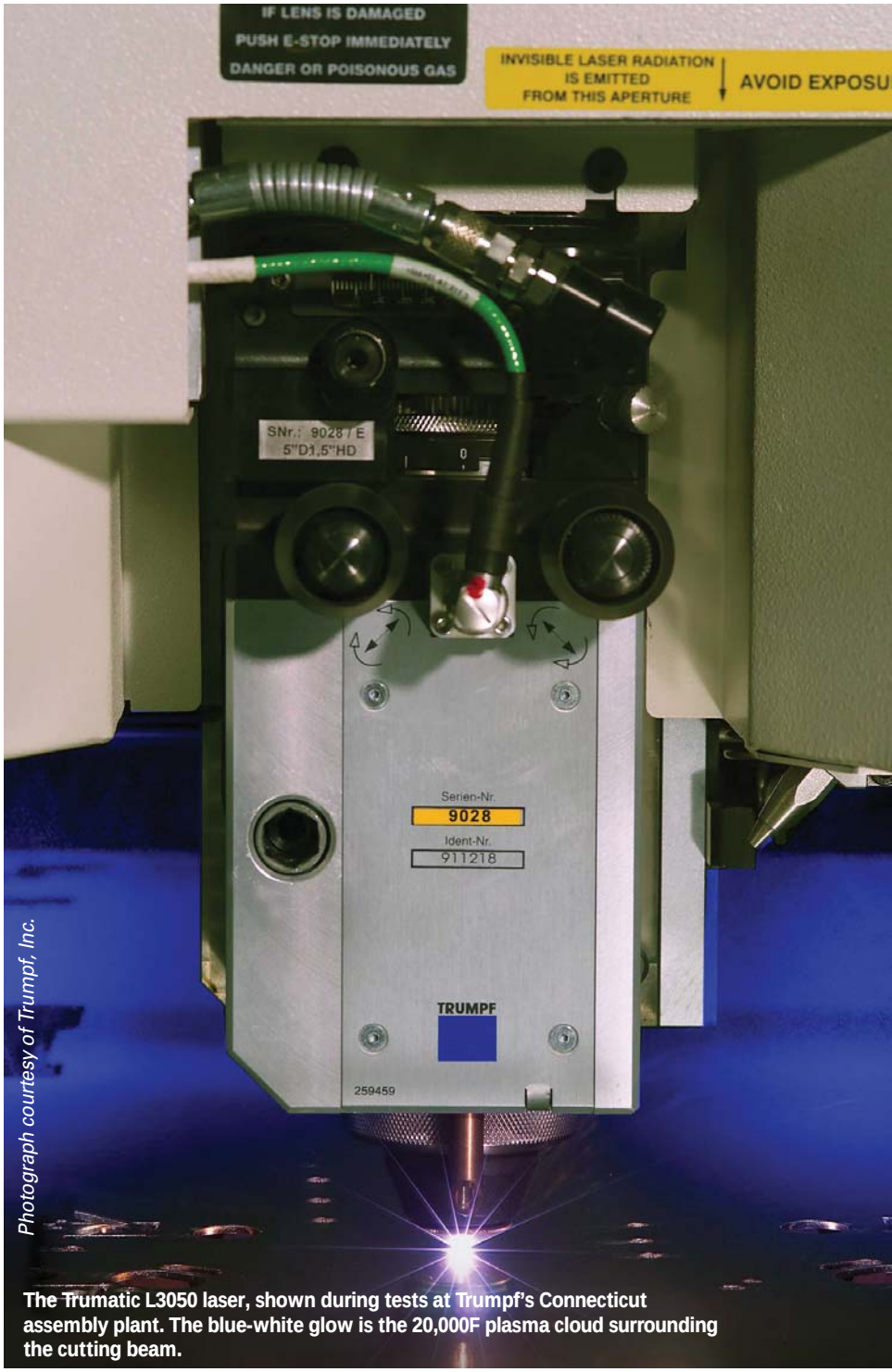
MVP doubles laser's cutting speed

The initials stand for metal vapor plasma, which has accelerated cutting rates up to 2000 in./min. in thin aluminum. For one sheet metal fabricator, MVP also means most valuable process.

By J. Neiland Pennington, Executive Editor



Photograph courtesy of Trumpf, Inc.

The Trumatic L3050 laser, shown during tests at Trumpf's Connecticut assembly plant. The blue-white glow is the 20,000F plasma cloud surrounding the cutting beam.

One of the most salable features of CNC laser centers is their ability to cut sheet metal cleanly, accurately—and fast. Speeds of 800 to 1000 in./min. are the current benchmarks for thin-gauge materials.

At least they were until the introduction of what German machine builder Trumpf calls metal vapor plasma (MVP) cutting. The process has been tested on 1-mm aluminum at speeds up to 2000 in./min.

The MVP machine is the Trumatic L3050, a 5-kw CO_2 flying-optic gantry laser, which has plasma-cutting capabilities on metals from 0.025- to 0.060-in. thick. It also cuts up to 1-in. thick mild steel plate, operating as a conventional laser.

The 3050 is not subject to the power-vs. speed limitations of standard lasers, according to company officials. Without MVP, increased cutting speed is totally dependent on higher resonator power. Metal vapor plasma, they maintain, adds another factor to wattage for increasing cutting rates.

A reactive plasma

Don't be misled by the word "plasma." It is formed reactively, without generating a plasma externally. The key words are "metal vapor." The laser vaporizes the material, which ignites and forms a 20,000F plasma cloud that surrounds the beam above the workpiece surface.

"In conventional laser cutting, the melt pool reaches 5000-6000F," said Daniel L. Robinson, laser product group manager at Trumpf, Inc., Farmington, Connecticut. "The superheated MVP cloud preheats the material as the laser beam moves

and augments the cutting process.

"The laser beam is only 0.005-0.006 in. in diameter, but the diameter of the plasma cloud is in the range of 1/4 to 3/8 in. The laser head moves so fast that the plasma doesn't heat the metal enough to cause melting. The only effect is a slightly more striated cut, which is hardly noticeable."

All metal-cutting lasers generate a plasma, but it is intermittent and unstable. The energy cannot be harnessed to assist the cutting process. Trumpf's breakthrough was developing techniques for sustaining the plasma.

"You can't hold the plasma without rapid movement of the laser head," Robinson explained. "On a conventional laser, the faster your cutting speed, the more likely it is for a plasma to form. If the laser head doesn't move quickly, the beam doesn't produce a consistent stream of metal vapor, and the plasma collapses." The X and Y axes of the 3050 have a simultaneous positioning speed of 11,000 in./min.

High power density is required. For MVP cutting, the 3050 uses a laser head with a 3¾-in. focal length to concentrate more energy on the workpiece. Five inches is the typical focal length for most thin materials on standard lasers.

Photograph by the author

MOR/ryde's small cutting quantities and frequent part changeovers make manual sheet handling more efficient than automation. Lead operator Greg Mueller loads sheets on the 5- x 10-ft. dual-pallet table in less than 1 min. The tinted shields surrounding the laser cell filter intense infrared and ultraviolet radiation from the plasma.


Photograph by the author

The 3050 control includes adaptive optics that change the shape of the laser delivery mirrors automatically to optimize the beam for each material that Greg Mueller enters.

Proprietary height sensor

Maintaining the optimum spacing between the laser head and the material is also critical to sustaining the plasma, and is the technology Trumpf is least willing to discuss. Robinson did indicate, however, that a proprietary noncontact capacitive height sensor designed for the process is a key component.

"Height sensing is more critical with MVP than it is with conventional laser cutting, to avoid collapsing the plasma" he said. "But height sensing through a plasma cloud is also more difficult, because the plasma causes erroneous reactions with a standard sensor, and the head moves at random. We maintain the spacing through the sensor electronics and the control software."

The plasma does not increase the width of the heat-affected zone, according to Robinson. "To produce the smallest HAZ, you need to cut as fast as possible," he noted. "Even though much more heat energy is present, the 3050 is cutting faster by a factor of two or more. So there isn't time for the additional heat to be absorbed."

One of the first 3050s in North America has been at work in Elkhart, Indiana, since last May, and was joined by another in September. Both are at MOR/ryde International, a company at the epicenter of the Midwest recreational vehicle industry. MOR/ryde produces its own products, suspensions for RVs and motor homes. It also manufactures RV chassis and supplies the industry with custom fabrications.

The majority of MOR/ryde's fabricating customers are within 40 miles of Elkhart. Although the RV industry has consolidated considerably, at least 15 builders continue in the area. MOR/ryde supplies at least a dozen of them, plus transit bus companies in the Elkhart vicinity.

A job-shop atmosphere

MOR/ryde's major market may be in the transportation industry, but it is the antithesis of the automotive model. "We are constantly modifying and revising parts," declared Bobby Moore, president and co-owner. "There is a lot of innovation in the RV industry, and we have to be able to respond. Ours is almost a job-shop atmosphere."

Any technology that can increase production speed and manufacturing agility is welcome at MOR/ryde, which has retired other sheet-metal technologies in favor of lasers. In addition to the two 3050 MVP units, it has two Trumpf 3030 4-kw conventional machines, the first of which was installed three and one-half years ago.

"Prior to that we had a high-definition plasma cutter that

we were not happy with," said Gary Tompkins, engineering technician and project manager. "It didn't deliver the speed, accuracy or quality of cut that we needed.

"We looked into punch-plasma machines; we also investigated turret punch presses. We ultimately decided to convert to laser cutting."

Show me

But first, Tompkins had to be convinced. "My background is diemaking," he related. "I made stamping dies for 12 years before I came here. When MOR/ryde went to laser technology, it was a hard sell for me. I'd been used to cutting metal with metal and making huge, high-production runs. It wasn't easy to convince me that we could make accurate parts without hard tooling and produce them profitably in small lots."

MVP has been a good investment for MOR/ryde. "When our customers saw what we could do with the MVP laser, they started designing parts for the machine's capability," said Bobby Moore. "The MVP laser brought in business that we wouldn't have had otherwise."

It has also gives them the flexibility to fill orders within 24 hrs. "Remember we said that this is a job-shop business," reminded Dale Bennett, plant manger. "We have received part revisions in the afternoon and shipped the new parts the following day. We accept the design file, reprogram the laser, cut and form the new components overnight, and have them ready for the welders to assemble the next morning. Without the lasers, this turnaround wouldn't be possible."

Photograph by the author

Monogrammed RV mud guards are one of the new products made possible by the MVP lasers. The guard is a strip of 0.080-in. polished 304 stainless steel bolted to a ribbed rubber flap.

In addition to the increases in cutting speed, the MVP lasers have expanded MOR/ryde's range of metal thicknesses. "If you compare the MVP machines to our standard lasers, the two are closest in cutting speed with metal 3/16- and 1/4-in. thick," said Gary Tompkins. "The 3050s are about 30-percent faster. The biggest advantages are at the extremes: We get a huge increase—more than double—with thin stock, and we can cut plate that would be impossible on our lower-powered lasers."

The second MVP laser, installed just four months after the first, was to fill a deluge of new orders. The first machine was fully booked, running around-the-clock— including weekends.

In this lean economy, with industry's disinclination to invest in new equipment, MOR/ryde's million dollar-plus commitment in 2002 is something of an anomaly. It's especially true in an industry so dependent on discretionary income.

Muscular market

But business is up, and Bobby Moore cited three factors driving the RV industry. "One is demographics," he noted. "The baby-boomers are retiring, and there is a large potential market. That's been going on for some time. Second, for whatever reason, the RV industry historically has led the economy into recessions and led it out again. Our industry goes sour before the rest of the economy, but it recovers faster; it's a leading indicator. That's been true for the past 30 years.

"We were down for the last half of 2000 and all of 2001. And when 9/11 hit, the market shut off like a valve for about four months.

"But then it took off, and I think this is the third factor: There is the feeling that life is now more uncertain, and if people keep putting off plans, they may never happen. 'We always talked about going to the Grand Canyon,' they say. 'Now let's do it.' People got over the initial shock of 9/11, then started traveling again—but less by air. As a result, 2002 has been a very good year, and 2003 could set a record." ■

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OH-SAY! CAN YOU HEAR . . .

Many visitors to last October's Fabtech International in Cleveland were startled to hear an ethereal, whining whistle throughout the I-X Center exhibit hall that sounded the unmistakable notes of the National Anthem. The curious tracked the source to Trumpf's display, a demonstration of the Trumatic L3050 metal vapor plasma laser cutting center.

Trumpf engineers had discovered that the pitch of the sound generated by the plasma could be varied precisely, according to laser product group manager Dan Robinson.

"This machine has the ability to change the laser's frequency and power level continuously, and synchronize them with the head's cutting speed. We call this Dynamic Power Control. The controller ramps the power and frequency up and down, based on the head velocity. The higher the velocity, the higher the power and frequency.

"We use an RF laser, so the laser pulses. The changes in pulse frequency produce the notes. What we did to play "The Star-Spangled Banner" was to vary the cutting speed to produce frequency changes, and program the time of the cut to determine duration of the notes. We harnessed Dynamic Power Control's capabilities to produce an attention-getting display— and have some fun."