Mike MacArthur has worked for RobbJack for 20 years. He started as a tool grinder and eventually held just about every position available, including an extended period as an Applications Engineer. Today, as Vice President of Engineering, Mike leads RobbJack’s research and development efforts, as well as technical sales and customer support. Mike is actively involved in developing new tools and processes for composites and aerospace applications.
Advances in Cutting Tools, CAD/CAM Systems, and Milling Technology

Overview

- New CAD/CAM Technology and Programming Techniques
- New Cutting Tool Technology to Solve Problems
- New Software to find Accurate Tools and Cutting Data
- Synergistically Applied to Gain 500% Improvements
Trochoidal Machining

Slotting that acts like profile cutting
Great for hi-temp. alloys
   Titanium, Nickel alloys
   Hard metal machining

**TIP:** Use tools 50% of slot width or tightest area
Axial depth (Z-depths) 1.5-2x tool diameter
Radial widths (X,Y step-overs)
   3-10% for difficult alloys
   25-50% for easy non-ferrous materials
Trochoidal Milling Video
## Controlling Heat in Difficult Materials

<table>
<thead>
<tr>
<th>Width</th>
<th>100%</th>
<th>50%</th>
<th>25%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>180°</td>
<td>90°</td>
<td>60°</td>
<td>37°</td>
</tr>
<tr>
<td>Time in Cut</td>
<td>50%</td>
<td>25%</td>
<td>17%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Controlling Heat

Heat generation at the cutting edge

Heat Accumulation

Fatal Temperature of Coating

Continuous Cooling

Fatal Temperature of Coating

Heat
Does this look like a typical toolpath that would machine out these pockets?
Why does the TrueMill toolpath look so different?
New Programming

TRUeMill®

Traditional

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Trochoidal Milling Video
Tool Holder and Shank Grip

Increase gripping force by 50%
Size: -.0001”/-0002” h4-h5
Roundness +/-0.00025
Taper less than.0001”
No polished shanks
Looks good but causes slippage in the holder

High Performance
Tight tolerances
Rigid design
Gripping forces in excess of shrink-fit

Photo courtesy of Big Kaiser
Lightweighting Automotive Aluminum

Ford F-150

Tesla Model S,X, and 3
New Dampening Geometries: No Chatter

A1-303 and FM Series Amazing Aluminum Tools

Mirror Edge Eliminates Chatter and Vibration also with Polished Flutes

Deep pockets and Thin Walls

Automotive Aluminum (lightweighting)
- Tested vs. 38 others technologies

Aerospace
- Tool saved over 1M per year
- Reduced cycle time by 40 hours per part.

Firearms
- No burrs, no chatter, super fast cycle time 500% faster
New Dampening Geometries: No Chatter

Mirror Edge™ – An edge preparation that dampens the cut to help eliminate chatter

Aluminum: Deep pocket and thin walls
Long reaches more than 3:1 Length to Diameter
Maximum RPM

Plunging corners:
Titanium, Steels, Stainless, Aluminum, and Etc.

Must use coolant

Chatter without Mirror Edge

No Chatter with Mirror Edge
New Dampening Geometries: No Chatter
Aluminum Demo Part

<table>
<thead>
<tr>
<th>Tool Diameter</th>
<th>3/8&quot;</th>
<th>1/2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial width</td>
<td>0.1875&quot; (50%)</td>
<td>0.250&quot; (50%)</td>
</tr>
<tr>
<td>SFM</td>
<td>1376</td>
<td>1835</td>
</tr>
<tr>
<td>RPM</td>
<td>14,000</td>
<td>14,000</td>
</tr>
<tr>
<td>Feedrate</td>
<td>300 inches per min.</td>
<td>336 inches per min.</td>
</tr>
<tr>
<td>Chip Load Per Tooth</td>
<td>0.0071&quot;</td>
<td>0.008&quot;</td>
</tr>
<tr>
<td>Axial Depth</td>
<td>0.750&quot; (2X Diameter)</td>
<td>1.0&quot; (2X Diameter)</td>
</tr>
<tr>
<td>Engagement Angle</td>
<td>90 degrees</td>
<td>90 degrees</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>2 minutes 10 seconds</td>
<td>1 Min. 50 Sec.</td>
</tr>
<tr>
<td>Program</td>
<td>Mastercam Dynamic Milling</td>
<td>Surfware TrueMill</td>
</tr>
</tbody>
</table>

500% Increase in Material Removal Rates — More than 42 Cubic Inches per Minute with a 3/8" tool.

Mirror Edge™ Patented Chatter Reduction Geometry and Polished Flutes
New Dampening Geometries: No Chatter

ALUMINUM
Mirror Edge Chatter Reduction

A1-303-16
1/2" Diameter Tool
14,000 rpm at 336 ipm
1" axial depth (2x) dia.
.250" width (50% dia.)
Variable Helix and Offset Fluting

X-Series Tools
Variable Helix and Offset Fluting
X-Series Tools

1” Diameter
10 Flute
400 SFM
75 ipm

Titanium Chips in 1 Hour
Variable Helix and Offset Fluting
Demo Parts

304 stainless

XG-502 SERIES
TECHNICAL DEMO DATA

RobbJack XG-502-12
Tool Diameter: 3/8"
Radial width: 0.037" (10%)
SFM: 400
RPM: 4075
Feedrate: 100 inches per min
Chip Load Per Tooth: .005"
Axial Depth: .750 (2X Dia.)
Engagement Angle: 37 degrees

TITANIUM

XF SERIES
TECHNICAL DEMO DATA

RobbJack XF-602-16
Tool Diameter: 1/2"
Radial width: 0.050" (10%)
SFM: 400
RPM: 3,056
Feedrate: 75 inches per min.
Chip Load Per Tooth: 0.004"
Axial Depth: 1.0" (2X Dia.)
Engagement Angle: 37 degrees
Cycle Time: 15.7 minutes
Program: Surfware Truemill

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Diamond Coated and New Solid PCD Advancements

- Used for abrasive materials.
  - CFRP (Carbon Fiber), Fiberglass, High Silicon Aluminum, other abrasive non-ferrous materials.

- Diamond coated is grown on at application specific thickness

- New Solid Tipped PCD allows for very sharp cutting edges and resharpen ability
Save Time and Money

**Problem Solving Tools**

**Composites Dovetail**
- Eliminate the need to trim the part to match the CAD file
- Ability to diamond coat for Carbon Fiber Composites
- Airplane structure parts

**Composites Reamer**
- Used with Micro-stop tooling
- Diamond coated for long life
- Reams and Countersinks in one operation
- One piece solid carbide design for tighter tolerances

**Composites Perforation Tool**
- Sound Reduction Perforation Tools
- Designed for Airplane Engine Nacelles
- Up to 80,000 Holes in Fiberglass
- Up to 40,000 Holes in Carbon Fiber

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Dynamic Tool Searches

- Enter any criteria or known info.
- Recommends the best tool to fit your application
- Fast, Easy, and Accurate.
- Saves money and mistakes
- Free no charge software
Dynamic Speeds and Feeds

- Get accurate tested speeds and feeds with built in logic
- Save your data and view for reference at any time
- Share info with colleagues
- Saves tons of time, money, and mistakes
- 50 years of high speed machining logic at your finger tips
- Difficult to find tested trochoidal/new tool path speeds and feeds with logic
Thank you for attending!

If you would like more information, feel free to contact me.

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See us at Booth W-2206