Coherent META Laser Machining Platform Delivers Value and Versatility

Building on the success of its Laser Machining Centers, Coherent introduced the new META platform product in September of 2012. The META platform features a number of important improvements, as summarized in the table below.

META Platform Feature	Primary Benefits
1.25 m x 1.25 m Cutting Area	• Capable of handling larger sheets • Supports international sheet sizes
Improved Capacitive Height Sensor System	• Full sheet cutting – maximizing productivity • Faster piercing routine • Faster focusing, for improved throughput and cleaner cutting
Dual High Pressure (250 psi) Regulators	• Increased flexibility – quickly change assist gas and process • Higher pressures for cutting thicker metals
Industry's First Sealed, Low Maintenance 1000 W laser	• Process materials faster • Process thicker metals • Lowest cost of ownership
Proprietary Power Control	• Fine cutting control • Wide dynamic range of operation

These improvements include a unibody chassis design that enhances mechanical stability for the system, resulting in faster cutting speeds and better positioning repeatability. In addition, the cutting bed on the META platform has been enlarged to accommodate standard European sheet sizes (1.25 m x 1.25 m). The META platform also now incorporates an industrial designed, ergonomic and efficient man/machine interface. Advances have also been implemented in the META platform's software. In particular, ease-of-use has been enhanced through a new, multilingual software interface, together with the implementation of greater system automation. Additionally, the system features automatic focus, advanced capacitive height sensing and a fully integrated machine vision system.

This document provides a brief overview of the META platform's capabilities, and also explores how users of the system have achieved rapid payback on its purchase price due to its exceptional value and capabilities.

META Capabilities

The Coherent META Laser Machining Center integrates a 1000W CO_2 laser, CNC controller, beam delivery system, assist gas delivery system, drive system and laser cutting head, all into one highly compact machine frame with a standard table size of 4' x 4' (1.25m x 2.5m). It is capable of cutting metals, such as stainless steel and aluminum, in thicknesses of up to $^1/_8$", and mild steel up to ¼" thick. It also readily processes a wide range of non-metal materials, such as wood, plastics, rubber, thin films, composites and other organics, in thicknesses of up to 1.25". Yet the system can deliver a precision of up to 0.001" (0.0002" repeatability), at cutting speeds up to 2,000 inches/min.

Job files are supplied to the META system in much the same way as other digital cutting systems. Namely, part drawings are created in SolidWorks or other applications that produce files in DXF, DWG, AI, HPGL, Gerber, JPG, BMP or TIF format. These files are then converted to a machine control file with the appropriate laser power settings and cutting speeds for optimized production.

Material can be rapidly loaded into the machine, and held in place by a vacuum bed. Switching materials or thickness can be done quickly because the META utilizes a capacitive sensor to accurately maintain the standoff distance from the work piece.

An integrated smart vision system also facilitates rapid loading of material into the META system. This vision

system can identify fiducial marks on the work piece, and then use these to perform cutting that is referenced to existing features on material regardless of its orientation in the machine, thus eliminating the need to position material with high precision. The software can even scale or distort the cutting pattern to correct for any dimensional changes in the material from the originally specified values.

Typical Applications

META platform products offer a unique combination of small physical size, low operating cost, ease-of-use and high operational versatility. This has made these systems particularly attractive to job shops that are involved in processing a broad mix of materials, ranging from metals and plastics, to organic materials like leather, textiles or wood. In particular, the system offers these users the ability to switch rapidly between different job types without lengthy downtime for setup, and supports economical production lot sizes from single units to volumes of over 1000 pieces.

The META platform has also proved popular in prototyping labs, in both industrial research and academic settings. Here, the system enables developers to move from concept to construction with minimal time and expense. It's particularly useful in aiding development of mechanically complex systems. Typically, these require numerous prototype cycles in order to refine a design. The traditional approach of using outside fabrication resources can become excessively time consuming and cost prohibitive under these circumstances.

The following images provide just a sampling of the tasks for which the META platform has been utilized. These show that its applications are truly as diverse as the customers utilizing it, and limited only by their imaginations.

Image 1. The META laser system was used to both cut and weld inflatable bladders for use as precision actuators in a two-axis mirror tracking system.

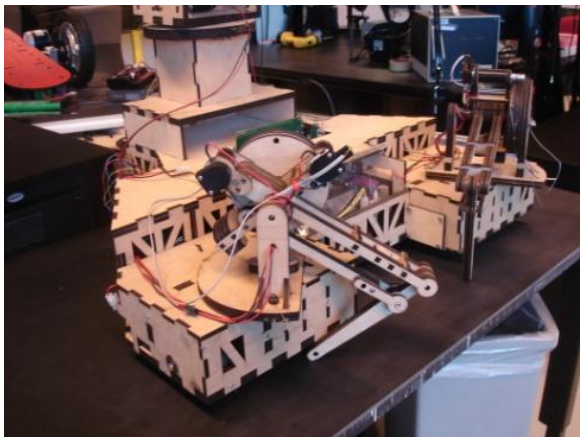

Image 2. A complex structure for a robot with numerous moving parts, prototyped in wood by a university research group.

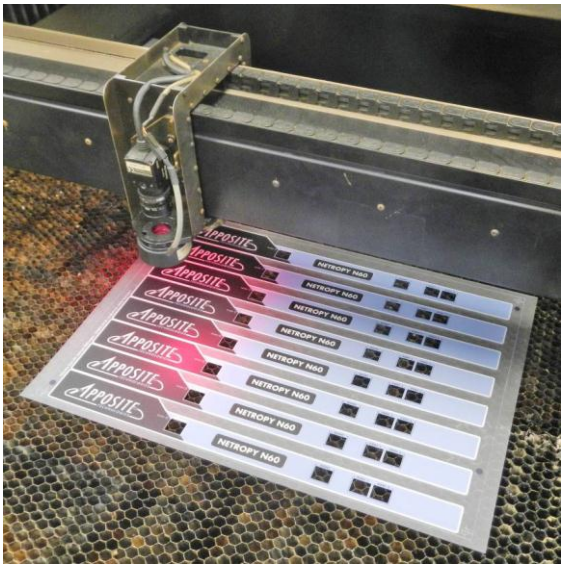

Image 3. Instrument panel overlays, fabricated on 0.010" thick polycarbonate. Several of these are screen printed on a single substrate. The META system cuts ventilation holes, connectors and controls, and separates the individual panels.

Image 4. The CO_2 laser used in the META system can produce a smooth, transparent cut edge on acrylic, eliminating the need for any post processing.

Image 5. A thin metal part cut, and a plastic part engraved with the META system.

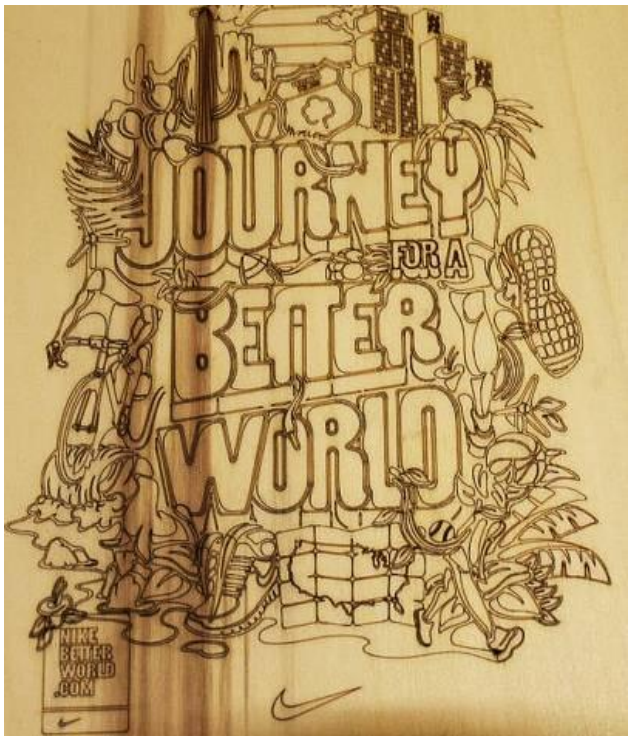

Image 6. The high acceleration of the META platform enables it to rapidly engrave even complex patterns.

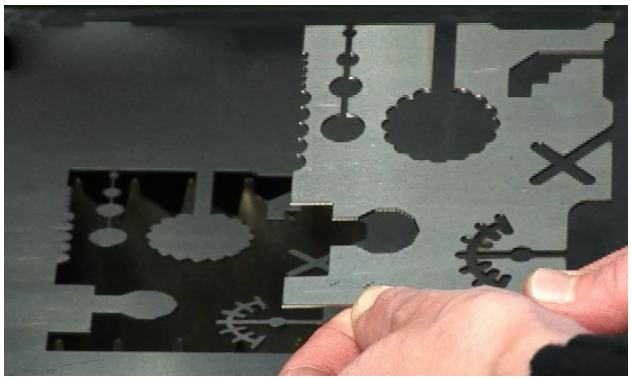

Image 7. The META system can cut complex stainless steel parts with high precision.

Image 8. One prototyping lab has developed ways of decomposing complex 3D shapes into strings and sheets that can be laser machined and then reassembled.

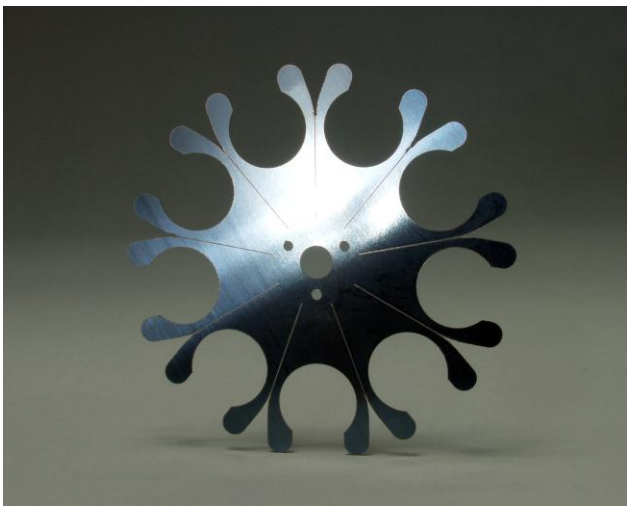

Image 9. The high cutting precision of the META system enables intricate patterns to be produced.

Delivering Value

The configuration and operational characteristics of the META platform result in exceptional value and rapid return on investment. For example, the sealed CO_2 laser technology employed in META platform products offers nearly 50% greater inherent electrical efficiency than the fast flow lasers commonly found in most other laser machine tools, making them much more economical to operate. Furthermore, sealed CO_2 lasers eliminate most of the costs associated with consumables and maintenance for flowing gas lasers. Specifically, the laser gas remains pristine over the entire 40,000 hour operational lifetime of the unit, eliminating the costs associated with gas replacement, handling, storage and supply, as well as the downtime connected with changing tanks. There are also no maintenance and consumables related to gas pumps, which in a flow laser require frequent service and oil

changes. Even cooling water is circulated through a closed loop system. In addition, sealed CO_2 lasers do not need blowers and storage tanks, making them very compact, giving the META system a small footprint. This makes it particularly easy to integrate the META into job shops and labs where space is at a premium.

Image 10. The META platform is more compact than most other laser machine tools, which can make it easier to integrate into the production environment.

One US job shop has documented that the META platform has substantially increased their capacity, and also lowered their costs. This shop focuses mainly on precision cutting of both metal and non-metal materials, for applications ranging from medical devices through architectural parts and automotive applications. The increase in throughput comes from several factors. First, the lightweight optics head in the machine can be moved under high acceleration, enabling much more rapid cutting than is possible with a larger, 4 kW laser machine that the company also employs.

They have also noted that increased throughput is further aided by the Coherent software, which simplifies the creation of job files. In particular, their 4 kW laser system requires very clean DXF files composed of only lines, arcs and circles. In contrast, the META system has no trouble operating from simpler artwork created using applications such as Illustrator or CorelDraw. This cuts down job preparation time.

The ease with which material can be loaded into the machine further enhances rapid processing. Specifically, because material is held by a vacuum bed, it doesn't have to be placed with any precision, and no fasteners have to be tightened. The vision system then compensates for the actual orientation of the work piece in the machine. One user found this feature particularly valuable when processing materials that have previously been silk screened. Sometimes these materials stretch unevenly, but the system can asymmetrically scale the cutting pattern to adjust for this. This isn't possible on a larger laser machine, which requires the operator to precisely square the blank to the machine. And as a final cost benefit, this job shop discovered that the META platform product uses much less assist gas than their larger laser system.

Another META platform user utilizes the system primarily for making nameplates, signage and other products fabricated from plastics, films and thin metals. While they only employ the META system for about two hours per day, they were able to achieve payback on the capital expense for the equipment within the first year of operation. There were two main reasons for this excellent ROI. First, using the META platform cut down on procurement expenses for dies by a substantial amount. Second, it eliminated a full time position for a die cut operator. Specifically, the company formerly had two full time die cut operators working a total of 16 hours a day. Now, they're able to achieve the same level of productivity with a single operator that spends about two hours per day using the laser.

In yet another example, a product development consulting group has found the META platform an economical alternative in a direct comparison with several other technologies used for creating prototype parts. For example, they calculate that the cost to operate a CNC mill is in the $20 to $40 per hour range. They also own an abrasive waterjet machine, but estimate that operating this system runs about $160 per hour. In contrast, the operating cost for the META system is only about $2 to $5 per hour. For this reason, the laser has become their preferred fabrication method.

Conclusion

In conclusion, the Coherent META platform delivers better cutting performance, lower operating costs and greater ease of use than most other laser cutting systems, as well as other machining technologies such as 3D printing, CNC milling and waterjets. The diverse capabilities of the system for processing a wide range of materials, and for performing tasks ranging from through cutting to kiss cutting and engraving, make the META system a flexible and cost effective tool that is equally suited to use in the laboratory, job shop and production floor.