EUROMOLD2000 および GARPA meeting "Rapid Production"に参加して

帝人製機（株）オプトイメージカンパニー　萩原恒夫

はじめに

ドイツ、フランクフルトのメッセ会場において開催されたユーロモールド（EUROMOLD）2000 に参加した。この際 GARPA の日本代表の代理として GARPA meeting "Rapid Production"に出席する機会を得た。

A.　EUROMOLD 2000

今年で第 8 回目となるユーロモールドは年末の 11 月 28 日から 12 月 1 日までの 4 日間開催された。ヨーロッパを中心に 30 ヶ国から合計約 1,400 の企業などが展示を行っていた。参加者は約 5 万人と主催者が発表していた。ユーロモールドは多くの金型メーカがブースをかまえ、CAD/CAM以外に成形品や金型そのものを展示していた。

◆ ラッピドプロトタイピング

1.　EOS、3D Systems、DTM 各社が会場の中央近くでデモンストレーション中心の展示を行っていた。全体的には光造形はすでに峠を過ぎ、今は EOS や DTM の粉末融着が興味の対象であることが強く印象に残った。サービスビューロの参加も多く、ラッピドプロトタイピングを用いた技術はごく当たり前になり、これを用いた新しい金型づくりが進んでいる印象を受けた。

2.　注目ラッピドプロトタイピング

2-1.　イスラエルの Objet 社がインクジェット式光造形装置(Quadra) をデモしていた。ほぼ A4 サイズで X 方向 600dpi, Y 方向 300dpi というスペックを表示していた。今後の注目の製品となろう。スピードは通常光造形の 2～3 倍程度と推定した。

2-2.　その他、インクジェットを利用した小型から超大型までの各種システムが発表され、今後の動向がインクジェットタイプであろうことを強く印象づけられた。

◆ 金型メーカ

ユーロモールドには多くの金型メーカが参加していた。大型の金型や精密金型といったものまで実際に展示し、ビールを片手に商談を行っていた。会場の雰囲気がたいへんおおらかで、日本の忙しさはない。

B.　GARPA Meeting "Rapid Production"

米国のコンサルタント　Terry Wohlers 氏主催の"Rapid Production"という題でのミーティングが 12 月 1 日に開かれた。ここには、各国の RP 業界の代表である GARPA(Global Alliance of RP Associtions) のメンバーが参加した。もちろんメンバー以外でも参加費を支

払って参加可能である。

添付した Absruct にもあるが、積層造形法のホットな話題であり、今後の方向である Rapid Production の現状について講演があった。その中、Wohlers氏は最近の動向とトピックスを、Dickens 教授は RP 特に光造形物と射出成形物の個数とコストについて比較し議論された。

各講演を通して、積層造形で最も重要なのは材料であることが強調されていた。材料の開発に積層造形特に光造形の将来はかかっていると結論された。

ミーティングの最後にパネルディス化ションで話題提供があり、萩原は飛び入りで SOLIFORM による実部品の製作例とその応用製品について 5 分間のプレゼンテーションを行った。この際、材料の開発が重要であることを強調した。

ミーティング終了後、GARPA の委員会が開かれ、この日のミーティングの総括がなされた。また、委員の紹介を兼ねて懇親会が引き続き開かれた。

GARPA の委員とのパイプが出来、有意義な 1 日であった。

以上

presents

RP = Rapid Production: An International Conference

Friday, December 1, 2000
9:00 – 17:30

Held in conjunction with EuroMold 2000 in Frankfurt, Germany
www.euromold.com

Once thought of as a method of prototyping only, rapid prototyping (RP) machines are now being used for the production of final manufactured parts. As this idea grows in popularity, organizations around the world will begin to view RP as a method of rapid production. Fueling this growth is the trend toward mass customization, where ultimately, a production run will consist of a single part, an inherit strength of RP. The ways in which rapid production could change the future of manufacturing, coupled with its economic impact, are staggering.

As the RP industry explores the opportunity of applying its technologies to production applications, it is faced with a number of challenges, including material properties, surface finish, and speed. Already, new developments in academia and industry suggest that some of these challenges can be overcome. World-class speakers will address many of these challenges and will present some the most interesting applications of RP for the manufacture of production quantities.

9:00
Using RP Methods for Production Quantities
Terry Wohlers, Wohlers Associates, Inc. (USA)

Abstract. Industry consultant Terry Wohlers will discuss a number of industries and applications that are ripe and ready to use RP for the production of final manufactured parts. Among them are parts for business jets, helicopters, racecars, high-end consumer and industrial automobiles, antique cars, sports gear, hearing aids, surgical implants, and prosthetics. Wohlers will also provide an update on some of the companies that have pioneered the idea of "rapid production" including Specific Surface, Therics, and Align Technology.

Biography. Industry consultant Terry Wohlers is president of Wohlers Associates, Inc., a consulting firm he founded in 1986. Wohlers' highly sought after views and opinions come from years of collecting and analyzing market data, coupled with his work as an advisor to major organizations in the U.S., Europe, Asia, and South America. He has authored nearly 250 books, articles, reports, and technical papers on engineering and manufacturing automation. In 1992, Wohlers led a group of 14 individuals from industry and academia to form the first association dedicated to rapid prototyping. In 1998, he co-founded the Global Alliance of RP Associations (GARPA) involving 14 member nations around the world. Wohlers is serving as the chairman of this conference.

9:45
Keynote: Laser Sintered Parts in Space
Roger Spielman, Boeing's Rocketdyne Propulsion & Power (USA)

Abstract. Keynote speaker Roger Spielman will present the fabrication of man-rated space flight hardware using selective laser sintering (SLS) technology. Over the past five years, he and his group have used laser sintering to successfully manufacture parts in glass-filled nylon and super alloys. Hundreds of these parts have been installed and today are in use on the International Space Station and other aircraft and space vehicles. Presently, the entire fleet of Space Shuttles is having their main engines retrofit using SLS parts. Roger will explain the rigorous testing involved in certifying the materials and processes, as well as the inspection process. Also, Roger will share many examples of how the sintered parts have helped save almost unbelievable time and cost.

Biography. From age 11, most of Roger's free time was spent with a neighbor, a tool design engineer from Lockheed Skunk Works, who mentored him in foundry work, machining, welding, and sheet metal. By 17, he had established a part-time business that involved building and maintaining specialty-fabricated vehicles. Through his early adult years, Roger apprenticed with world-renowned automotive experts including Gene Winfield of Modesto, California. Winfield was famous for land speed records during the 1950s, concept cars for the Ford Motor Company throughout the 1960s, and cars for Hollywood films through the 1970s and 1980s.

By the mid-1970s, Roger was functioning as shop manager with a crew of 63 fabricators, transforming new top-of-the-line Cadillac automobiles into hand fabricated specialty vehicles for a worldwide market. In 1980, Roger moved to the aerospace industry. Soon, his primary source of income came from fabricating liquid fuel rocket engines for the Rocketdyne Division of Rockwell International. His first year in aerospace was spent as a senior welder where he carried 26 certifications for different materials and processes. By 1981, he advanced to the engineering ranks as a weld engineer.

Over past several years, Roger has been responsible for Rapid Prototype Operations at Boeing's Rocketdyne Propulsion & Power. In 1995, he and his team launched its first effort to characterize the laser sintering process and certify end-use parts for flight operations. Since then, many hundreds of parts have been fabricated for the International Space Station Program, the Space Shuttle Main Engine Program, and many other programs. Roger spends many of his evenings and weekends continuing his education and fabricating special effect vehicles for Hollywood films including Blade Runner, The Last Starfighter, The Wraith, Robo Cop, and Back to the Future.

11:00
Break
Coffee and refreshments

11:30
Using Direct Croning to Decrease the Cost of Small Batch Production
Ray Wünsche, ACTech (Germany)

Abstract. As a fast-growing method of RP, Direct Croning can decrease costs associated with small batch production of metal parts. Using

laser-sintered cores to reduce cost is especially effective when producing intricate castings with complex internal features. Mr. Wünsche will introduce the technology and share examples of how his company is using this method to produce parts that are higher in volume than typical prototype production runs.

Biography. Ray Wünsche received a degree as an engineer in 1988. He attended the Technical University of Dresden for two additional years and began a career in sales at Avdel Textron in 1990. In 1994, he became a team leader of the German Automotive Team at Avdel Textron. In 1998, Mr. Wünsche took part in a European project that involved the development of engineering assemblies using the worldwide capabilities of the Textron Fastening Group. Currently, he serves as general sales manager of ACTech.

12:15
Break
Sufficient time to visit the exhibition.

13:45
Using RP to Manufacture Complex Titanium Parts for Formula 1 Cars
Franco Zucchelli, C.R.P. Technology, a division of the Cevolini Group (Italy)

Abstract. Franco Zucchelli will discuss a novel approach that leads to the realization of complex titanium parts. Focusing on the importance of process specific design and tight process control, the approach combines several technologies including rapid prototyping, investment casting, and CNC machining. Using these technologies, it is possible to more quickly produce lighter, higher performing, and less expensive titanium parts, compared to traditional methods. This approach stretches the limits of design and allows for the production of much higher quality parts.

Biography. Franco, born in 1961, graduated from the University of Florida with a bachelor's degree in economics. Later, he received a master's degree in International Political Economy from the University of South Florida. He has six years of experience in the packaging machinery industry and five years in the eyewear industry. Since 1998, he has been involved in the production of titanium parts for Formula 1 racecars.

14:30
Production Parts Using Stereolithography as a Manufacturing Solution
Norma Jean Rutledge, Pure Fluid Magic (USA)

Abstract. Norma Jean Iverson will present applications that use stereolithography as a manufacturing method for production parts. She will address a high-density test clip product line, as well as unique sculptures generated by music. The presentation explains why stereolithography was the preferred method of production and what modifications were necessary to accomplish this task. The idea to use stereolithography as a manufacturing solution came about six years ago when it was impossible to produce the test clip product line any other way.

Biography. Norma Jean is the president of Pure Fluid Magic, Inc. She was honored in 1997 with the 3D Systems Excellence Award and again in 1999 with second runner up. As an engineering consultant in new product development for the past 15 years, she holds a patent with an additional two patents pending. She is a journeyman machinist and NC programmer, working with Stanford Linear Accelerator, NASA, and Lawrence Livermore National Labs to obtain these credentials. Her favorite past time activities include food and wine paring. She is a chef and sommelier with a certificate and advanced level credentials. One day she hopes to become a Master Sommelier.

15:15
Break
Coffee and refreshments

15:30
Micro RP&M Technologies for End User Applications
Andrea Reinhardt, microTEC (Germany)

Abstract. Andrea Reinhardt will describe applications of rapid micro product development (RMPD) for the end user. Processes are available in the field of microstructure and microsystems technology for prototyping, as well as for fast mass production without any tooling. RMPD-MASK, which is RMPD with a masking technology, allows production runs of up to 150,000 parts per machine per hour. It is possible to quickly produce medical products, such as biochemical sensors, that contain very fine internal channels in all directions. Also of interest are fluidic devices, such as the flow of cells for a medical company, and optical products, such as fiber-connectors and optical switches.

Biography. Andrea is the chief executive officer of microTEC,Gesellschaft für Mikrotechnologie mbH in Duisburg, Germany. Born in 1965, Ms. Reinhardt studied at the University of Mannheim and started her professional life as a banker at SGZ Bank Frankfurt and continued at CITIBANK Mannheim in the field of risk management. In 1997, she began her work in the field of Micro Electro Mechanical Systems (MEMS) at microTEC. One of her goals is to develop and enhance new technologies such as MEMS. She is also active in assisting young entrepreneurs in the areas of nanotechnology and information technology.

16:30
Advances in Rapid Manufacturing
Philip Dickens, De Montfort University (England)

Abstract. Professor Philip Dickens will review the progress of rapid manufacturing and highlight important changes that have occurred. Over the past couple of years, examples of using RP processes for the manufacturing final parts have emerged. Most have been plastic parts for electrical or electronic housings, although a few have been metal parts. These examples have sparked a change in the attitude among some people in the RP industry and a growing number now believe that these processes can begin to replace conventional manufacturing processes. Over time, this is sure to have a snowball effect as RP machine manufacturers, material suppliers, and customers become convinced that these technologies are a viable option for manufacturing. The presentation will review the problems to be overcome in materials, machine design, and CAD software and the possible effects it will have on the world of design and manufacturing.

Biography. Professor Philip Dickens has been involved in rapid prototyping and manufacturing since 1990. He has led UK government missions on rapid prototyping to Japan and has been a member of a similar mission to the USA. He is a past member of the advisory board of the Rapid Prototyping Association of the Society of Manufacturing Engineers (RPA/SME). He has also been involved in organizing several conferences and seminars on rapid prototyping and manufacturing. Philip Dickens is a professor of Manufacturing Technology at De Montfort University. He has established the Rapid Manufacturing Consortium with major European companies to undertake research, training, and

technology transfer in Rapid Product Development. He continues to work on rapid tooling and is now starting work on a new generation of machines for rapid manufacturing.

17:30
GARPA Reception
Meet representatives from GARPA and win valuable prizes.

Conference Registration

To register for the conference, contact Cornelia Metz of DEMAT Exposition Managing, the organizer of the conference and trade fair. You can reach her at Cornelia.Metz@demat.com, phone 49 69 23 43 31, fax 49 69 25 30 71.