF from EOS ranked third at 12.7%. Material extrusion (FDM) from Stratasys ranked fourth at 8.9%. The "Other" category includes in-house/proprietary systems, binder jetting systems from ExOne and Voxeljet, laser sintering systems from 3D Systems, and metal PBF systems from 3D Systems and SLM Solutions. Due to rounding, percentages may not add up to exactly 100%.



8b. If you were going to expand your AM capacity, which technology would you most likely acquire?

This question reveals which technologies the respondents see as most promising for the future of their businesses. The following chart shows the results.



A high number of respondents said that they would acquire PBF technology—both polymer and metal. In fact, 46% of respondents selected a metal PBF technology, with EOS leading at 17.1%. (The 46% includes some selections in the "Other" category.) Meanwhile, 22.9% of respondents selected polymer PBF from 3D Systems or EOS. In total, 58.5% selected PBF technology. 3D Systems' stereolithography (SL) rose to 11.4%, up from 5.7% in 2015. Meanwhile, Stratasys FDM technology rose from 5.7% in 2015 to 7.1% in 2016. Due to rounding, percentages may not add up to exactly 100%.

The "Other" section includes binder jetting technologies from ExOne and Voxeljet, Solidscape, Renishaw, Stratasys PolyJet, and 3D Systems material jetting technologies and metal PBF, in-house/proprietary systems, and a small quantity of other equipment. The wide diversity of responses to this question is a trend that developed only in the past few years.

Question 9. Additional Comments
Please provide additional thoughts or comments on your business and how it did in 2016, as well as your observations of the AM industry and the service provider segment.

The following anonymous comments were selected for their relevance to growth in the service provider segment. They are interesting and insightful and provide views on specific technologies, applications, and industry trends. The comments were edited for spelling, grammar, and clarity, but their meaning and intent were not modified.

"The segment is growing, and we have seen a change in the enquiries we receive, from those generated by hype to more realistic questions. We are also seeing much more of a shift to production parts."

"2016 was a great year. All of the footwork we did in the past 22 years to convince and prove that 3D printing is a great alternative for short-series production is now paying off. We see a very large increase in production orders and requests for low-volume production of complex parts."

"We expected to see an increase in both AM and total sales dollars in 2016, but were surprised that it did not occur. 2017 looks good."

"The growth rate definitely flattening versus prior years. We are seeing less cooperation between service bureaus, with every man to himself."

"The business in AM grew gradually in 2016 compared to 2015, but growing slower than we expected. Over the past year, we put a lot of effort into educating our customers on how to design parts to suit our AM technology. We got more "quality" AM design from our customers in 2016. However, due to a lack of AM knowledge in this industry from most of our customers, they have very high expectations on final

metal AM parts regarding surface finish and achievable tolerances. This is always a big concern, especially when metal AM parts cannot be post-machined. Continuous work on surface improvement for metal AM parts is needed, especially for complicated part features that cannot be post-machined or ground or sanded manually."

"Many metal AM machines were sold in the past few years, and a lot of local metal AM machine manufacturers are now in China. The supply is now over the demand. The cost of producing metal AM parts is not cheap. Most customers in China will choose the cheapest service providers, regardless of part quality. Hence, all service providers must lower prices in order to stay competitive in the China market. This over-supply phenomenon certainly has an impact on our business, not only in the China market, but also worldwide."

"In 2015, we saw quite an increase in the number of 3D printer distributors, which led to an increase in the number of people providing a service using cheap (desktop) 3D printers. In 2016, we saw a reduction in them and also found a lot of distributors becoming disillusioned with the profits they expected from selling 3D printers."

"The industry still needs to understand some variables to fully transition into this arena and emerging technology, including microscopy, hardness, compression, and other variables and characteristics."

"The AM industry is changing very fast. On one hand, fab labs are serving basic customers that do not have specific requirements, and, in this way, fab labs are helping the AM industry. On the other hand, services bureaus are specializing in short-series production. The important thing is that fab labs must convey the right knowledge to avoid discrediting a market in such rapid expansion."

"We are 100% in the jewelry industry and it grew slowly in 2016. Also, we did not see much growth in 3D printing over the past year, as most companies were battling to survive. Other than purchases of very small and cheap machines ($2,000 to $5,000) for people trying them out, I believe most purchases were to replace existing machinery and not to increase capacity."

"Strong growth and expanding interest."

"We are very interested in the capabilities of HP's new 3D printing systems."

"Demand for fully dense functional high tech ceramic parts is increasing. This is a good example of AM technology evolving into a highly-accurate and economically-feasible production method for end-use parts. We believe that the dental and medical market will especially benefit, as Zirconia ceramics are preferable to metals."

"The AM market saw a slowdown in 2016. Still, the manufacturing of end-use parts is growing steadily and at a high pace, and it is really developing into a sustainable business."

“2016 was not a good year in terms of growth. Election uncertainties probably caused indecision.”

“Great year, with 25.5% top line growth compared to 2015. We continued to add capacity and diversify. Most of our efforts are now around building our infrastructure for more production work in the near future. Additional laser-sintering capacity and being an early Carbon CLIP production partner are leading the way towards production applications.”

“I expect to see continued attrition as capacity in mid-range machines seems to be greater than demand. It is unclear how "prosumer" aggregators, such as 3D Hubs, impact business, but we suspect limited quality is a detriment to professional AM. We are seeing a serious lack of innovation in the $10,000 to $124,000 market segment, which is largely dominated by Objet, Stratasys, and Z Corp. machines from 5–10 years ago.”

“We are still seeing significant amounts of misinformation regarding the capabilities of metal AM. Some of it is coming from new entrants and some from the OEMs. Business was up approximately 20% last year and is already on track to doubling or more in 2017. Customers are starting to become more experienced, and high-end customers are realizing that buying on price alone, will likely result in an unusable part.”

“The industry has become more competitive, with many of our clients investing in low-end technology to do basic prototyping. Machine distributors are increasingly active in competing for service bureau work.”

“We saw a very big surge in prototyping in the first half of 2016, and then a steady decline in the second half. More customer awareness of cheap desktop systems is affecting the market. Some big brands are taking on leasing of mid-level machines.”

“Entry-level 3D printing service providers took some of our business for jobs less than $495, but we have sales of more than $5,000 using our high-end Fortus 900mc and 400mc machines. Also, we increased sales volume with bigger jobs.”

“We are seeing enormous demand for metal parts that take advantage of freeform fabrication, as well as the repair of existing high-value parts. The cost of the equipment is a factor and limiting opportunities. If the cost of the equipment and materials drop, we expect tremendous demand for AM metal parts in the Indian market.”

“2016 was down due to increasing competition from machine OEMs that are also making parts and acting as service providers.”

"At this stage, AM machines are a waste of money due to immature technology. These machines have very high operation and maintenance costs. Therefore, we are not investing any money on AM technology, and the bulk of our income is from CNC machining."

"The price of laser-sintered parts is dropping every six months, yet you can still find new customers for end-use applications."

"Our revenue from serial production has really increased dramatically in 2016."

"Our additive manufacturing services continue to see steady growth. We are gaining market share from our competitors through new customers. Some of the increase came from our new AM machine. The market interest in 3D printing is growing, especially over the past six months, with increased quoting. Also, we are still hearing that pricing for services by the big guys (Stratasys and 3D Systems) is high, and feel that we can provide the market with higher-quality service. We are forecasting an increase in business for 2017."

"The turn to production for aerospace components is becoming more common. We expect to see a much larger percentage of production work in 2017."

"As metal AM technology shifts from prototyping to production, we increasingly see process control, repeatability, and part verification as critical needs and a challenge."

"We recently lowered prices by about 30% to adjust to the realities of greater competition. We are also expanding our online presence and capabilities."

"With the cost of AM systems falling continuously, more and more OEMs are procuring their own systems, so the need for initial prototypes from a service bureau is declining dramatically. However, the business is seeing growth for manufacturing of functional prototypes using silicone and soft tooling for making parts in production-intent materials."

"2016 was a strong year for us. However, a re-birth of small and medium-size bureaus are creating a more competitive field. Unfortunately, the high prices of capital industrial equipment is driving these smaller companies to compete in the industrial market by using off-brand consumer and prosumer machines with small build envelopes and inexpensive materials. This typically results in lower quality parts. Also, it can create confusion among buyers and may affect their understanding of the technology's real capabilities (quality, build size, materials, and so on)."

"2016 was a very difficult year, and from what I could see, it applied across the marketplace. It seems like SLA has fallen out of grace to FDM. However, as the first part of 2017 suggests, it may be on a come-back."

"We had a nice year until the end of the third quarter when we lost all of our gains for the year. Our data shows that the run up to the election every four years provides the same collective breath-holding in product development. December finished very strong. Stratasys continues to be one of our biggest opportunities as a partner, yet also one of our biggest threats. Overall, we are looking forward to healthy growth in 2017. We are one of the largest independent, AM-focused companies in the marketplace, so our challenge is to invest enough on marketing to rival the likes of Stratasys Direct Manufacturing and Proto Labs."

Summary

One hundred service providers in 26 countries participated in the survey for *Wohlers Report 2017*. The industry as seen through the eyes of these companies is important because they represent a wealth of knowledge, experience, and insight. They are among the early adopters and innovators of new AM and related technology, and are often the first to experience growth or downturns in business that serve as harbingers of emerging trends in the AM industry.

Most of the service providers that responded to the survey had a positive year in 2016, in both the primary and secondary revenue streams. Based on this data and their comments, we believe the majority are in relatively good financial health when the survey was conducted in early 2017. As a whole, they are growing, and growth in 2016 continued a positive trend that has been ongoing for five years.

Acknowledgement

We are grateful for your participation in our annual survey, and we hope that this report helps to make your contribution worthwhile. The data we collect aids us in trend analysis, recent changes in the industry, and market forecasts. The AM industry has received an unprecedented level of attention from the media, government agencies, and organizations of all types in the recent past. We are experiencing some of the best years for the technology and industry, yet even more exciting times are ahead, in our view.

We believe in the adage, "A rising tide lifts all boats," so we sincerely wish you continued success in your business. Thank you again!

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