

PRATT & WHITNEY
Engineering Division South

INTERNAL CORRESPONDENCE

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Subject: SLA Users Group Conference Trip Report
Date: October 9, 1989
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HIGHLIGHTS

During the week of October 1st, 1989, Fred Steinbauer, Stereolithography Project Engineer and I attended the Stereolithography Users Group meeting in Orlando, Florida at the Living Seas Conference Center in EPCOT.

3D Systems released information on the first three quarters of 1989 and explains their marketing strategy for the future.

3D Systems is still noncommittal on release date for SLA-500 and has become reluctant to release any information about future changes.

Building techniques, file manipulating procedures and resin research papers were exchanged between participants to facilitate the development of Stereolithography.

Version 3.6 Software is ready for release for the SLA-250, but will not run on SLA-1 machines that are currently in the field.

Service Bureau Companies providing Stereolithography services to industry are now more numerous but are concentrated in the north-central area of the country.

DISCUSSIONS

A Stereolithography Users Group meeting was held at the Living Seas Conference Center at EPCOT Center in Orlando, Florida on Oct 2nd - 4th for all SLA owners. Ray Freed, CEO for 3D Systems announced the expansion growth of 3D Systems and explained that in 1988 the company had grown to 70 employees, and had shipped 32 units but had realized a \$5 million loss. During the first quarter of 1989 the company expanded

to 90 employees and had shipped 10 units for a loss of \$1.5 million. During the second quarter of 1989, 3D systems expanded to 140 employees, shipped 20 units and cut their loss to \$900,000. The third quarter is still too early to tell, but their personnel has grown to 185 people. Currently, 130 units have been ordered, of which 92 have been shipped. A total of 105 working machines are now in the industry world wide. The 1990 goals of 3D Systems is to improve their post sales services, and to explore material development with world-wide chemists, and not be limited to single source vendors as Desoto and Ciba-Geigy.

Chuck Hall, President of 3D Systems, spoke on the latest developments in 3D Systems research and announced that the long awaited beam width compensation feature to be incorporated into the software has made "substantial progress with 75% of the bugs worked out". Chuck would not speculate on a release date for this software change, but felt that they would have the problem solved "in the near future". 3D systems has been investigating the area of advanced parts management, and will be releasing matrix data sheets on materials and uses for incorporation of individual companies requirements into future software changes.

There appears to have been a problem associated with the recoater system that has been installed on the SLA-250 machines in the field. Evidently, the arm of the recoater has failed to leave a consistently thick layer of uncured polymer on the surface of the part. The calibration of the recoater, must be precise, and has caused some major difficulties for the field engineers to perform an exact calibration. 3D has revamped their entire calibration techniques to ease the installation of the recoater, and have reduced the "gap" between the recoater and the top layer of the part being built. The retrofit kit for conversion of the SLA-1 to a SLA-250 turned out to be more work than was originally thought by 3D Systems, but the kit has finally been released and installation has been started by 3D Field Representatives.

Tom Vorgitch, Marketing Vice President of 3D Systems, announced that documentation for the SLA-250 has been compiled into a SLA Quick Reference Manual and will be sent with the delivery of the retrofit kit, or the purchase of a SLA-250. Tom also announced that the new 3.6 version of the software will only run on the SLA-250 and is therefore not being released at this time to SLA-1 users. The new software eliminates the mirror bits and antiquated units used in previous versions, and now supports CAD units of inches and millimeters. Other changes incorporated into 3.6 include an option for installing personalized slice defaults, a scaling options, range checking feature, default overcure of 6 to 15 mils, consolidated slice-prepare and merge feature, matrix part building styles, automatic output of slice files in binary, and enhanced graphics display during build cycle to establish "What you see on the screen is what you get". Although 3D Systems was candid about future expectations, they appeared to have tightened up their security and were reluctant to release any dates or time period for any of their developments. The SLA-500 is rumored to be spotlighted at the AUTOFACT Show in November.

Several companies presented research papers on a variety of investigations. Frost Prioleau presented a paper on the Use of Molded Tooling With Stereolithography and Walt Kirkaldie of Percision Castparts spoke on Stereolithography masters used to generate metal parts using the investment casting process. Dr Allan Lightman of the University of

Dayton presented a description of a new program at the University that addresses improvements to the development of Stereolithography. The program is funded by the State of Ohio and a consortium of industries including 3D Systems. The Rapid Prototype Development Laboratory has been established to aid industry in making the transition from labor-intensive, time intensive, hand drawn, hand fabricated models to the most advanced computer aided design and automated fabrication equipment available. This program is industry driven and funded by a major grant from EMTEC, which is the State of Ohio Edison Materials Technology Center, and substantial contributions from local & national industries.

Several presentations from Ciba-Geigy were made on the characteristics of REN plastics and an update on photopolymer developments. Fred Steinbauer presented our data on the performance of the SLP-20 workstation versus the NEC-386 computer. The SLP-20 workstation is clearly superior to the NEC-386, but further testing is warranted to understand all the variables taking place during the "slice" operation.

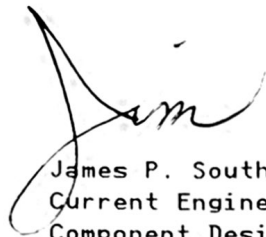
Dr. R. Larry Dooley of Clemson University presented a discussion on the integration of an expert design system to the front end of Stereolithography. At the present time, Clemson has developed an editor called "SLED", and is working with a smart "hip replacement designer" program in testing this software. Dr. Dooley is looking for BETA sites to test and develop this program in the industry environment and has currently expanded this program to adapt to the sun/sparks workstation and Macintosh II platform, and they are investigating other systems at the present time.

Robert Paul of Proctor & Gamble presented his companies research on the mixing of known monomers to obtain a resin with a lower flexural modulus. Their research, although promising, has not produced a resin which is low enough to produce the desired results necessary to meet their companies packaging needs. Ciba-Geigy warned all companies to be extremely careful in blending of various monomers, because although specially developed for Stereolithography and stable in their present form, they may become highly unstable when mixed with other agents or monomers.

Currently, twelve Stereolithography Service Bureau Companies have started throughout the country. Although only a few have a machine yet, their sales department has been pitching to major corporations on the benefits of Stereolithography. Interestingly enough, seven of the twelve are located in the Chicago area. Most of these companies have billed themselves as prototype manufacturers and will supply a Stereolithography master model for injection molding or spray metal tooling.

The conference ended with the election of new Officers for the coming year. Elected were Tom Kerschensteiner of AMP as Chairman, Dave Flynn of Prototype Express as Vice-Chairman, Frost Prioleau of Plynetics Corporation as Secretary/Treasurer and myself, Jim Southard of Pratt & Whitney as Site Coordinator. Several charter amendments were proposed, and will be voted at the next meeting in April 1990 in either San Diego or Santa Barbara, California.

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Attachment:

Also in attendance were representatives from 3D Systems (10), AMP (2), Abbott Laboratories (2), Apple Computers (1), Auburn Engineering (1), Baxter (3), Brandon Assoc. (3), CAECOR, Inc (3), Carnegie Mellon University (1), Cascade Engineering (1), Ciba-Geigy (2), Clemson University (3), Data Image (2), DePuy (2), Digital Equipment (2), Dupont (2), Kodac (1), Ford (4), GE Aircraft (3), GE Appliances (1), GM (8), Hoechst Celanese (2), Hughs Aircraft (1) IBM (1), Johnson Controls (3), Johnson & Johnson Orthopedics (1), Laser Prototypes, Inc (2), Laserform (1), Leap Technologies (1), Marathon Manufacturing Company (2), McDonnell Aircraft (1), Monarch Marking (1), Motorola (2), Naval Avionics Center (1), Oakley (1), Pitney Bowes (2), Plynetics Corporation (2), Precision Castparts (1), Proctor & Gamble (3), Prototec Engineering (3), Prototype Express (1), Prototype Services Inc. (1), Texas Instruments (2), Tredegar Molded Products (2), Pratt & Whitney North (1), University of Dayton (3), and Volvo (2).