

TOOLING & PRODUCTION

Strategies for Large Metalworking Plants



[Return to Homepage](#)

Complex Laser Processing System -- The "Ace in the Hole" for Precision Machining Manufacturer

Multi-axis laser processing is one of the complete spectrum of precision manufacturing services provided by Ace Precision Machining Corporation. What sets this one-stop contract manufacturer apart from others is the depth of its laser processing operations along with large scale capabilities in metal joining, CNC machining, metal forming, thermal processing and much more.

Ace Precision is a strategic manufacturing partner with leading aerospace, power generation and defense manufacturers. By doing all operations in-house without dependence on outside subcontractors, Ace Precision reduces turnaround time on projects and eliminates issues that might occur when using a third party supplier.

"Almost nothing is outsourced," reports Ed Magedanz, Senior Manufacturing Engineer for Ace Precision. "Because our facilities and trained people encompass all areas of metal forming, fabrication and testing, the company maintains process control from start to finish. We work on large projects that involve prototype development over many months before actual quantity manufacturing takes place. When the project ramp-up occurs, we are ready with the right equipment and the trained personnel to deliver as required. Our track record with multi-axis laser processing is a great example of how we provide all of our contract services to the benefit of our many customers."



Shown with a recently purchased Laserdyne 795 BeamDirector systems are (left to right) Kurt Magedanz, Process Engineer, and Ed Magedanz, Senior Manufacturing Engineer of Ace Precision Machining Corporation. The systems are used for processing complex aerospace components similar to the one pictured on the worktable.

Rapid Expansion Of Global Turbine Industry Provides Growth Opportunities

Ace Precision laser processes a wide range of materials and has capitalized on the growth opportunities within industries that have seen a rapidly expanding need for the latest in laser system processing. Among these are long time OEM customers Honeywell, Rolls Royce, Siemens as well as other global manufacturers who require components and assemblies processed with multi-axis laser systems.



One of five Co2 laser systems ranging from 1700 to 4000 Watts used for cutting, trimming, welding, and hole drilling.

"The aerospace and turbine industry has made a large move to cooling combustion components with effusion holes," reports Mr. Magedanz. "These are small holes drilled through the part at steep angles. In many cases, where parts are thermal barrier coated, our Nd:YAG lasers are the only way of providing these steep angled holes efficiently and with accuracy. We continue to grow our laser department by acquiring the latest technology to take advantage of these new industry trends and to provide the versatility with different laser system models to handle these and a growing range of projects."

Ace Precision's dedication to Laserdyne systems goes back to its beginnings and now includes four CO2 systems with up

to 8 axes of motion, five multi-axis BeamDirector drilling systems with Nd:YAG lasers, and a shuttle-equipped 2D cutting system. Together, these systems give Ace Precision the capacity, flexibility and precision required to produce highly complex combustion chambers, liners, turbine plenums, compressor housing, tailpipe and heat shield assemblies along with other precision engine components.

The materials for these components and assemblies are varied and include cobalt, nickel, stainless steels and aluminum in thickness from 0.005 to 0.500 inch. The nickel and cobalt based high temperature alloys are especially challenging and include Haynes® 625, 188, 230 and 718.

Having The Right Equipment And Trained Personnel Ready To Respond Is Key

With seven Laserdyne multi-axis laser systems already in house, Ace Precision recently added the two new 795XL systems to process complex parts needed for a military vehicle project. In developmental and through prototype stages over a 2-year period, when the project went into quantity production, Ace Precision was ready with the newest Laserdyne systems. "This is how we handle major projects and use our broad range of precision processes," reports Mr. Magedanz. "It gives us the advantage of faster turnaround because we are using the very latest, high-speed laser systems with the highest repeatable quality level established during the prototype stages of the project."



Ace Precision manufactures engine components for the commercial and defense industries. A laser-processed engine component is pictured being visually inspected. Ace Precision has experience with many engine designs including military platforms for Apache and Chinook helicopters, Abrams M1 Battle Tanks and B2, F18, F22 and F35 aircraft.

"One of the best things about working with Laserdyne equipment is that even though the technology has evolved over the years, their program structure is still the same," stated Kurt Magedanz, Process Engineer for Ace Precision. "We can take a program from one of our older laser systems and put it into one of the newest laser systems and it will operate with no changes, even with a completely different laser source and a controller that is two generations newer. We accomplished that by taking the part programs from the older lasers for the prototype work and then moving them to the newer and faster systems when we move into volume production. It's a real time-saver and our system operators like it because there is minimal learning required to operate the newer systems."



With nine Laserdyne multi-axis laser systems in-house, Ace Precision is equipped and experienced at the most complex projects requiring laser processing. As pictured, these include drilling effusion cooling holes in very dense patterns at shallow angles holding hole diameter tolerances of less than 0.002 inch.

The latest two Laserdyne 795XL systems at Ace Precision are capable of seven axes of motion with 2m X 1m x 1 m (80 inch x 40 inch x 40 inch) work envelope that includes two high accuracy rotary tables. The structure of these laser systems allows for the processing of small to large part configurations in all seven axes giving Ace Precision the needed flexibility to handle a wide range of projects with repeatable precision.

"Our Nd:YAG lasers are capable of drilling effusion cooled holes in very dense patterns at shallow angle holes with diameter tolerances of less than 0.002 inch. Methods of achieving these effusion-cooled holes are: deep hole drilling, percussion drilling, trepan drilling and drilling on the fly," Mr. Magedanz stated.

Hole Accuracy Made Possible With Automatic Focus Control™

Achieving a high level of accuracy from prototype to production stages and from one job to another is possible because of

how Laserdyne designs and integrates its system features. Everything works perfectly together -- the controller, software, motion system, laser, process sensors -- because everything is LASERDYNE's design and manufacture.

A good example is Laserdyne's Automatic Focus Control (AFC™). It's a feature users swear by and one Ace Precision provided feedback to Laserdyne engineers and saw refined through the years. AFC guides the motion system, maintaining critical focus position and following the contour of the part regardless of slight surface irregularities. With AFC, all machine axes react to sensing of the part surface, creating unlimited R-axis correction with high speed and unmatched sensitivity. AFC allows top machine speeds so productivity is maximized without downtime or scrapped parts.

AFC is used by Ace Precision for trepanning, percussion drilling and drilling on the fly.

Trepanning is a process for creating holes where the part is held stationary and the laser beam is moved with simultaneous multiple action motion to create a round hole or any feature by cutting the periphery of the shape. Laserdyne's extremely accurate and repeatable laser positioning allows for very unique and tight tolerance trepanned features.

In contrast, percussion drilling delivers one or more pulses from the laser to a part while the laser beam and part are stationary. More than one pulse may be required depending on the material type and thickness.

A variation of percussion drilling is "drill-on-the-fly", where pulses are delivered to the part by the stationary laser while the part is rotated. The hole placement is a function of rotational speed and laser pulse frequency. If multiple pulses are required, "drill-on-the-fly" software, developed by Laserdyne engineers, is utilized to synchronize the movement of the part to the laser pulses, ensuring that multiple pulses are delivered to the exact location required. By changing the laser pulse energy, pulse count or lens focal length, the characteristics of the drilled hole size and taper can be controlled to meet the requirements of the part. Drill-on-the-fly software also allows changes of the pulse shape during the process to improve hole geometry.



The motion required for multi-axis laser is very complex. Laserdyne's AFC features makes trepanning, percussion drilling and drilling on the fly fast, precise and with high quality results. The photo shows this complex motion simulation made possible by dual processors.

"Repeatability (plus/minus 0.0001 inch) of the laser system really comes into play on our jobs," Mr. Magedanz reports. "Our Laserdyne BeamDirectors with their AFC features are designed so we maintain this accuracy with consistency through the entire work envelope."



Ace Precision Machining Corporation is an ISO-9001, AS9100 and NADCAP certified contract manufacturer with over 250 employees. It occupies two facilities with over 110,000 square feet. It provides precision manufacturing services to leading defense, aerospace and power generation industries utilizing the very latest manufacturing technologies including automated Laserdyne multi-axis laser processing systems.

Willingness To Find New Laser Solutions

"The best thing about working with Laserdyne as a company is their willingness to work with us to find a solution when we have a complex part that needs outside-the-box approach to laser processing," reports Mr. Magedanz. "By doing so, we come away with a solution to our problem and Laserdyne gets to

use the experience to develop new technology for integration into future systems."

"Our new Laserdyne systems -- together with our other seven laser systems -- show our capabilities, their depth and how we use Laserdyne supplied systems to the benefit of our customers," reports Mr. Magedanz. "This also applies to our machining, metal forming, thermal processing and other precision services. In the chip cutting area for example, we have over 50 CNC machines -- vertical mills, horizontal mills, turning centers and more. We're positioned so our business ensures redundant capabilities in two separate facilities to manage risk and provide timely and reliable service to customers around the world."

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