

# Gear Manufacturer Benefits from CAM Initiatives and Advanced Manufacturing Technology

**Multiple CAM initiatives at Snyder Industries are improving safety, quality and productivity for parts ranging from 50 to 5,000 lbs.**

Turnaround is a big problem for many manufacturers today because customers in every industry want progressively faster deliveries of smaller part quantities without sacrificing quality or increased prices.

This has been a particular challenge for Snyder Industries, Inc. because the parts they make are very large, ranging from 50 to 5,000 lbs. Enormous amounts of material are removed to arrive at the finished part. This can be time-consuming unless workflows and g processes are optimized for high productivity.

To overcome that challenge, over the last decade Snyder has replaced nearly all of its machining equipment with advanced multi-axis machining centers and CNC lathes with live tooling. The high spindle speeds, along with the ability to stage many different types of work for continuous production on pallet-based machining centers, has substantially improved the company's productivity and allowed it to simultaneously keep pace with the needs of a very diverse customer base. The company is actively working to continuously reduce costs and increase productivity by taking full advantage of all the capabilities offered by its CAM software (*Mastercam X6 Mill and Lathe* from CNC Software, Tolland, CT).

## Rock Around the Clock

Snyder serves heavy industry, manufacturing a wide variety of cast and hardened steel components, including internal and external gears, planetary cages and wheel units, drive shafts, haulage sprockets, bearing carriers, couplings, and custom fabrications.

To shorten its manufacturing lead times, the company does almost all of the work in-house. For example, Snyder has a resident metallurgist, and the company operates several heat treatment and specialized metal treatment processes that may be required in the manufacture



**Big gears, fast turns**—Snyder Industries manufactures gears ranging in size from 50-5000 lbs. To reduce lead times the company replaced nearly all of its machining equipment with advanced multi-axis machining centers and CNC lathes with live tooling. The company is actively working to continuously reduce costs and increase productivity by taking full advantage of all the capabilities offered by its CAM software.



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of a finished part. These include quench and tempering, carburizing, induction hardening, gear hardening (utilizing the NATCO Intensifier method), shot peening, sandblasting and weld fabrication. According to Production Operations Manager Aaron Bruning, eliminating the lead time for external vendors of these services has slashed days, sometimes weeks, off quoted lead times that Snyder can offer to its customers.

The company operates two ten-hour shifts, five days a week. There are 36 CNC mills, lathes and machining centers. Two *Mastercam* programmers generate all of the programs needed to keep work running efficiently. Perhaps the greatest gains in productivity have come from increased reliance on two 20-pallet Mazak Integrex, multi-tasking centers. Bruning said, "Five years ago some parts might need six operations using six separate machines. Those same parts are now being manufactured in one operation on our multi-axis system. We can do all of our milling, turning, side holes and planetaries. We have really turned things around in terms of productivity."

However, Bruning is also convinced that there is much more to be achieved. "I don't think our best today will be our best tomorrow," he said. "Because we are constantly pushing after process improvements, our team keeps coming up with a better approach and a better product."

### Multiple CAM Initiatives

With the recent purchase of new CNC Gleason and Fellows gear cutting machines, Snyder is doing almost everything on advanced CNC equipment, and the company is intent on taking advantage of the untapped capabilities of its CAM software to improve its manufacturing processes. Here are some of the initiatives that are underway:

**On-Machine Inspection.** One important area of improvement is the integration of in-process on-machine gaging into its processes. Bruning explained that setting up some of the larger parts it manufactures could take as much as ten hours. That setup has to be repeated when parts have to be taken off the machine for in-process gaging on a CMM. Increasingly, Snyder is building in-process gaging into both its setup

procedures and its inspection routines. Probing during setup allows for a faster and more accurate orientation of the part with more precise tool offsets.

During manufacturing, spindle probe data delivered directly to the inspection software is used to generate reports just as if the part had been measured on a CMM. Some customers have already reviewed this inspection process and have granted Snyder permission to supply in-process results captured at the

machine instead of a CMM for mandatory in-process inspections.

To integrate probing into CNC processes, programmers insert manually generated probing macros at predetermined intervals in the CAM program. One of the first things Snyder intends to do as it transitions into *Mastercam X7* software is investigate the utility of generating probing macros semi-automatically using the new Productivity Plus probing module within the software.

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**Machine Simulation.** Heavy equipment part designs are typically delivered to Snyder Industries as prints. One of the first things his company does is model everything in *Mastercam*—not just the part, but also the pallet setup and the machine itself. Being able to view a complete simulation of the part being manufactured gives the programmers confidence that the part can be manufactured at high speeds without encountering any interference.

While thorough machine simulation is essential for productive 5-axis milling, it is also highly useful for multi-axis turning as well. Bruning explained, “It really gives you an idea of where everything is going to fall. Is the part going to fit? Before it was a guessing game. Do we have enough travel? Do we have enough reach? Are we going to be high enough? That has helped out quite a bit.”

While not all of the machines at Snyder have been modeled for machine

simulation in *Mastercam*, it is one of the company’s objectives.

**More Definitive Setup Sheets.** Snyder Industries uses the graphical outputs from the software’s machine simulation mode to generate setup sheets with images and text that leave no doubt how a given part is to be processed on the machine. For the tool room staff, these sheets clearly call out all the tools required, including lengths, diameters, etc., so there is no guesswork.

Bruning said, “The more information we put out there for the operator, the less time they spend trying to figure out how to run the part, or figure out the right tooling and fixtures. All of this cuts down on scrap and costs.”

**Bar Coding.** Snyder Industries is now in the process of implementing a bar coding system that will allow users to automatically call up a program and tool room people to access carbide tools from a vending system simply by scanning the code. This system will further reduce the potential for human error at the machine and provide for more accurate management of tooling costs.

**Advanced multi-axis lathe programming.** The company has dramatically improved lathe productivity with the new multi-axis lathe programming capabilities introduced in *Mastercam X6*. Manufacturing Process Leader, Dan Szykowski, said, “What took me five hours to write with a conventional lathe programming software, I can do in two hours now in *Mastercam*. And you have more confidence because you see it on the screen. We are doing multi-axis milling, surfacing, blending radii, dynamic milling, and OD threading, even polar milling. To be able to see it on the screen and to be able to trust it and send it out to the machine is just huge.”

**Material Aware Toolpaths.** The last three versions of the software have introduced a succession of material-aware dynamic tool paths that operate at high speeds, minimal engagement and adjust feeds and speeds to avoid burying the tool in the material. These tool paths also reduce tool wear by using as much of the tool’s flute as possible with every cut. Snyder has been applying these tool paths as often as possible for efficient blending of surface transitions, automated precision programming of radii,

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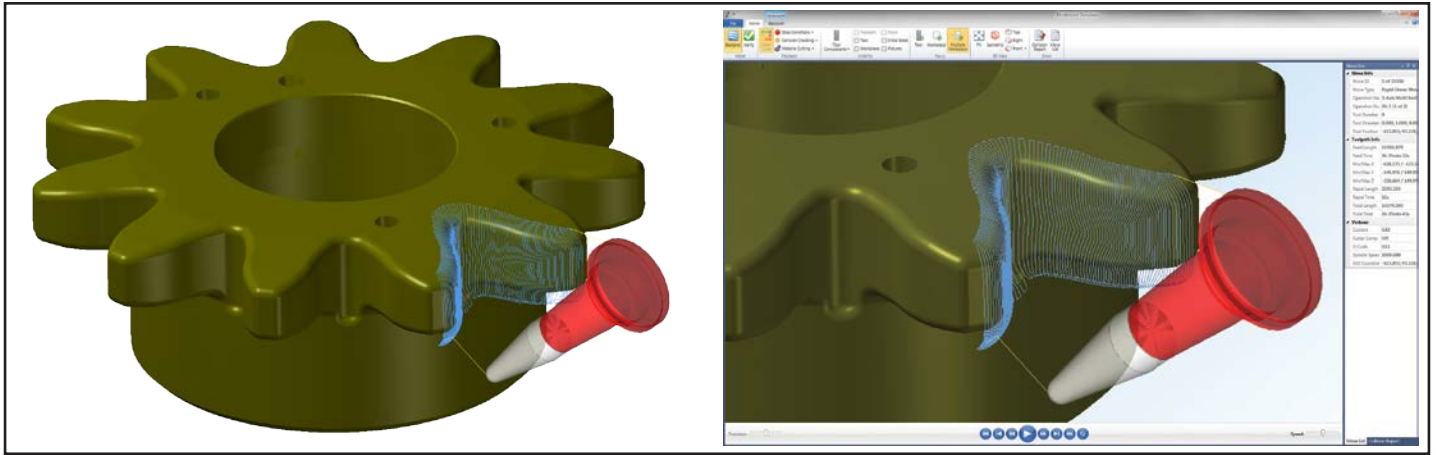
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Zooming in on dynamic tool motion using backplot simulation gives the programmer confidence that he can use *Mastercam's* Dynamic Motion Technology to achieve high material removal rates without encountering interferences.

and hybrid roughing and finishing prior to sending parts for conventional gear cutting. In addition to improving part quality, reducing the need for secondary deburring operations and improving machining productivity, these tool paths have been extremely reliable, giving programmers great confidence in the programs they send out to the shop floor.

**Safety.** CAM initiatives at Snyder Industries improve safety, improve the

working environment and reduce costs. The fewer times workers have to move or reposition parts because setups are not right or inspections can be performed on-machine, the less potential for accidents. As for burrs, said Bruning “Our programmers can go into areas where we have problems with sharp edges and blend them all. So there is less chance of cutting a strap or cutting a finger, or having customers send back parts

because of burrs.” CNC deburring also eliminates the cost of an expensive manual operation.

**One Final Detail.** The final step in manufacturing is to custom engrave the customer’s label into the part. These high-resolution representations of each customer’s identification can be quite intricate. Bruning believes the engraved ID label makes a visual statement about his company’s attention to detail.

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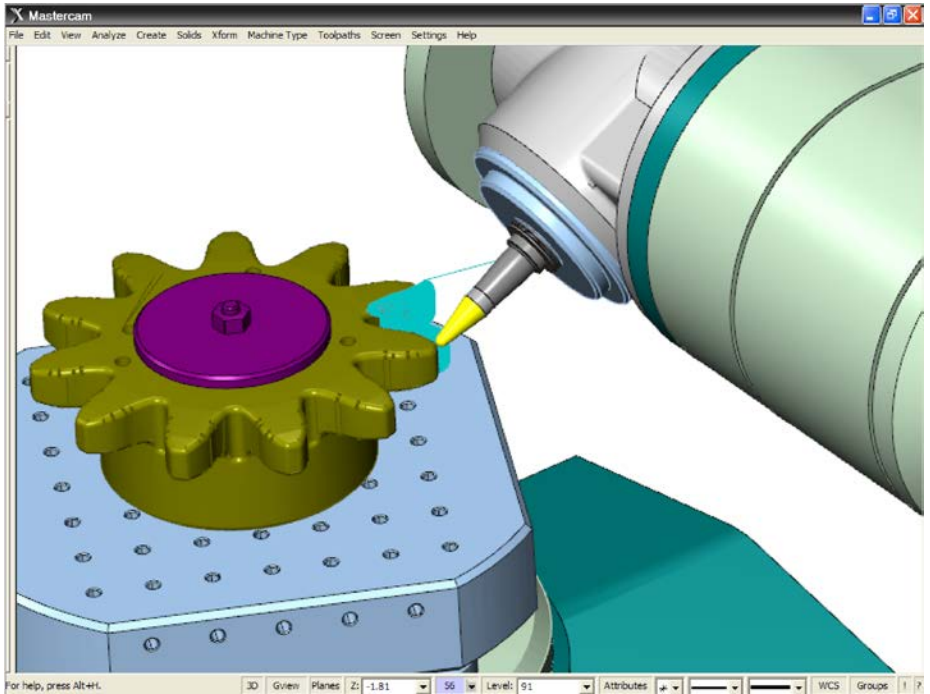
Snyder Industries began its transition to CNC equipment about six years ago. Today, the company is continuously engaged in a variety of CAM initiatives:

- On-machine probing for setup and inspection
- Machine simulation to improve unattended manufacturing confidence
- Setup sheets generated from CAM to improve setup accuracy and tool management effectiveness
- Bar coding for human error reduction
- Advanced multi-axis lathe programming
- Material aware toolpaths to improve quality and productivity
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