WHITE PAPER

Laser Projection for Streamlining Production and Assembly

Michelle Bangert | Managing Editor | Quality Magazine | July 2017

Imagine assembling aircraft, laying up composites, painting large aircraft, ships, and railcars; or positioning machinery and robotics on the factory floor. These tasks could be simplified using one technology – Laser Projection.

Laser Projection can be used in a range of applications to simultaneously streamline production and improve quality. Originally Laser Projection was used in the aerospace and defense industries for reducing cycle times, increasing production rate / throughput and improving quality. Recently though, forward-thinking companies in the automotive, heavy equipment, weld/machine shop and composites sectors have also been using Laser Projection for these same benefits.

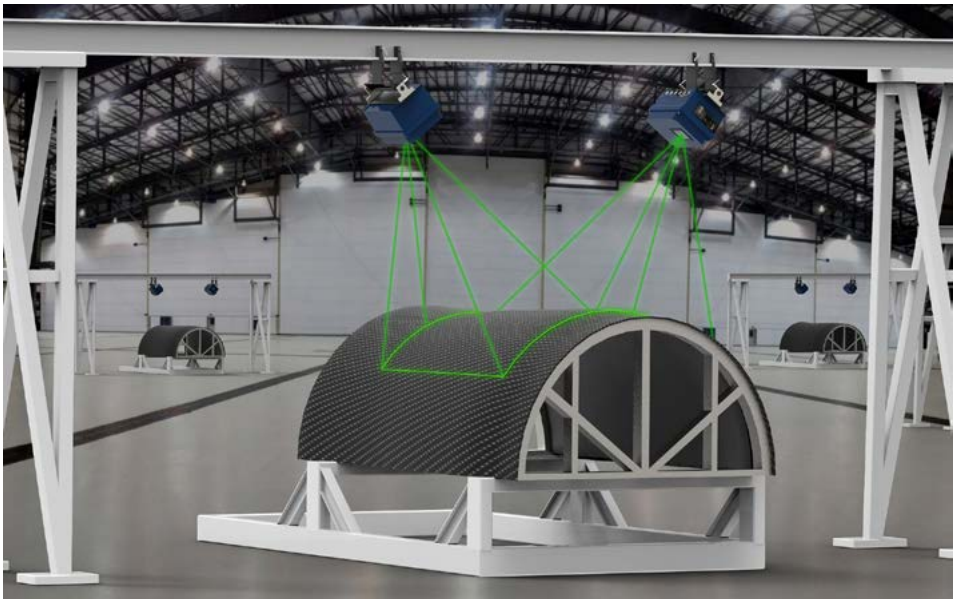


Figure 1. Two Tracer^{M} projectors projecting onto an engine nacelle for ply layup in a composites clean room.

Figure 2. The FARO® Tracer^{M} Laser Projector

The Benefits of Laser Projection

Laser Projection offers laser-guided assembly and production. It makes it possible to eliminate/reduce physical templates, speed up the inspection process and improve quality. Projecting a laser onto a surface provides a virtual template which allows operators to position parts with complete confidence and accuracy.

Consider composites layup. This may involve physical templates and a complex multi-step process that requires a detailed series of tasks. If any of these steps are performed incorrectly, it could scrap a part, cause expensive rework and/or halt the production process.

The process can be improved, however, by guiding an assembly process sequence. Laser Projection allows operators to accurately locate, orient, and assemble components. Reducing or eliminating the three T's – templates, tape measures, and tools – also reduces or eliminates scrap and rework. It improves setup time, accuracy, and customer satisfaction.

Figure 3. Two Tracer^{M} projectors at work in an assembly operation.

Figure 4. Industrial welding shop deployment. The Tracer^{M} is rugged enough for the production floor, with a dust-sealed industrial enclosure.

How It Works

3D Laser Projection is done by steering a single laser beam onto complex, contoured 3D surfaces. CAD model data is used to generate a series of specific points that the laser projector will use to create a projection outline on a surface. 3D projection prevents distortion while creating a best fit of the projection onto a multi-plane surface.

Using advanced optics, galvanometers, and high-precision mirrors, the laser beam "draws" images onto the surface. The high-speed motion of the laser beam creates what appears to be a continuous line to the human eye.

The FARO Tracer^{M} Laser Projector is a versatile, scalable and flexible solution that can handle small-to-large volume applications. It covers an envelope of 50 x 50 feet, with a 3D projection range of 6 to 50 feet, making it well-suited for both short and long-range projection. For large assemblies such as aircraft and shipbuilding applications or space-constrained areas, several Tracer^{M} projectors could be deployed for total and complete coverage, all from a single workstation. This allows for one virtual template in a common (or shared) coordinate system.

Several laser projector features make it versatile for a range of applications. The Tracer^{M} Laser Projector's proprietary Advanced Trajectory Control (ATC) feature allows for fast projection with dynamic accuracy and minimizes the "flicker" often associated with other laser projectors. The use of retroreflective targets allows for the best-fit alignment of the projected image onto the surface. In addition, the solution is rugged enough for the production floor, with a dust-sealed industrial enclosure.

The Tracer^{M} software is open format which means that it is compatible with most CAD file formats, and optimizes the CAD model for projection. FARO offers a Model-Based Optimizer Module, an Administrator Prep Module, and an Operator Interface Module. The first two modules are used by the manufacturing process engineer. The Optimizer Module allows CAD files to be optimized for projection. The Administrator module allows for the project to be organized and for the workflow sequencing to be defined. The Operator Module is used by the assembler to run the Tracer^{M}, and perform the work. The operator level is set up with specific access levels and sequences of operating steps.

Applications

A broad spectrum of industries can take advantage of Laser Projection. Aerospace and defense businesses benefit from composite part layup, system bracket placement, rib and stringer placement, click-bonds and standoffs, and fastener/drill location, as well as paint templating and masking. Laser Projection in automotive and heavy equipment can help with weld stud/block location, precision table applications, precise decal placement as well as factory floor layout for production lines, fencing, and robotic station layout.

The composites industry is one of the biggest application areas for Laser Projection, as laser technology allows for hand ply layup, mandrel tracking and layup, as well as assistance in Advanced Fiber Placement (AFP) machines. In aerospace, composite parts are typically optimized to provide maximum strength at minimum weight. Laser Projection facilitates this process better than traditional methods.

In working with composite laminates, manufacturers look for ways to locate and place plies as quickly and accurately as possible to streamline the layup process. They traditionally use physical or Mylar® templates to attempt to accelerate the process. This can be difficult as it involves pulling the proper template, aligning and placing it, affixing it and then maintaining that position during the actual layup process.

Laser Projection for Streamlining Production and Assembly

In addition, physical templates can quickly become obsolete when new parts are created or engineering change orders (ECOs) are introduced. They also create a significant expense when it comes to building, storing and maintaining them.

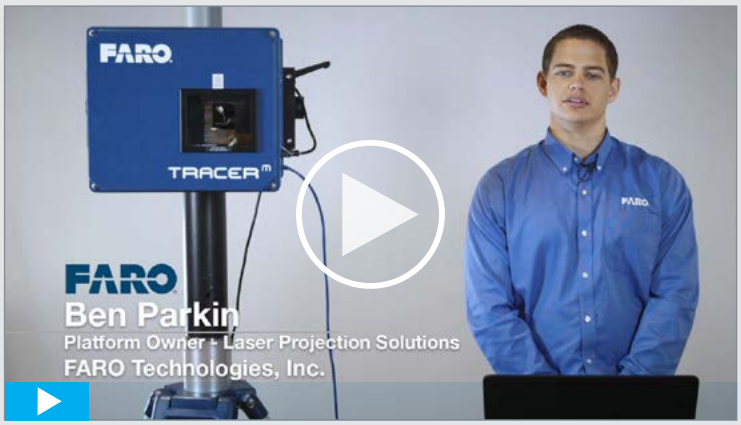
This is where Laser Projection can improve cycle time and accuracy. Laser Projectors outline the exact location for the placement of composite materials. All information is digitally stored on one device rather than a room full of templates. It is easy to look up virtual templates, ensure the correct one is being used, and update when changes are made. Benefits include faster layout times, precise ply placement, and shortened production cycles, resulting in higher throughput and improved quality.

The AFP machines are used to place fiber in the correct orientation. Traditionally, manufacturers checked fiber angles using hand tools. However, this is time and labor-intensive; laser projection is the fastest method of verifying ply orientation. By adopting a laser projector solution, fiber angles can be visually verified during the projection process. It projects the desired line and an operator visually checks using the line image and a protractor. In addition, physical tools (other than a protractor) are no longer required to check the angles, and fiber angle verification is independent of the AFP machine.

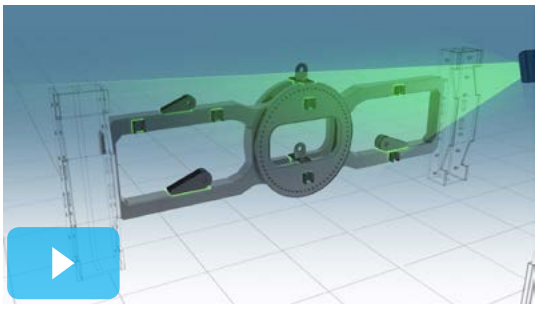
If part positioning is improved, the entire production process benefits. Laser Projection can show the correct sequence, position and alignment for a range of parts such as weld blocks, brackets, sub-assemblies and fasteners.

Using laser projection for paint and decal templating eliminates the high cost of Mylar paint templates. This has benefits in applications from helicopters to railcars. Visual verification ensures correct placement, verifies completed work and identifies no-drill/no-cut zones.

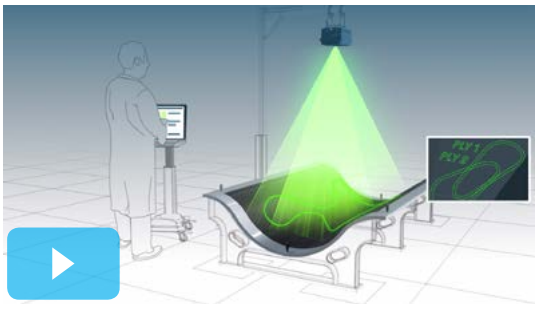
The FARO® Tracer^{M} Laser Projector can be the solution for a variety of production and assembly challenges. For more information on this technology, visit ***www.faro.com.***



Click above to watch a three-minute demo video on the FARO Tracer^{M} Laser Projector.



Part Positioning and Assembly
http://www.tracerm.faro.com/#Part-Positioning-and-Assembly



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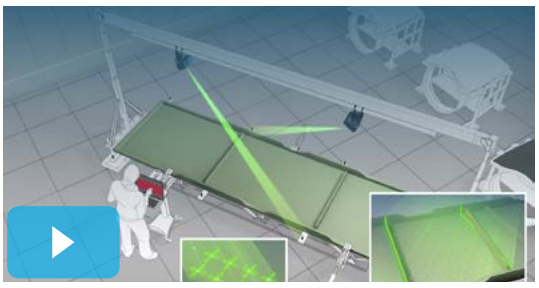

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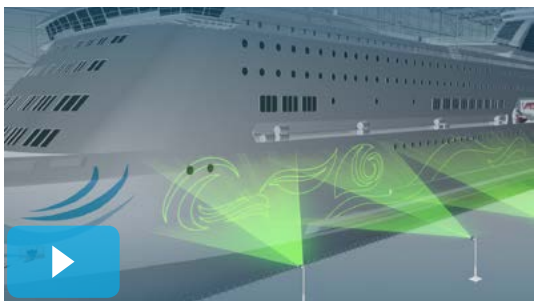

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