Migrating Legacy Tube Assemblies to a Digital Thread Lifecycle

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GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2024

MUNDO-TECH

Left to Right: Joseph Harbaugh, Product Director. Chris Harbaugh VP. Mundo Harbaugh, President

FX 3D

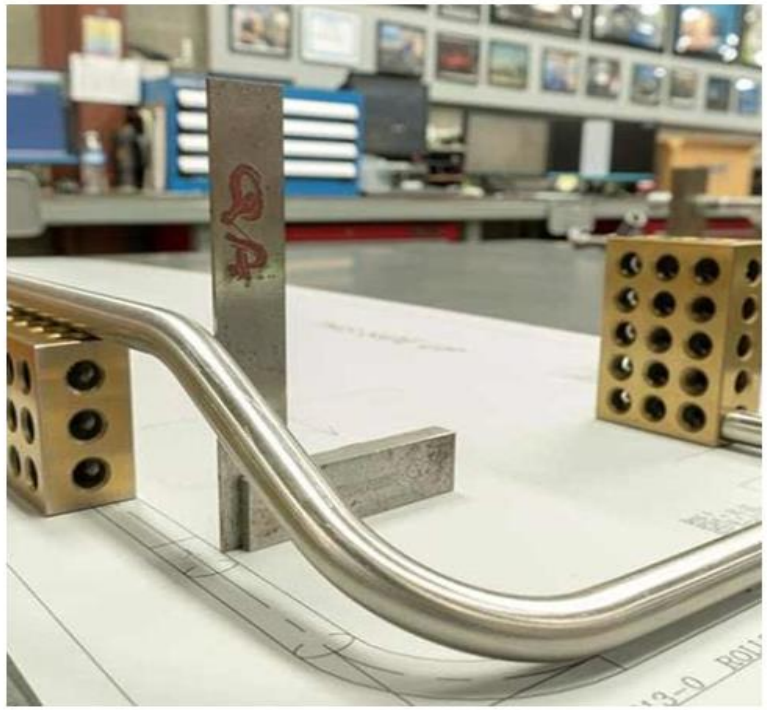
Challenges that were recognized that FX3D wanted to address

- Transforming old blueprints into data compatible with modern manufacturing processes and data models.
- Reverse engineering legacy parts from physical samples.
- Reducing waste in a low volume, high mix production environment.
- Accelerating the inspection process, which can sometimes take several hours.
- Converting digital data for multi-use functions within the supply chain to enhance capabilities and value.

Tube bending isn’t easy

- Being in the Tube bending industry for over 30 years and starting off in a tube shop, I've learned the difficulties of what it takes to make a good part .
- The data that you have and how you translate it will determine whether or not your part is correct

- Types of tube data include LRA (Length Rotation Angle)
- 2 D dimensional drawings
- Sample parts
- And lastly 3D modeled parts.

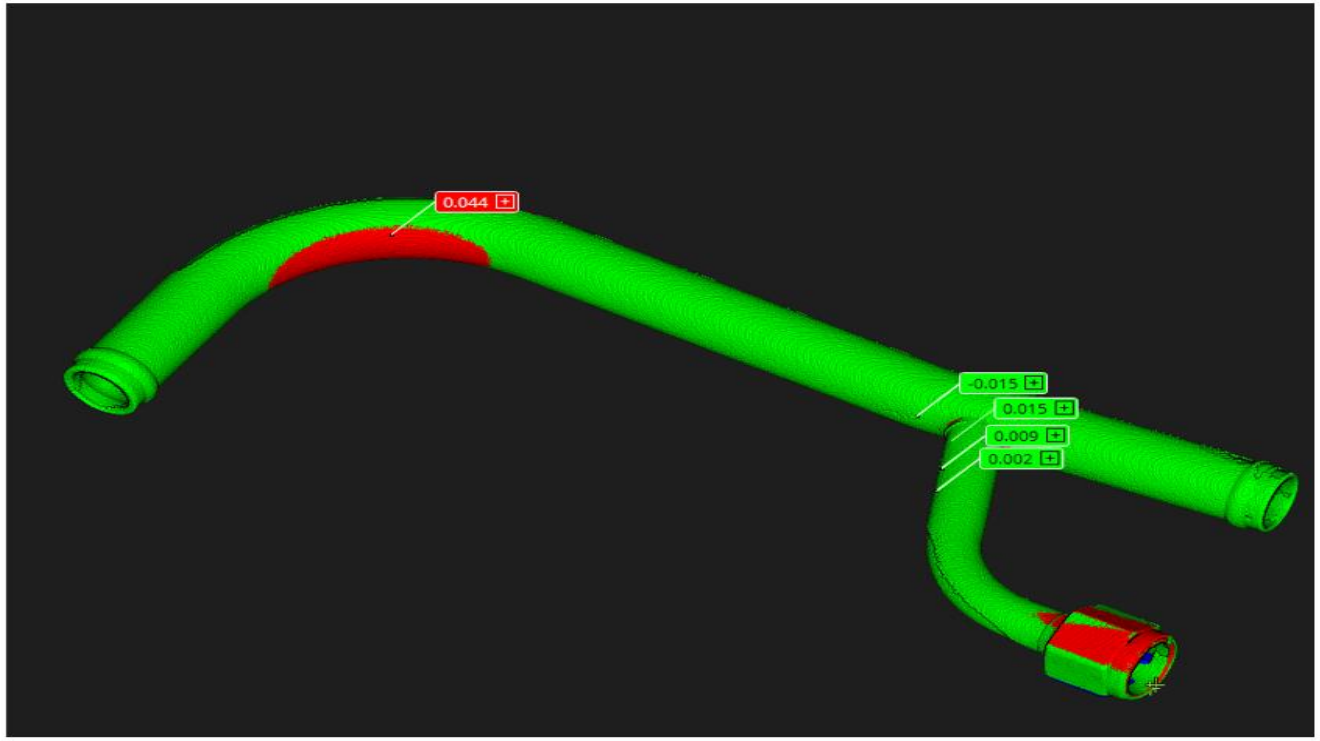


Dead Sea Scrolls

- Some of the biggest obstacles are having old data made in the 50's
- Similar from what you may find reading some of the old C-130 prints.
- This takes understanding how to translate LRA bend data (length, Rotation Angle) you would have to know the difference between a Holly Bender and a Leonard bender because the old machines gave you different results depending on what style bender you used.

Sample Legacy Parts scanned to 3D models

- FX3D converts old drawings into modern data formats. Using 3D laser scanners, we scan sample legacy parts to create digital twins and extract bend data.
- Additionally, we design digitally modeled fixtures that can be printed on demand with an accuracy of ±0.005 inches.
- The digitization of nearly all parts and data across our shop has evolved into what we call FX3D.

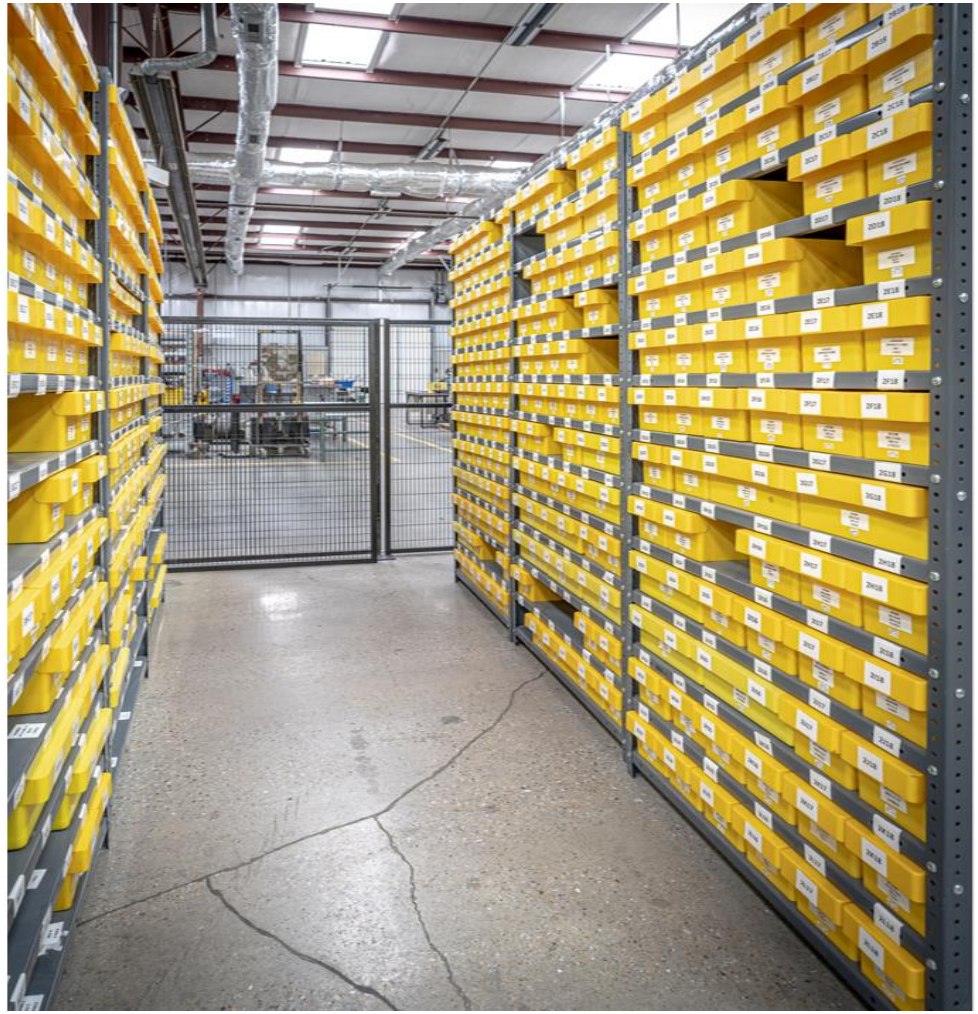


modular

- To scale this process for longer parts that exceeded a one-piece build, we divide the fixture into modular pieces that could be printed and reassembled on a pegboard-style plate.
- This innovative approach allowes us to design fixtures without the constraints of tube size.
- By capturing only the essential structures that supported points, angles, and rotations, we leave spaces between the printed parts while maintaining alignment as if it were a single-piece fixture.
- Using this new concept, we design our modular 3D printed fixtures, easy to ship and print on demand.

Print on Demand Digital Fixture Library

With our process, we are able to create a digital fixture library for all digital twin components that we manufacture. As you see, they are easy to store, taking up a very small footprint. They are also able to be printed quickly at remote locations.



Manufacturing Cycle Advantage

With modular fixtures , we can alleviate inspection bottlenecks, resulting in a 40% reduction in manufacturing time for parts moving through the shop. This process also decreases the number of NCRs, enhances material efficiency, reduces rework travelers, and prevents scheduling interruptions.

Legacy Parts – Modern Digital Solutions

Through the evolution of creating modular fixtures, we have added several additional features. These include laser projection, barcode scanning, and compact parts bins with a small footprint. The modularity has transformed from large, heavy metal fixtures to smaller, metal-printed components with magnetic pins and a no-tool system. Our advancements in metal printing have paved the way for future solutions, resulting in significant savings.

Supply Chain Value –Driving out Risk by Conforming Standards for Manufacturing

How Do Vendors decrease costs with Digital Transformation?

"Having a digital twin of a part, a system, or even an entire aircraft is only as valuable as what you do with it.
Speaking purely from the manufacturing side, I know firsthand the challenges of making parts from old data or samples. There are significant hurdles to overcome in PLM, security, interoperability, and making all the pieces come together as a whole for the benefit of a completely digitized aircraft. But it might as well be a hologram on your desk if you can't use it to drive down manufacturing costs and reduce the time it takes to get it through the supply chain."

Chris Harbaugh
Founder FX3D.com
Vice President Mundo-Tech Inc.

Level the playing field

Many of the legacy parts that need to be manufactured are unfortunately hindered by limited resources. The majority of these parts do not have a digital representation.

- Some problems are:
- The only resource known is named on the print, or there are few historically approved vendors.
- Limited or outdated data.
- Sample parts do not meet bend data requirements.
- Old methods or fixtures may be required, which are not readily available.
- Costs are driven up by single-sourced businesses.
- Lead times are extended due to limited accessibility and resources to focus on specialized supply chain vendors.

RoPix

We are digitizing a legacy

- FX3D has entered this arena with the goal of offering the best proven solutions to simplify the process of converting non-digitized prints and parts into digital twins.
- We have developed a patented process to create modular 3D printed fixtures with the precision to trim, assemble, and measure your most complex tube assemblies, driving down supply chain costs.
- Whether you need data conversion, part digitization, or digital fixtures for new or legacy parts, FX3D is committed to revitalizing our legacy aircraft and being the first step in the digital thread