Mitsui Seiki TiME Seminar Addresses Challenges of Titanium Machining

Mitsui Seiki Titanium Machining Event attendees view a titanium milling demonstration on the Mitsui Seiki HU100A horizontal machining center.

Mitsui Seiki USA, Inc. recently hosted "Titanium Machining Technology Days" in Mahwah, NJ. The one-day technical presentations provided over 120 attendees valuable insight into various challenges and solutions for titanium machining with a focus on the aerospace manufacturing industry. "I believe one of the biggest drivers in technology today for manufacturing is

Scott Walker, Mitsui Seiki USA President.

the change in the types of materials being used. Manufacturing materials today are lighter and stronger and can also be harder or almost impossible to machine. We in the manufacturing industry are all in the same business together and what we are very good at is sharing information. The opportunities for titanium machining work are growing and will continue to grow over the next 18-24 months," said Scott Walker, Mitsui Seiki USA President.

Evolving Aerospace Machining Technology, presented by Mike Watts, Technical Fellow, Machining Research & Technology, The Boeing Company. Mr. Watts provided attendees an in-depth his-

Mike Watts, Boeing Commercial Airplanes Technical Fellow, Machining Technology.

torical review of machine tool evolution, aerospace machining challenges, titanium machine tool requirements and new machine tool technology advancements for titanium. "The need for titanium machining capacity is growing," said Watts. "Titanium machining requirements differ greatly from aluminum machining and machine rigidity plays a vital role in titanium material removal rates." In Mr. Watts' review of advanced machining technology, he presented how implementation of advanced technologies over time have significantly improved the ability to achieve increased material removal rates in difficult to machine alloys. He also spoke about the importance of using technical advancements such as machining software optimization tools. "Not only does the software help achieve reduced machine cycle times, but it also protects the machine tool and cutters against equipment failures especially where high cutting forces are encountered such as titanium machining," added Watts.

Meeting the Challenges for Today's Titanium Machining, presented by Brian DeBlasi, Manager New Product Development, Sikorsky Aircraft Corporation. Mr. DeBlasi, a 43-year Sikorsky veteran, reviewed Sikorsky's transition from one type of heavy-lift cargo helicopter to another and presented the non-technical aspects of making this transition a success. "The major keys to this project's success included having the right capital, the right manufacturing processes, the correct fixture design and the right cutting tools. These factors equate to a successful project," said DeBlasi. "This project is not a one man show and teamwork equals project success." Sikorsky uses several large Mitsui Seiki 5-axis machining centers to manufacture the main rotor hub components, most of which are comprised of aircraft grade titanium. "Prior to selecting the Mitsui Seiki 5-axis machining centers for this project, we first needed to establish our complete relationship with a machine tool builder. The factors we looked for were:

- Up-front machine tool limitations: Spindle torque specification requirements need to be high; overall rigidity of the system is extremely important; common but capable machine controller and 'Big Plus' tooling; size and flexibility of machine design including a clean design with integrated pallet transfer system, a design to handle both developmental and production workpieces, a large capacity tool storage magazine and a proper pallet size for the application.
- The ability for the machine tool builder to modify, configure or design the machine tool around our specific needs.
- Helping the machine tool builder understand that they are clearly a part of our team and also understand our team's ultimate mission.
- The machine tool builder is responsive to our questions and actions.

"I cannot stress the importance of collaboration enough," said DeBlasi. "Everyone must be included as one team including your employees, machine tool builder,

Brian DeBlasi, Sikorsky Aircraft Manager of New Product Development.

OEMs, partners and suppliers. We must understand that what we are doing is hard. It takes pride and determination to become successful. Commit to what you are doing and be respectful of each other while you are doing it."

Where the Tool Meets the Work, presented by Bernard North, Vice President Product Engineering, Kennametal Inc.; Surinder Lamba, President and Thomas Mertel, Application Engineer, Apache Aerospace; and Dr. John Webster, President, Cool-Grind Technologies. Mr. North presented to event attendees the new developments in titanium cutting tool technology including Kennametal's titanium cutting tools. "The Kennametal KCU10 offers a post coat treatment, advanced PVD coating and a fine-grained tungsten carbide substrate," said North. "The post coat treatment increases compressive stresses, reduces micro chipping and improves edge toughness. The advanced PVD coating reduces the depth of cut notching. The tungsten carbide substrate can be ground to a very fine sharp edge with excellent strength therefore providing lower cutting forces and reduced heat. These attributes of the KCU10 provide longer predictable tool life, higher metal removal rates, higher

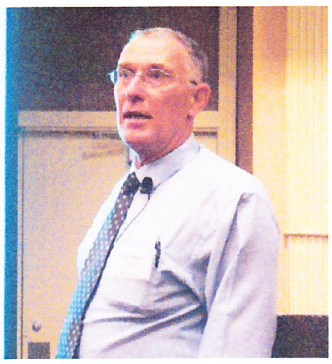
Bernard North, Kennametal Inc. Vice President Product Engineering.

Thomas Mertel, Apache Aerospace Application Engineer.

productivity and dependability at high cutting temperatures and reduced part distortion." Mr. North also reviewed coolant application effects on titanium cutting tools, Kennametal's Beyond Blast technology, turning tool performance and new cutting tool development.

Apache Aerospace's Surinder Lamba and Thomas Mertel reviewed special purpose tools for titanium aerospace applications. "For the titanium stack of the Boeing 787 wing panel, Apache has developed a new line of carbide tools with CVD diamond coating to optimize the tool life," said Lamba. "These current tools are shop friendly and provide better tool life than PCD tools."

Dr. John Webster with Cool-Grind Technologies discussed coolant applications for modern titanium milling. "Coolants serve many roles in grinding and machining," said Webster. "The coolant cools the workpiece therefore reducing thermal damage. Coolants also flush away chips from the work area, lubricate the



Dr. John Webster, Cool-Grind Technologies President.

process and cool the tool. Coherent coolant jets can also be fixtured into the cutting process. These jets can be placed further away from the mechanical interference with the workpiece and fixture. Coherent coolant jets also reduce mist with straight oil coolants therefore minimizing the risk of fire and also provide a more precise aiming of coolant directly onto the cutting area."

Controlling the Tool Path, presented by Eric Dechant, Program Manager Machine Tool Productivity, FANUC FA America. Mr. Dechant reviewed with attendees the essential criteria of CNC drives and controls for titanium applications. "To achieve a smooth motion in titanium milling, a combination of high speed, high precision servo control and advanced feedrate control features are needed," said Dechant. "A complete machining solution is smooth,

Eric Dechant, FANUC FA America Program Manager Machine Tool Productivity.

fast and accurate. Smoothness, speed and accuracy are not a G-code in the part program but rather a result of a highly engineered machining system. The three factors that define a world class machine tool include CNC feedrate control, servo control and response and machine rigidity."

Putting It All Together, presented by Koichi Iwakura, President, Mitsui Seiki Kogyo. Mr. Iwakura concluded the presentations by reviewing with attendees the critical elements of machine tool construction for titanium milling. Mr. Iwakura also reviewed Mitsui Seiki's developments in machine tool modeling and analysis, assembly methods for long-term, reliable productivity and the integration of the critical aspects of milling technology for today's titanium applications. "Over the past eight years, the aircraft industry has created a huge demand for milled titanium components including spars, bulkheads, brackets, supports and much more," said Iwakura. "In the next few years, we will continue to see an increase in the use of titanium in aerospace and other manufacturing industries."

Koichi Iwakura, Mitsui Seiki Kogyo President.

Titanium cutting demonstrations were also presented to event attendees at the Mitsui Seiki USA Franklin Lakes, NJ headquarters. T6AL4 and Ti5553 titanium cutting demonstrations were performed on the Mitsui Seiki HU100A horizontal machining center. Standard Mitsui Seiki HU100A specifications include:

Working Capacity
- Table longitudinal stroke (X axis) - 51.2"
- Spindle head vertical stroke (Y axis) - 39.4"
- Column longitudinal stroke (Z axis) - 39.4"

Axis Traverse Rates / Rapid Traverse Rates
- X, Y axes = 590 ipm
- Z axis - 472 ipm
- B axis - 1,980°/min 5.5 rpm

Cutting Feedrates
- X, Y and Z axes - 0.004 - 394 ipm
- B axis - 0.1 - 3,600°/min

Numerical Control Equipment
- FANUC 30i CNC Control

To conclude the event, Mitsui Seiki titanium machining event attendees were also treated to an evening New York Harbor dinner cruise.

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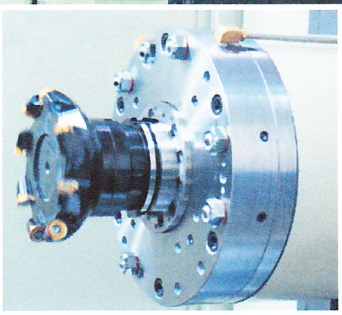
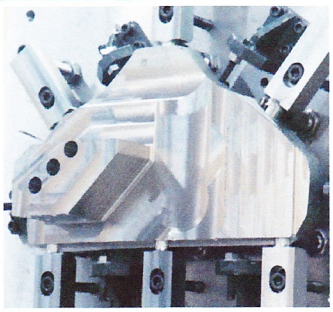
Mitsui Seiki TiME attendees viewed a titanium cutting demonstration on the Mitsui Seiki HU100A HMC.





MAG Acquires Forest Liné Industries

MAG has acquired French company Forest Liné Industries Group (FLI). Forest Liné specializes in manufacturing systems for aerospace applications, dies/molds, large parts, titanium and composites processing. The company is a technology leader in composite wing and wing box applications and operates sites in France, Germany, China and Canada, employing about 300. Mr. Jean Bertrand Prot will continue as President and CEO of FLI and join the MAG Executive Board.

"This acquisition gives MAG another significant point of access to aerospace composites technology, manufacturing resources and demonstration facilities, as well as additional market and customer segments," said Dan Janka, President of MAG Global Industrial Systems. "Liné has always been an innovator, and its technology portfolio is highly complementary with our own so we anticipate a wide range of new opportunities to result from this acquisition."

Like MAG, Liné is a supplier of both automated tape laying and fiber placement systems. Lightweight and rigid composites are widely used throughout the aerospace industry and in renewable energy systems, such as wind turbines. "MAG enthusiastically looks forward to increasing demand in the wind industry over the next few years and has strongly positioned itself for growth in all segments of renewable energy, as well as the automotive sector, for which we have developed new composites production technology," Janka said.

MAG, through its European business, MAG Europe GmbH, with headquarters in Göppingen, Germany, has acquired 100 percent of the shares in the Forest Liné Group.

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