ON3D LAB · PRACTICAL GUIDE

OBSOLETE PART REPLACEMENT

REVERSE ENGINEERING, 3D SCANNING, AND MANUFACTURING



Practical guide: reverse engineering an industrial spare part

ON3D Lab, professional 3D printing and prototyping laboratory · Oran, Algeria · Version 1.0 · October 2026

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At a glance: the guide in brief

Scanning ≠ modeling	The mesh is a measurement of the observed object; the CAD model is the definition of the part to manufacture.
Function first	Identify interfaces, hole spacing and service conditions (heat, vibration, impact, chemicals) before measuring.
Scan or calipers?	Simple part: targeted measurements. Curves, ribs, blends: scan. The two can be combined.
Rebuild, don't copy	A cracked or worn part is not copied as is: the useful geometry is recovered from the sound areas.
Prototype and inspect	Check assembly, clearances and function before final manufacturing; scanner accuracy is not the accuracy of the final part.
Archive	Scan, CAD, critical dimensions, material and inspections form a digital spare-parts stock.
Critical parts	Safety-related, highly stressed or regulated component: engineering validation is essential.

A machine still works, but a small plastic part breaks. The manufacturer no longer supplies it, the drawing has disappeared, or the lead time has become unreasonable. In some cases, reverse engineering makes it possible to start from the physical part, create a usable CAD model, manufacture a new part, and check that it fits.

The shortcut "scan, then print" is misleading, though. Between measurement and manufacturing, you need to understand the part's function, rebuild the important areas, choose a material, and check the result. This is where the quality of the solution is decided.

When the part exists, but its data does not

A cover, a guide, a handle, a sensor bracket, or an interface part can shut down a piece of equipment even though the rest of the machine is usable. If the drawings and 3D files are no longer available, the part kept on site becomes the main source of information.

Reverse engineering means recovering a digital definition from that object. The goal is not always an exact copy: a worn or deformed part may require reconstructing its original shape and adapting it so that it remains compatible with the machine.

This approach is especially useful for a maintenance part, a prototype, an adaptation, or a small batch. It can also prepare a later production run by another process when quantities increase.

Scanning a part is not yet modeling it

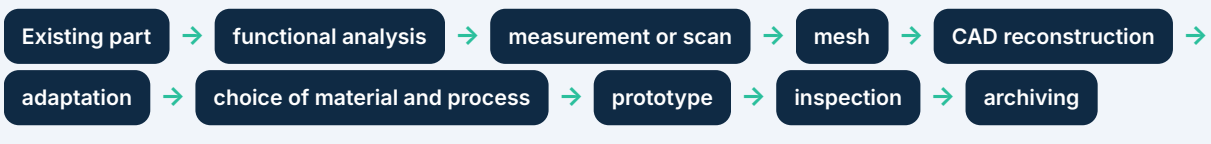
A 3D scanner captures the visible surfaces. Its data is generally turned into a point cloud, then into a mesh made of triangles. This mesh describes the shape as observed, including any defects.

A parametric CAD model instead describes elements that can be understood and edited: planes, axes, diameters, holes, thicknesses, or radii. It makes it possible, for example, to correct a hole spacing or locally reinforce a fastening without reworking thousands of triangles.

The Autodesk Fusion documentation shows how mesh sections are used as the basis for sketches, then for rebuilding surfaces and parametric solids. Specialized software such as Geomagic Design X also offers tools for processing scans and reconstructing CAD models.

> **Key takeaway:** the mesh is a measurement of the observed object. The CAD model is a definition of the part you want to manufacture.

The steps, from physical part to reusable file



1. Understand the function before measuring

First, identify the interfaces: bearing surfaces, fasteners, axes, clips, cable routes, seals, and assemblies with neighboring parts. An outer curve may be secondary while the spacing between two holes determines the whole assembly.

Service conditions matter as much as dimensions: heat, vibration, impact, humidity, sunlight, oils, chemicals, and frequency of use. They guide the reconstruction and the choice of plastic.

2. Choose between manual measurement and 3D scanning

A drilled plate or a simple spacer is sometimes quicker to rebuild with calipers and targeted measurements. Scanning is useful when the part has curves, ribs, blends, or surfaces that are hard to measure directly. The two methods can be combined: scanning for the general shape and direct measurement for the functional dimensions.

A scanner's stated accuracy does not describe the accuracy of the final part. For example, Creaform states up to 0.030 mm for the HandySCAN 3D PRO. This value applies to that measurement system under its reference conditions. It does not guarantee the accuracy of a printed part, nor the capabilities of another workshop.

The final quality depends on the whole chain: condition of the original part, acquisition, mesh processing, CAD reconstruction, process, material, manufacturing distortion, and inspection.

3. Rebuild the useful geometry

An old part may be cracked, worn, crushed around a screw, or deformed by heat. Faithfully copying that geometry would sometimes mean reproducing its defect.

The aim is then to recover a consistent geometry from the intact areas, symmetries, mechanical axes, and adjacent parts. Critical dimensions are defined and checked separately. Shape changes intended to improve the part must remain compatible with the equipment.

4. Manufacture, assemble, and inspect

A first part can serve as a prototype: you check the overall size, fasteners, clearances, and assembly before deciding on final manufacturing. The material and process are chosen according to the actual loads and environment. A part that can be printed is not automatically fit for service.

For components related to safety, subject to high stresses, or requiring approval, an appropriate engineering validation is essential. A simple fit test is not enough.

Example: a cracked protective cover

Imagine an old plastic cover, cracked around two fastenings. A scan can capture its outer shape and curves that are hard to measure. But the damaged areas should not be copied as they are.

After examining the possible causes of the crack, the fastenings are rebuilt in CAD from their axes and the machine's interfaces. If the available space allows, a more generous radius or a locally reinforced thickness can be considered. A prototype is then used to check the fit and correct the model.

The result is therefore not just a reproduction: it is a verifiable, reusable digital definition.

What to keep after the first manufacturing run

The first copy replaces the part. The CAD file, on the other hand, avoids redoing all the work the next time it is needed. It can be corrected, adapted to another version of the machine, or used as the basis for tooling.

To keep a useful record, it is best to archive:

- the raw scan and the cleaned mesh, if they exist;
- the CAD model and its version;
- the critical dimensions and interfaces;
- the material and process used;
- the useful manufacturing parameters;
- the results of inspections and fit tests.

This file forms a kind of digital spare-parts stock. It does not replace the validation of each new manufacturing run, but it reduces the reconstruction work.

What role for 3D printing?

3D printing is particularly relevant when the quantity is small and a mold or conventional tooling would be disproportionate. It can speed up prototyping, validation, and some maintenance manufacturing.

The standard ISO/ASTM 52900:2021, confirmed in 2025, defines the general terms of additive manufacturing. In a real project, the manufacturing file is only one step: stiffness, heat resistance, flexibility, chemical resistance, build orientation, and long-term behavior must also be examined.

The best choice is not simply "the strongest plastic". It is the combination of a geometry, a material, a process, and an inspection suited to the use.

When is this approach relevant?

Situation	Value of reverse engineering
Part discontinued by the manufacturer or drawing unavailable	High if a sample or its interfaces remain accessible
Small quantity or prototype needed	Often high
Complex shape that is hard to measure	Scanning can save time
Simple, easily measured part	Direct measurement may be enough
Worn or deformed part	Possible, by rebuilding the functional areas
Very large series	Useful for the prototype; another process may suit production
Safety-related or regulated component	Study, testing, and specific requirements are essential

Limits to be aware of

A scanner generally sees only the accessible surfaces. Cavities, hidden areas, and internal geometries require other measurements or examination of the neighboring parts. If the original material is unknown, choosing a replacement polymer requires additional analysis.

Success is judged on the function of the new part, not only on its visual resemblance. It also depends on the study time, the total cost, and the level of validation required. For a simple part that is still available at a reasonable price, reverse engineering will not necessarily be the best choice.

In Algeria, a practical use for maintenance

For a workshop or an industrial company that operates older equipment, having local capabilities for measurement, CAD, and manufacturing can make it easier to study an unavailable part. The same approach can be used for a prototype, an adaptation, or a small pre-series before moving to a more suitable production process.

The benefit is turning an emergency repair need into reusable technical data, while checking that the manufactured part really meets its intended use.

Conclusion

Faced with an obsolete part, the first question is not only "Can we print it?". You first need to know whether its function can be recovered, a reliable geometry rebuilt, and a suitable manufacturing method chosen.

At ON3D Lab, the study can start from the existing part and its mounting environment: feasibility analysis, 3D modeling or reconstruction, choice of plastic, prototype, and inspection. If you have a broken part or no 3D file, this first analysis determines whether reverse engineering is relevant.

Quick glossary

Reverse engineering	Process that recovers a digital definition (3D model) from an existing physical part.
Point cloud	Set of points measured by the scanner on the visible surfaces of the part.
Mesh	Surface described by thousands of triangles, derived from the point cloud. It records the object as it is, defects included.
Parametric CAD	Model made of understandable, editable elements: planes, axes, diameters, holes, thicknesses, radii.
Hole spacing	Distance between the axes of two holes or fastenings; often the dimension that determines the whole assembly.
Additive manufacturing	Standardized term (ISO/ASTM 52900) covering 3D printing processes.

An obsolete part to remanufacture?

Bring the broken part (or describe it): we assess the feasibility, the measurement method, the material and the prototype suited to your equipment.

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Scan to message us on WhatsApp

Sources

- Autodesk Fusion — Create a mesh section sketch.
- Hexagon — Geomagic Design X.
- Creaform — HandySCAN 3D PRO Series.
- ISO — ISO/ASTM 52900:2021.