Minni Tek 2009 CNC Machining

Presented by Dave Reasor

www.1pds.com
Founded in 2000

Located in Blaine MN

45 employees

28,000 sq feet

Prototype

Production

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- Parts in days
- Wide variety of materials
- Complex shapes
- No Draft and Negative draft allowed.
- Secondary Machining

Cast Urethane

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• Cast in color
• Soft durometer over molding
• Large size up to 72”
• Circuitry encapsulation
• Paint, texture and EMI/RFI shielding

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9 Vertical CNC Machines

2 Horizontal CNC Machines

Plastics

Metals

Secondary operations to Castings

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Plastics

- ABS
- Polycarbonate
- Nylon
- Delrin
- Ultem
- Peak
- Polypropylene
- Teflon
- HIPS

Metals

- Steel
- Aluminum
- Magnesium
- Zinc
- Brass

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ISO 9001:2000 Certified Since 2005

PDS will provide a Competitive Advantage to its customers through Timely, Innovative, High Quality Products and Outstanding Customer Service Driven by a Culture of Continuous Improvement

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Advances in Milling

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• Data transfer difficult, most programming was done at the machine using G and M code

• Limited to basic geometry

• Typical feed rates 20-30 inches per minute

• Tool changes slow or nonexistent
Advances in Milling

15 Years Ago

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• Data transfer still limited
• Feed rate 100 inches per minute
• 10 second tool changes
• Spindle speeds of 10,000 RPM
• Improving controls
• In machine probing cumbersome and expensive
• Limited number of shops that could machine complex parts at a reasonable price

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Today

Advances in Milling

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• 20,000 RPM Spindle Speeds

• 2200 IPM Feed Rates

• 3 Second chip to chip tool changes

• CNC Controls have made improvements in line with the improvements in the PC Industry

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• Updated Controls and Software to support complex geometries and feed rate capabilities
• Wireless data transfer
• Data Smoothing algorithms for improved surface finishes
• Conversational programming

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• Multi-Axis and Horizontal machines allow complex parts to be completed in 1 or 2 setups
• Robotic part placement and removal to increase accuracy and productivity
• In Machine Touch Probing that quickly and precisely verifies part accuracy

• Laser Tool Detection

• Large Capacity Tool Magazines allow for Redundant tooling

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• 60,000 + RPM spindle speeds
• Feed rates up to 3000 IPM
• Tool change time less than one second

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Advances in Milling

- Quality Parts
- Increased Utilization
- Competitive Prices
- Unattended Machining
- Flexibility

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Typically there are two Pallets, allowing for one Pallet to be loaded while the other is in the cut.
• The Pallet rotates allowing for multiple operations.

• Gravity allows better chip evacuation allowing for increased productivity and better tool life

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• Lights out Machining

• Fit in Rush Jobs without breaking down a setup

• Machine multiple sides of part without removing it from the Fixture
+ Extremely Accurate to 0.0001”

+ Features that would require pick out cores or slides can be done at little added cost on a horizontal

+ Design cycles can be shortened because draft and typical wall sections are not required

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+ Very quick turn around

+ Parts can be made to print including draft and fillets

+ Inexpensive Design Changes

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- Not as effective for deep parts due to higher material cost and additional machining time required

- Free Form Shapes and number of features can make the process less competitive

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Exceptions are required for some geometry such as cutter radii.
- Limited on depth of cut to cutter size.

Three inside corners are not possible with traditional milling.

One inside corner needs the radius of the end mill.

Relief hole is drilled first, then corner is milled.
- Custom Colors require special order

- Not all Material Grades and Fillers are Available

- Injection Molding or Die Cast Parts may eventually be less expensive
• Fully Functional Prototypes in Spec Material delivered within 6 working days

• Small Engineering changes to reduce machining time

• Machining was optimized thru 4th Axis indexing table

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• Revision Number 2 requires 100 sets within 12 working days
• Modified 4th axis tombstone to hold 4 parts
• Cutting time reduced 20%
• Machine utilization increased 25%
• Part price reduced by 30%
• Provide a cost effective solution for production (500 sets)
• Retooled for High Speed Horizontal Machining center
• Two tombstones and automatic Pallet changes allowed for continuous cutting
• Part cost reduced over 65%
<table>
<thead>
<tr>
<th></th>
<th>Prototype</th>
<th>Pre-Production</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td>25</td>
<td>100</td>
<td>500</td>
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<tr>
<td><strong>Rapid Speeds</strong></td>
<td>900 IPM</td>
<td>900 IPM</td>
<td>2200 IPM</td>
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<tr>
<td><strong>Tool Change</strong></td>
<td>8 seconds</td>
<td>8 seconds</td>
<td>3 seconds</td>
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<td><strong>Total Cycle Time</strong></td>
<td>51 minutes</td>
<td>40 Minutes</td>
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<td><strong>Material Cost</strong></td>
<td>$10.00</td>
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<td><strong>Program –Fixture</strong></td>
<td>12 Hours</td>
<td>20 Hours</td>
<td>40 Hours</td>
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<tr>
<td><strong>Non Cutting Time</strong></td>
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<tr>
<td><strong>Part Load Time</strong></td>
<td>3 minutes</td>
<td>1.5 minutes</td>
<td>Continuous Run</td>
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<tr>
<td><strong>Tool Changes</strong></td>
<td>2 minutes</td>
<td>30 Seconds</td>
<td>5 Seconds</td>
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<tr>
<td><strong>Rapid Movements</strong></td>
<td>8 minutes</td>
<td>6 minutes</td>
<td>2 minutes</td>
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<tr>
<td><strong>Idle Time</strong></td>
<td>2 hours</td>
<td>1 hour</td>
<td>Zero</td>
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<tr>
<td><strong>Price</strong></td>
<td>$110.00</td>
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</table>
• Able to partner with the same supplier for Prototype thru Production
• Speed to market
• Flexibility for low cost engineering changes
• Versatility as same concept was used for subsequent product variations
• JIT shipments
Comparison Between DDM CNC and RT

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Thank you

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