



3D SCANNING

& REVERSE ENGINEERING





Overview

What is 3D scanning?

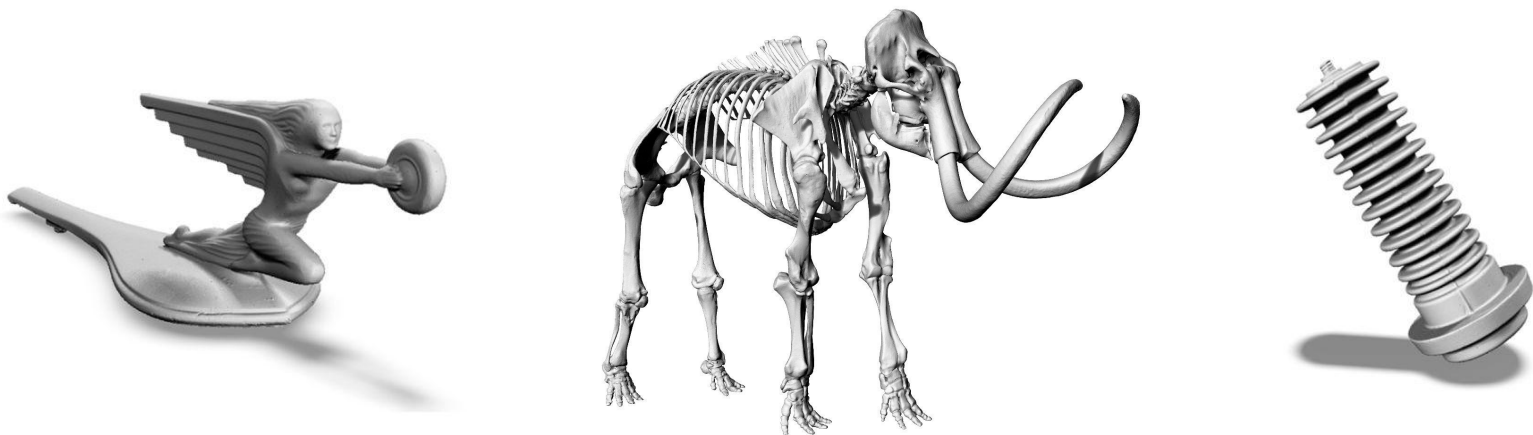
3D scanning is the process of capturing a physical subject in order to replicate it efficiently and accurately in a 3D digital environment.

How is that beneficial?

Scanning allows designers to create accurate and detailed digital models of physical objects that can then be modified and refined. It is an essential tool to aid in reverse engineering, where existing products can be scanned and analyzed to understand their structure and design. This is particularly useful when trying to create replacement parts or when developing a product that needs to fit with existing components. Scanning may be the more accurate and efficient option when the original CAD doesn't exist or taking manual measurements is inefficient or costly.

Generating a 3D scan is only the first step of the project.

From the scan data, a 3-dimensional model can be used in various applications and software programs. This includes, but is not limited to, Polygonal Models, CAD, CAE, CFD, FEA, and parametric reverse engineering.



INDUSTRY APPLICATIONS GENERALLY FALL UNDER THE FOLLOWING CATEGORIES

Reverse Engineering

Building CAD models from 3D scan data

Scientific Measurement

Monitoring measurement changes over time

Rapid Prototyping or Additive Manufacturing

High quality 3D printing used in commercial applications

3D Visualization

Modeling objects by referencing an existing object rather than creating from scratch for viewing, replicating, or digital archiving purposes

Inspection or Metrology

Comparing measurements and verifying parts against a standard

SPECIFIC INDUSTRY APPLICATIONS

Manufacturing

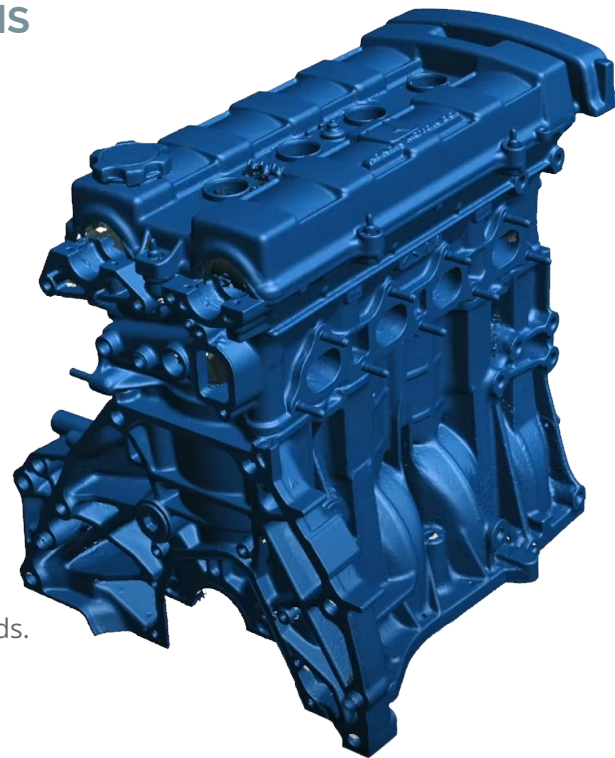
- Reverse engineer legacy parts that lack CAD models
- Create a mesh for 3D printing from an existing object without taking the time to create a model from scratch
- Perform detailed quality control checks on manufactured parts
- Collect detailed data for finite element analysis (FEA) and computational fluid dynamics (CFD)
- Recreate accurate CNC cutter paths to remanufacture older parts
- 3D scanning solves tool or mold repair problems when no history, drawings or design files exist.

Healthcare

- Create products that precisely fit the human body and are customized to patients needs. This includes orthotics, prosthetics, medical implants, or even dental applications.

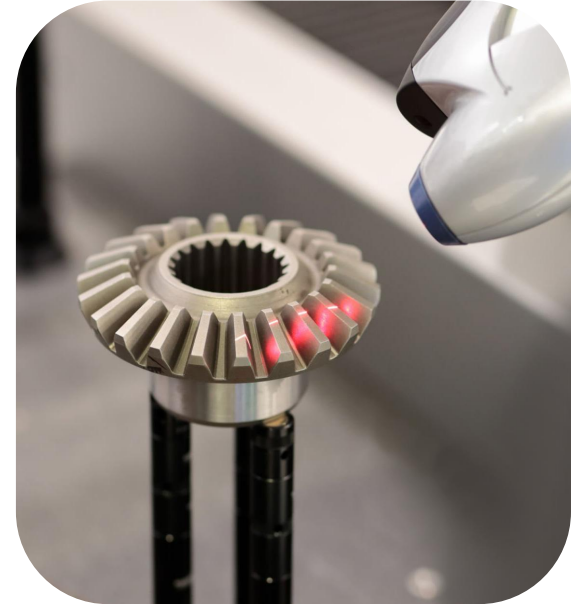
Automotive or Aerospace

- Collect data to generate 3D model if one doesn't exist or for FEA or CFD studies.
- Recreate original parts that cannot be purchased
- Designing of aftermarket components

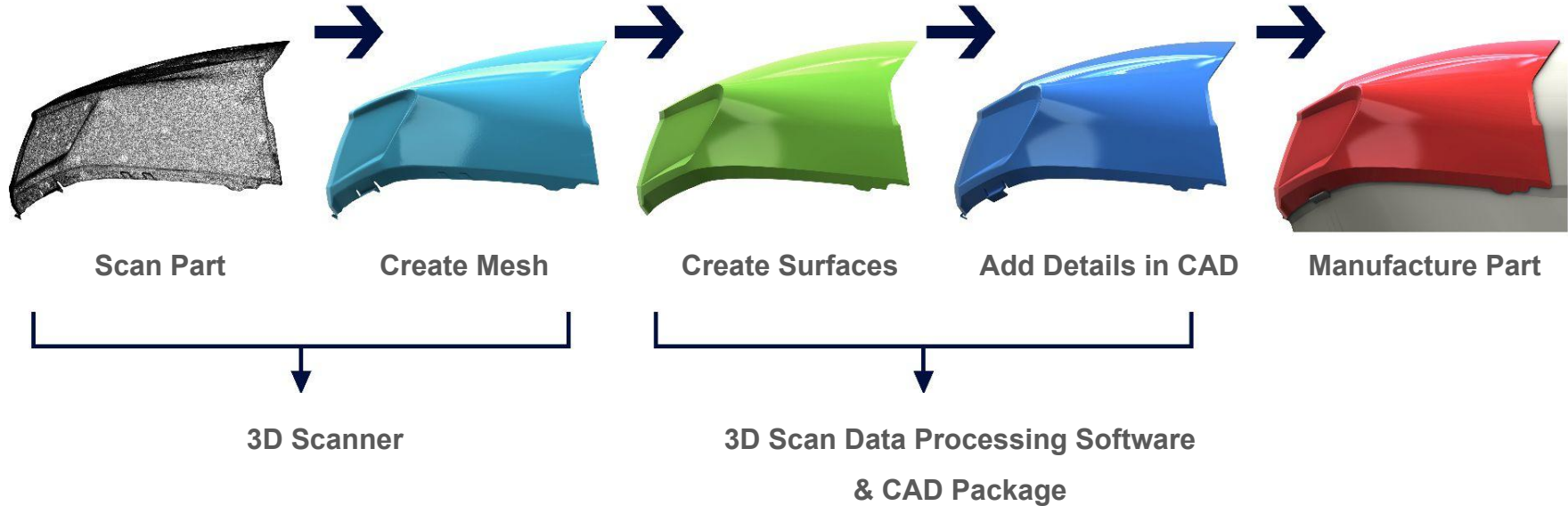


Benefits of 3D Scanning

- **No Original CAD, No Problem**
 - One of the main applications of 3D scanning lies in recreating parts. Combined with reverse engineering software, scan data can easily create accurate CAD models. Physical objects that are difficult to manually measure or complicated surfaces that are difficult to capture can easily be replicated using a 3D scanner. This can include full surface scans or even feature data.
- **Time Savings**
 - Using 3D scanning helps to streamline the design process by providing exact dimensions and accurately capturing unique surface contours. By precisely capturing the details of a surface at the beginning stages of the process, time and resources can be saved.
- **Accuracy**
 - In general, a 3D scan is going to more accurately capture features than manually generating CAD from measurements, especially if the surfaces are complicated.
 - (Quality Control) 3D scanning can perform non-contact inspections, quickly assess overall shapes and size, and detect issues like part warpage or dimensional discrepancies when compared to the original CAD. A highly valuable tool in manufacturing applications where quality of production parts is of the utmost importance.



How Does the Overall Process Work?



Depending on the end goal, the workflow from here will vary. *Generating the scan is just the beginning!*

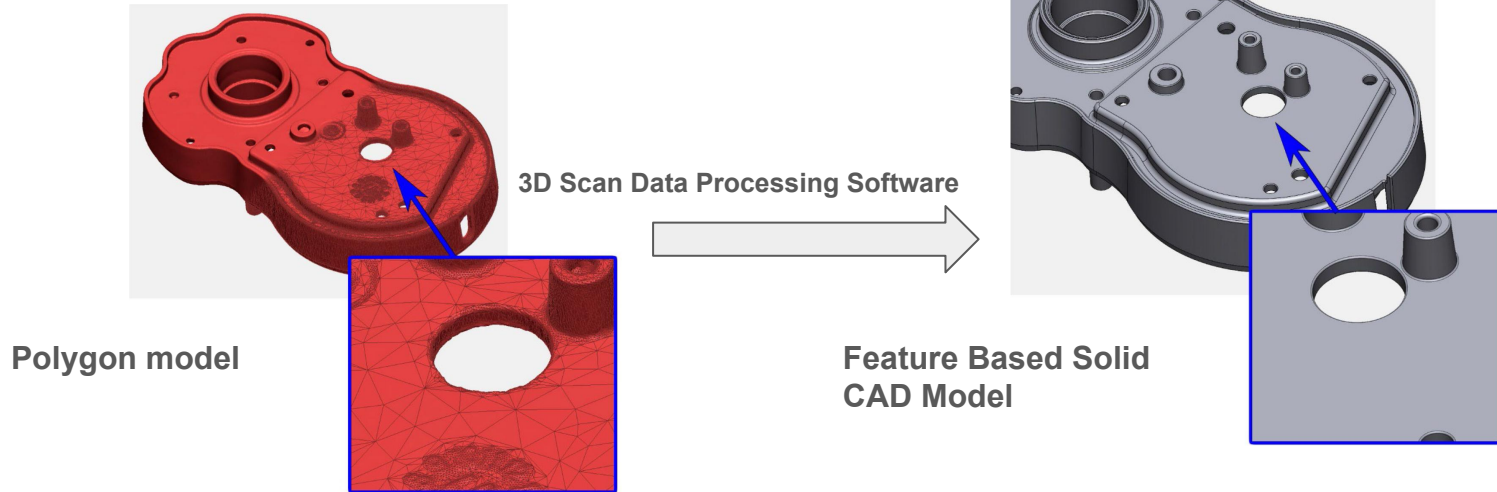
What is a Mesh?

Part of the scanning process is generating a mesh. But what is the difference between mesh and CAD?

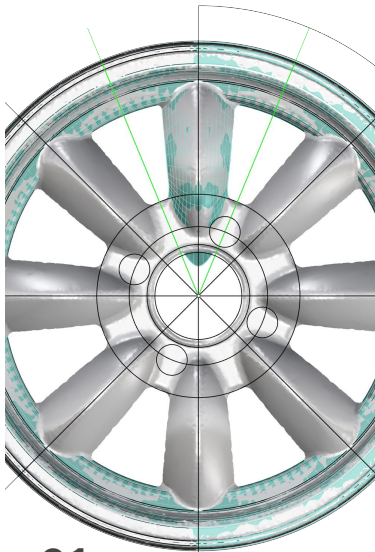
When an object is scanned, a 3D polygonal mesh is created (STL). This mesh is made up entirely of triangles to create a model. This helps to accurately capture the features and complex surfaces of the physical model.

A CAD model on the other hand is a solid body or NURBS based surfaces that can be easily manipulated and changed. From the CAD model, parts can be manufactured, simulations can be run, or design changes can be made.

Software is used to process the scan data from a polygonal mesh to CAD.

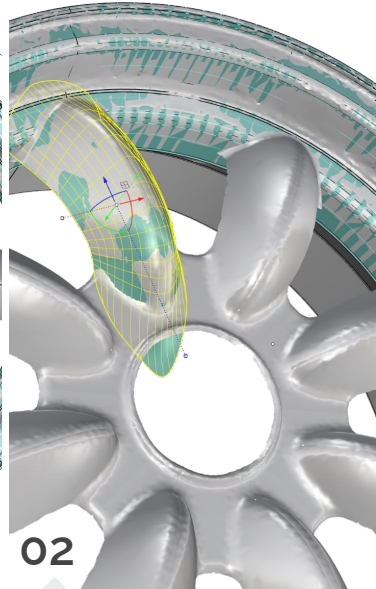


Processing an Automotive Wheel from Scan to CAD



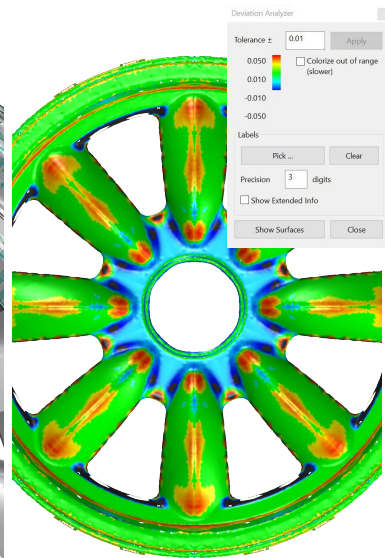
01

Scan and import the mesh into the proper CAD software.



02

The tedious process of applying CAD surfaces over the mesh.



03

The deviation for this model is within 0.01 inch from the scan to the CAD model surfaces.



04

Completed CAD model.

A World of Scanning Possibilities

3D scanning is a valuable tool for generating highly accurate 3D digital models of physical objects *quickly* and *efficiently*.

- Ideal when the original CAD is no longer available.
- Valuable in a variety of industries from manufacturing to healthcare, to automotive, to aerospace and beyond.
- *Generating the scan itself is just the beginning!* From the scan data, a mesh is generated and processed into a useable CAD model.
- Completed models can then be used to manufacture recreations of the part, develop new designs, run simulations, or various other applications.

