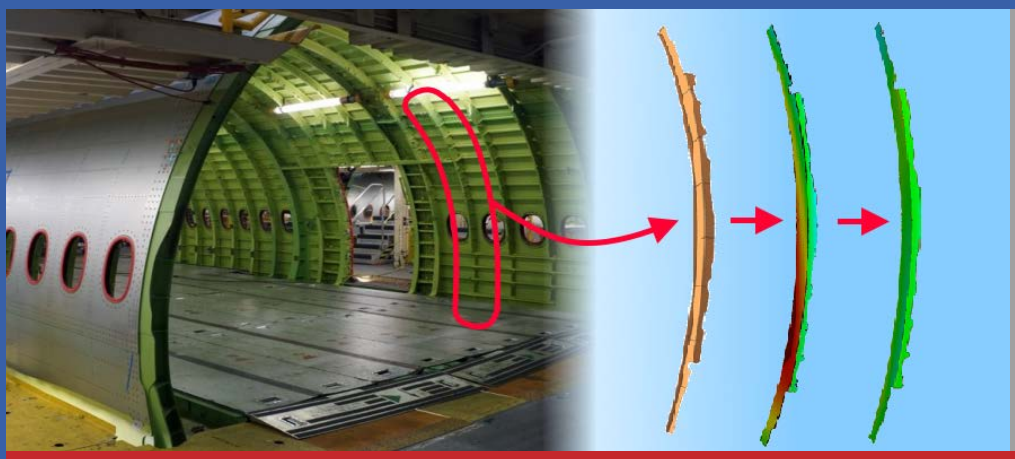


esrd Engineering Software Research & Development, Inc.

ESRD, Inc. is the developer of StressCheck®, the world's premier high definition simulation tool

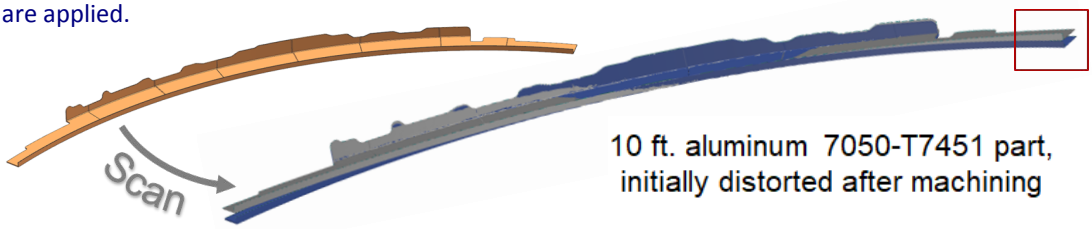
www.esrd.com

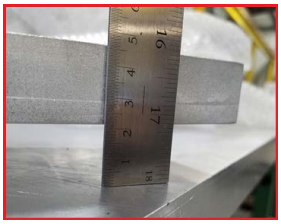
Predictive Reshaping Using Surface Treatments

This work was sponsored by the Air Force Research Laboratory with experimental support from The Boeing Company.

The Engineering Challenge

Near-surface processes such as shot peening, laser peening, and others can induce beneficial compressive residual stresses but problematic distortion, requiring parts to be mechanically reshaped or discarded. This is an expensive problem that often lacks quality and traceability. Additionally, the machining process itself can also cause excessive distortion before surface treatments are applied.





In other cases, surface treatments are used as a forming operation to achieve complex shape profiles with minimal raw material. In these cases the distortion due to surface treatments is desirable and must be controlled.

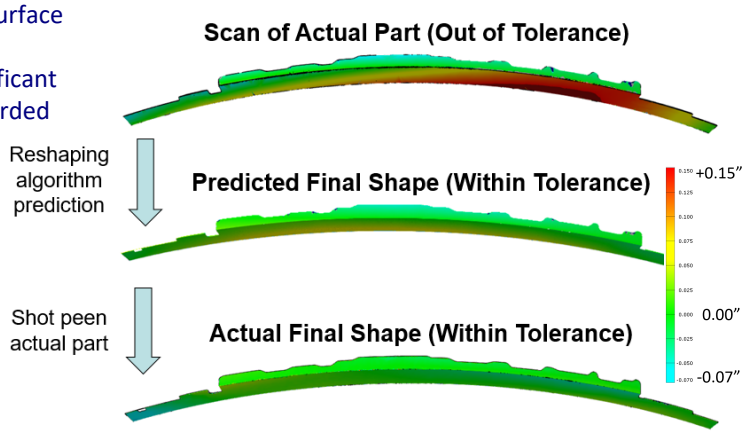
Now there is a reliable analytical procedure for predicting and correcting such distortion problems.

The Simulation Solution

Our predictive modeling tool leverages already prescribed surface processes to produce a desired shape change in complex 3D parts. The reshaping model built into the tool provides significant manufacturing cost savings by reducing the number of discarded parts and limiting the expensive trial-and-error search for optimal surface treatments.

➔ Use Cases Include:

- Reshaping of distorted parts
- Forming parts to a desired shape or curvature
- Minimizing deformation
- Distortion predictions



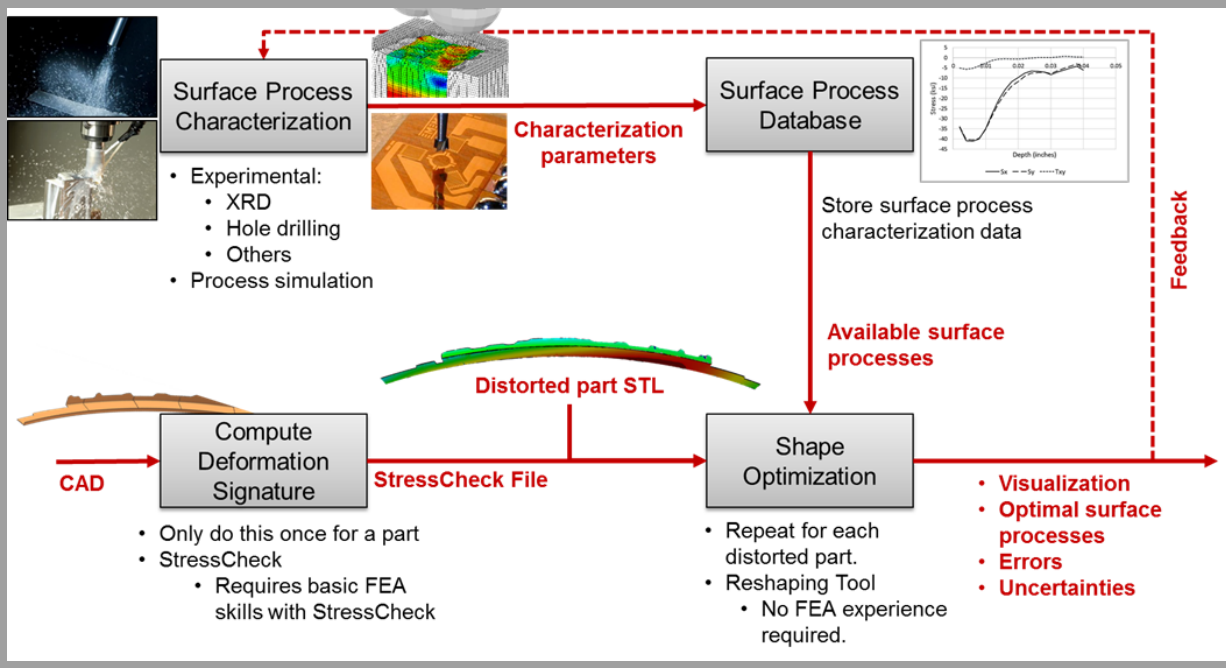
Value to Manufacturing

Reliable predictive reshaping is possible for a variety of processes, resulting in increased part production capabilities and lower rejection rates of finished parts. The model has been successfully validated using representative aerospace parts and manufacturing processes. Excellent correlation was observed between reshaping predictions and experimental results.

Learn more at esrd.com/about/safer-simulation

ESRD, Inc. 111 West Port Plaza, Suite 825. St. Louis, MO 63146. Telephone: (314) 744-5021

The Reshaping Process: Scan → Predict → Reshape

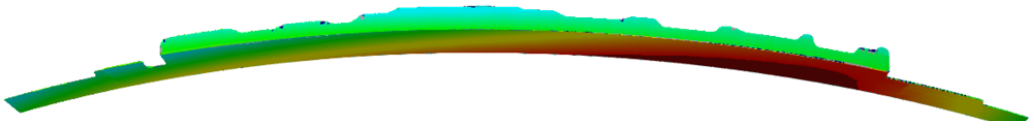


A Real Life Validation Success Story

Step 1: Scan

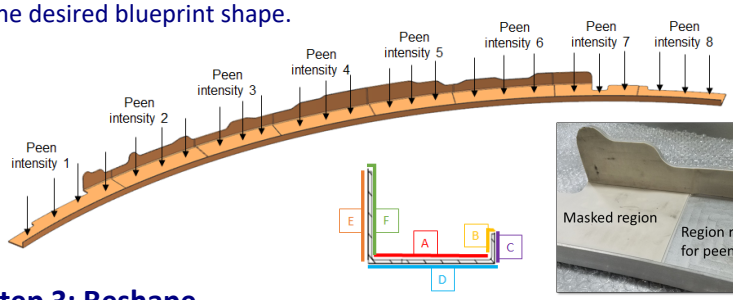
After machining, the part was scanned to determine the level of distortion as a result of the production process. The image below shows that the distortion due to the machining of a 10 ft long, aluminum 7050-T7451 part, has large regions severely out of the allowed design tolerance.

Initial Shape after Machining, Compared to Target Shape



Step 2: Prediction

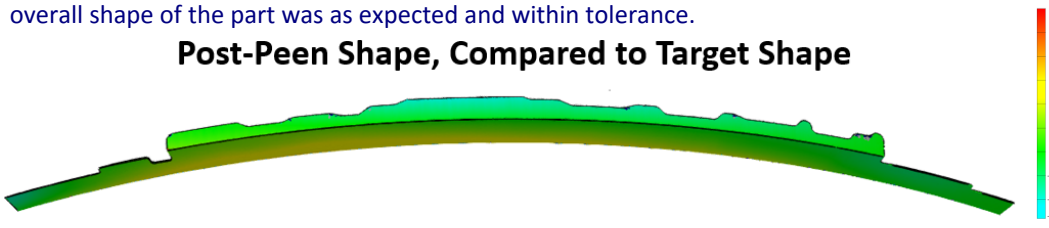
During the simulation, the part was divided into many independently-controlled peening regions, but the optimal peening solution chosen only required two different intensities on two regions. This was enough to reshape the distorted part back to the desired blueprint shape.



Step 3: Reshape

The part was shot-peened according to the predicted shot peening parameters procedure, and the improvement in the overall shape of the part was as expected and within tolerance.

Post-Peen Shape, Compared to Target Shape



Excellent correlation to the predicted shape!

Learn more at esrd.com/about/safer-simulation

ESRD, Inc. 111 West Port Plaza, Suite 825. St. Louis, MO 63146. Telephone: (314) 744-5021