

# DIGITAL DIGEST

Manufacturing News from American Precision Prototyping, LLC

May/June 2009



## Stereolithography Still the KING of additive fabrication

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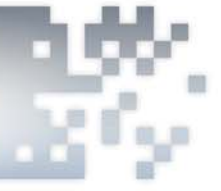
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## FROM THE PRESIDENT'S DESK



As a guy who started out as a draftsman at General Electric drawing on paper with a pencil and a T-square, the introduction of 3D CAD was revolutionary. When I saw the first part made from a stereolithography machine it was mind blowing. I was so excited and impressed I threw away my T-square and pencil the very next day.

I was operating Unigraphics v.5 when I saw my first stereolithography apparatus (SLA®). Back in the early 1990's, General Electric Aircraft Engines had just purchased their first SLA®-250. For me, it was love at first site. For the first time we were able to "grow" a physical part directly from our computer data – in just a few days! I will never forget watching my first SL part build. I was totally amazed to see the laser light tracing around the liquid photopolymer. As the build progressed you could see what looked like a distorted part deep within the vat of amber liquid. When the build was complete, the laser stopped, the platform with the parts attached rose up and out of the liquid. There it was, a part that had existed only inside my computer just a day ago glistening under the fluorescent lights of the RP lab - and not distorted at all. From that moment on I was hooked.



Jason L. Dickman  
President

It didn't take long for GE to build up their SLA® department by adding additional machines and staff and it proved to be an invaluable experience for me. I was the customer purchasing parts from the "internal" service bureau. Later in my career, it helped me understand what was truly important to customers – excellent service and quality parts. Later, my passion for stereolithography and rapid prototyping led me to a new and exciting career and eventually laid the foundation for one of the "top five" service bureaus in the US.

The early SL parts were brittle and the accuracies were less than desirable. However, the machines worked and as the 1990's progressed, the new technology invented by Chuck Hull just ten years earlier was now commercialized. Building SL parts was starting to become a standard practice by engineers and designers in all industries. 3D Systems, Inc was born and the stereolithography technology flourished. OEM's acquired machines for internal projects and service companies started springing up to provide SL parts to companies that chose not to invest in the expensive equipment. Over the next decade, stereolithography dominated and became synonymous with the term "rapid prototyping".

Today, SLA® is just one of many "layer additive" methods to quickly produce parts direct from 3D CAD. Other technologies such as selective laser sintering (SLS®), fused deposition modeling (FDM™) and 3D printing (3DP) have all made great advancements. Even high-speed CNC has made claims to be as fast as some additive processes. The term "rapid prototyping" has now been replaced with terms such as "additive fabrication" because these machines no longer produce

of many "layer additive" methods to quickly produce parts direct from 3D CAD. Other technologies such as selective laser sintering (SLS®), fused deposition modeling (FDM™) and 3D printing (3DP) have all made great advancements. Even high-speed CNC has made claims to be as fast as some additive processes. The term "rapid prototyping" has now been replaced with terms such as "additive fabrication" because these machines no longer produce just prototype parts. They are now capable of producing functional, or near production quality parts for functional applications and real time application testing.



Stereolithography may not be number one across all aspects but when examined as a whole; it is the best, well rounded, affordable technology available. SLA® has excellent speed and



throughput, a wide variety of material choices, reliability, consistent accuracy and it provides a solution for complex parts built quickly and accurately with a plethora of post finishing options. Additionally, SLA<sup>®</sup> machines are true manufacturing centers that can run 24 x 7 and build consistent parts day after day. The speed and throughput of an SLA<sup>®</sup>-5000, SLA<sup>®</sup>-7000 and now the

SERVICE	SPEED	MATERIALS	ACCURACY	COMPLEX PARTS	COST OF OWNERSHIP
SLA <sup>®</sup>	●	●	●	●	●
SLS <sup>®</sup>	●	●	●	●	●
FDM <sup>®</sup>	●	●	●	●	●
CNC	●	●	●	●	●
● Poor      ● Good      ● Better      ● Best					

iPro™ machines are impressive enough to allow a service company like APP to provide thousands of high-quality parts with an array of near production materials and finishes at break-neck delivery schedules.

SLA<sup>®</sup> has developed significantly since 1990. The days of brittle, inaccurate parts have now been replaced with accuracies of +/-0.007 inch over a 30 inch part in an array of materials. Additionally, newer machines provide a higher quality surface finish and easier support removal right out of the machine which cuts down on post processing and augments deliveries. Stereolithography was our vanguard technology and it continues to be our number one selling service. When you do something for a long time you become good. When you do something for a very long time you become great. SLA<sup>®</sup> from APP is great; some say the best in the industry. On pages 9-11 of this month's newsletter, we are proud to showcase several projects that SLA made a success – read on and enjoy this May/June issue that is a tribute to stereolithography technology at APP.

In closing, I would like to extend a personal thank you and happy birthday to Chuck Hull. As mentioned earlier, Chuck is the inventor of stereolithography and is still working and inventing at 3D Systems. Back in mid-May while attending the RAPID 2009 conference, I was lucky enough to be sitting with Chuck as he was handed a birthday cake for his 70th birthday. Happy birthday Chuck! – and thanks for the career.





**^** SUPER



**Push play and walk away?...think again.** Anyone that tells you stereolithography (SLA<sup>®</sup>) systems are push button, lights out operations have never operated SLA<sup>®</sup> machines at a busy service bureau. At APP, we build thousands of quality SL parts monthly and our success over the years has been due to processes and procedures put into place early in the company's history and to the dedication and skill of our operators.

The procedures employed at APP were started long before the company began in August of 2002. Methods used by current APP SLA<sup>®</sup> operators date back to methods used in the early 1990's by operators at companies like GE Aircraft Engines, Accelerated Technologies and Hasbro Toys.

Steve Deak, an early mentor of APP President Jason Dickman, was considered a major contributor in the early years of rapid prototyping, specifically stereolithography. Mr. Deak was very passionate about machine operations and continual build style enhancements. He was also fanatical about getting the most out of each build and imparted standards for machine operators, post processing and shop safety that continue at APP today.

SLA<sup>®</sup> has and will always require skill, patience, education and dedication to be successful. Machine operators today have to learn to balance a busy work schedule with their personal lives, maintaining a cool head & making logical decisions under pressure and striving to run all machines efficiently and at peak performance. APP is fortunate to have two of the best operators in the industry. Jason Mendes (Tulsa, OK) and Jacob Eva (Anaheim, CA) are the genius behind the successful SLA<sup>®</sup> departments at APP.

Mendes and Eva have learned to adapt to the deluge of orders and continual schedule changes that APP customers require. Both agree maintenance is key to successful builds and is one of the most challenging aspects of their jobs. "Making time in between builds for calibration tests and routine maintenance is extremely difficult when you have a full schedule and more orders coming with expedited lead times", stated Mendes. Both expressed a desire to have more time to assist with beta testing of new resins and additional time for advanced training. "I enjoy working with 3D Systems to beta test new resins. It feels good to have input about new materials being developed", stated Eva. Additional daily responsibilities of operators include repairing bad STL data, resin management and troubleshooting machine problems as they occur.

The high stress environment at a busy service bureau, specifically the stereolithography lab, is not for everyone. It requires patience and keeping a cool head under pressure as schedules change hourly. Over the last seven years, APP has completed hundreds of same day projects, sixteen foot architectural models, intricate works of art and millions of other parts and all this is possible because of the drive and determination of the SLA<sup>®</sup> operators.

So, push play and walk away? Yes, every now and then... but in about an hour or so, Jacob or Jason will be back in the shop to either setup a new build for a next day SLA<sup>®</sup> project or to modify an existing build due to a customer change request. Their position doesn't allow for normal 8-5, Monday through Friday work weeks or standard, uneventful work days. Each day for an SLA<sup>®</sup> operator brings about a new challenge, a new way of doing things to get a job done and more challenging, envelope pushing designs needing to be built at lightspeed. Are our SLA<sup>®</sup> operators superheroes? DEFINITELY!



*Eva*



*Mendes*



## American Precision Prototyping Offers Large Single Piece SLA

Tulsa, Oklahoma, June 4, 2008 – American Precision Prototyping, LLC. (APP), an industry-leading service bureau that provides fast, high-quality Rapid Prototype and Rapid Manufactured parts announced today customers can now purchase large, single-piece SLA® parts from the iPro™ 9000 XL SLA® System.

The iPro™ 9000 XL SLA® System delivers more on demand than any other SLA® system. It is capable of producing SLA® parts up to 60 inches in length in one piece and delivers the accuracy and precision of small hi-res parts. The iPro™ 9000 XL produces parts with accuracies from .01" to .015" over the entire 60 inches and on average parts are within .005".

"We are confident this new service will open up new opportunities for our automotive, aerospace and agricultural clients with consistent large parts", stated Jason Dickman, President of APP. "This system will give our large part customers the ability to manufacture their parts faster and more accurately than before. Time consuming sectioning, multiple builds over several days and labor intensive post processing are eliminated as are the dimensional inaccuracies that can occur when a part is built in multiple sections and reassembled", concluded Dickman.

In addition to the iPro™ 9000XL, APP also operates two iPro™ SLA® Systems. The iPro™ produces parts up to 30 inches in length with superior surface finish from the machine and accuracies similar to those on hi-res parts. The entire 3D Systems iPro™ line of SLA® systems offers customers unmatched build envelopes and unparalleled precision and accuracy for large parts. In addition to offering more for customers, the iPro™ line also gives operators additional enhancements including more build styles for more diverse applications, consistent and reliable output, easier maintenance and operation, and more intelligent software to handle part preparation and build.

### About American Precision Prototyping, LLC.

American Precision Prototyping, LLC (APP), a privately held services company located in Tulsa, Oklahoma, is the premier rapid prototyping and manufacturing facility in the Midwest. APP sets itself apart from other digital manufacturing facilities by offering free, instant online quoting 24/7, complete project solutions from design to production utilizing the latest equipment and materials in-house, providing unsurpassed customer service, and offering their customers a 100% quality guarantee. "Instant Quotes, Quality Parts"

More information on the company is available at [www.approto.com](http://www.approto.com).



# HOW TO INSTANT QUOTE



UPLOAD STL OR ZIP FILE AND PROCEED TO STEP 2

Instant Online Quotes

## Step 1 Upload Your Files

tFilename.STL

Instant Online Quotes

## Step 2 File Summary

Available for instant quote:  
Filename.STL

Available for manual quote:  
Filename.PDF

DECIDE INSTANT OR MANUAL QUOTE. SELECT THE UNITS. PROCEED TO STEP 3.

Instant Online Quotes

## Step 3 Select Material

File Name	Qty.	Service	Material	Finish
Filename.STL	(#)	(Select 1)	(Select 1)	(Select 1)

SELECT SLA, MATERIAL, AND FINISH. INCLUDE SPECIAL INSTRUCTIONS AND LEAD TIMES. PROCEED TO STEP 4

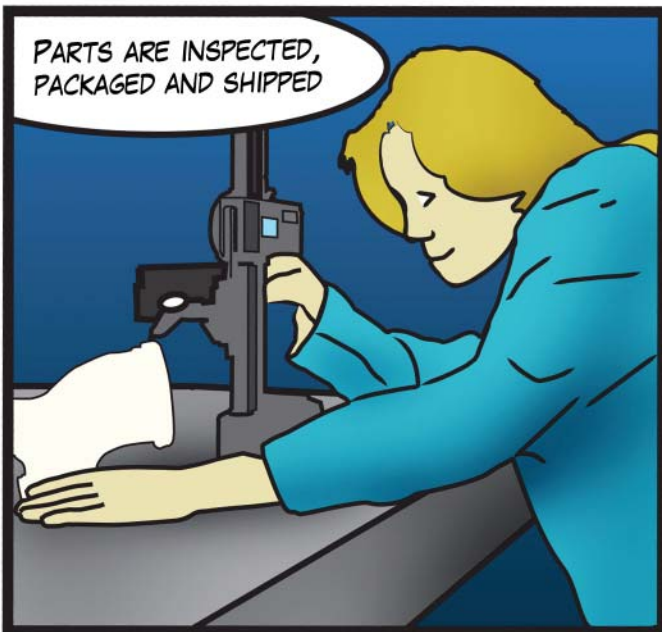
SELECT "BILL TO", "SHIP TO". ADD SHIPPING INSURANCE. SHIPPING METHOD, AND ACCOUNT. ADD PROMO CODE IF YOU HAVE ONE. PROCEED TO STEP 5.

Instant Online Quotes

## Step 4 Place Order

**Bill to:**  
 Name: John Smith  
 Company: C&D  
 Address: 123 Anywhere  
 City: Anytown

**Ship to:**  
 Name: John Smith  
 Company: C&D  
 Address: 123 Anywhere  
 City: Anytown



# STEREOLITHOGRAPHY... THE FUTURE OF ADDITIVE MANUFACTURING

More than twenty years after Chuck Hull discovered and commercialized the first SLA<sup>®</sup> 1 (the first 3D Systems' Stereolithography Apparatus) and launched a brave and young industry, stereolithography continues to be the industry standard for precision parts, quality and performance. Today's SLA<sup>®</sup> parts are delivered through 3D Systems' newest and most advanced generation of iPro™ SLA<sup>®</sup> Centers, using a complete family of engineered Accura<sup>®</sup> Plastics and composites that are expertly integrated for optimal performance and cost effectiveness.



Chuck Hull (left)

The number of Subtractive and Additive Manufacturing alternatives crowding the Rapid Prototyping and Manufacturing space have continued to increase, but, when it comes to part precision, accuracy, wall smoothness and feature details, SLA<sup>®</sup> made Accura<sup>®</sup> plastic parts remain the bench mark. Today, SLA<sup>®</sup> parts are used in a variety of applications, including form, fit and function, tools, fixtures and jigs. These direct and indirect manufacturing applications span the globe and cover every imaginable application from toys to hearing aids.



And we are not resting on our laurels. At 3D Systems, we believe that marketplace leadership is achieved and sustained through technology leadership, and as we have learned over and over again, pioneering has its costs... and its rewards. In keeping with this belief, our engineers and scientists are busy at work shaping our vision 2020 for Stereolithography.

So how might future SLA<sup>®</sup> Centers and Accura<sup>®</sup> plastic parts benefit you? By delivering to you economically enhanced parts' performance from new materials. In a nutshell, that means an expanded range of general purpose and specialty Accura<sup>®</sup> plastics and increasingly more productive SLA<sup>®</sup> Centers that will employ cutting-edge imaging technology for speed, reliability and consistency.

The architecture of future SLA<sup>®</sup> Centers will feature fewer moving parts and reduced service and maintenance needs for improved total cost of ownership and significant build-speed improvements for improved part economics. Cost effectiveness will be further addressed through the extension of materials' shelf life, yield improvements and a reduction of the significant on-hand inventory associated with today's Vat-Centric materials' delivery system. Finally, we expect our developers to continue to develop new Accura<sup>®</sup> Plastics that will meet or exceed the prototyping and manufacturing needs of tomorrow's engineers.

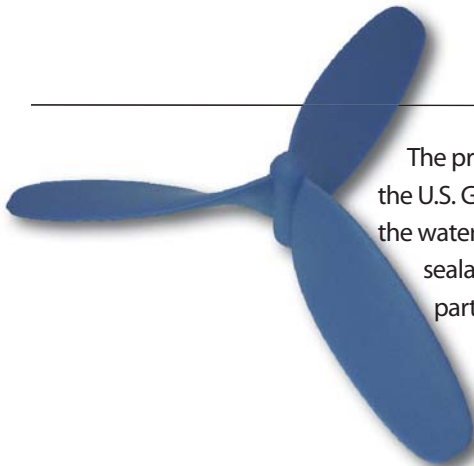
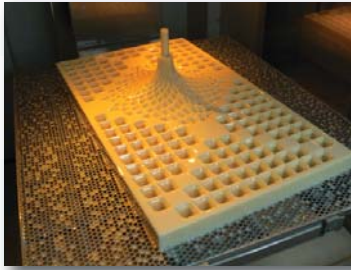


Abe Reichental  
President & CEO  
3D Systems, Inc.





Accura® 25 is an excellent material for a functional presentation model as seen below in this design by a major New York architectural firm. The 29" model was built in one piece in the iPro™ SLA System (bottom middle image) and completed with a gloss white color paint finish.



The propeller shown to the left was produced in Accura® Bluestone for a branch of the U.S. Government. The prototyped propeller was placed on a submarine and used in the water for field testing. The part was finished to a liquid proof finish which includes a sealant to repel water. Bluestone is excellent for high heat environments and testing parts that require high flexural modulus.



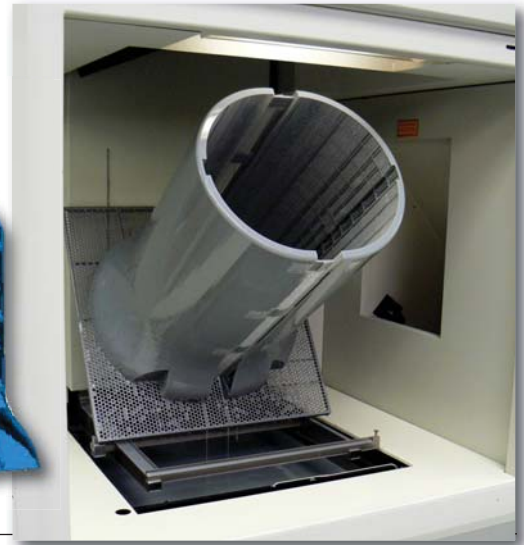
A major bicycle manufacturer used Accura® Xtreme to create this integral component for a bicycle assembly mock-up. Accura® Xtreme simulates molded plastic and has excellent impact resistance and durability.





Tough, functional parts are best manufactured from Accura® Xtreme. Built in two halves side by side, this 24" bucket was produced in the SLA 7000. The UpBucket is designed to lift the contents of the bucket to three various heights by adjusting and locking the handle in notches inside the bucket.

**ACCURA** XTREME™



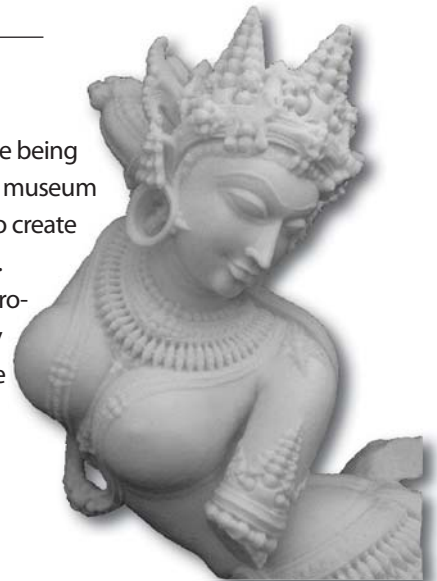
A major auto parts manufacturer required clarity and color for these tail light lamps. Accura® 60 was the perfect material for the job. Ideal for producing optically clear parts, Accura® 60 is also suitable for models requiring a transparent or translucent finish. The orange dye finish was color matched to the customer's specifications.

**ACCURA** 60™



Rare works of art in museums around the world are being preserved with the help of stereolithography. The museum artifact pictured to the left was digitally scanned to create a 3D CAD file for the molding phase of the project. Once the CAD file was complete, the model was produced in Accura® 25 and finished to a mold ready finish to create the plaster replica used to simulate the real artifact.

**ACCURA** 25™

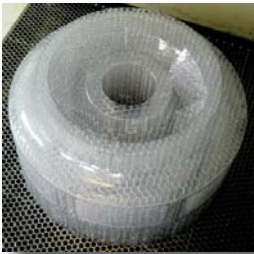
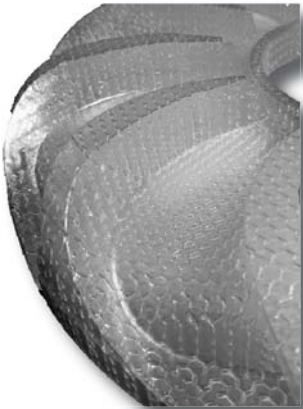




Accura® 55 painted produces realistic looking production quality parts. This helmet, produced for a consumer products company, was painted and assembled for a fully functioning demonstration model. This rugged, ABS-like material allows for repeated testing and prolonged handling without degradation.

*Courtesy of Kraig Kooiman with Nexgen Product Design & Development*

Quality investment cast metal parts begin with a high quality SLA® Quick-cast pattern. The honeycomb pattern pictured to the right was produced from Accura® 60 with a Quickcast build style. Accurate metal castings can be produced from these patterns without the use of a conventional tool.



Produced for an entertainment company, the Lich King helmet shown to the right, was produced in Accura® 55. The part was completed to a paint ready finish. The finished product, shown to the left, was used as a trophy for a World of Warcraft team.



# APP GUARANTEE

At APP, we strive for a 100% customer satisfaction experience. We guarantee your order will arrive on time, be of the highest quality, and be purchased at the industry's most competitive price. We will do whatever it takes to keep you as a loyal customer.



# TESTIMONIAL

"I'm very satisfied with the overall quality of the service and parts I received from APP. Kamran was very helpful in making sure I received what I needed when I needed it. I shop around for the best deal, and APP provided me with the most competitive price. The prototypes looked awesome and the design engineers were very pleased. Bonus points for sending the parts earlier than expected."

E.V.  
Clorox Services Co.



# PROMOTIONS



## Refer a Friend



If you refer someone to APP and they perform an instant online quote, you will be entered into a drawing for a \$50.00 Home Depot Gift Card.

## Upcoming Events

APP BOOTH 109021

TCT Expo 2009  
June 22-26, 2009  
McCormick Place  
Chicago, IL



## Material

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request your samples.



Instant Quotes, Quality Parts



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