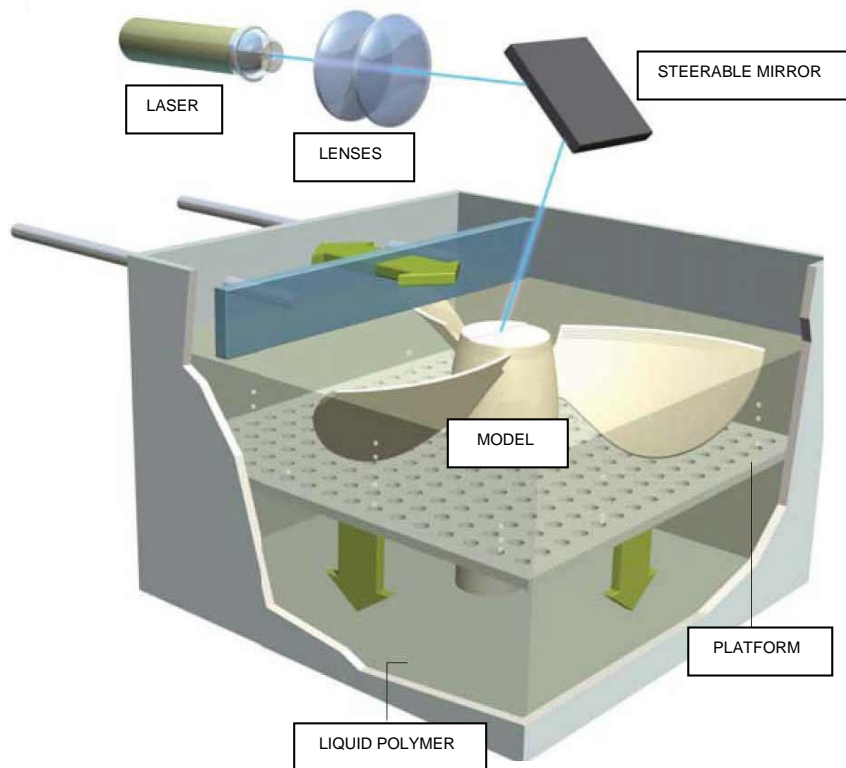


# WORKING KNOWLEDGE

## RAPID PROTOTYPING

**STEREOLITHOGRAPHY:** Software translates design data for an object into a series of very thin cross sections. A perforated platform in a vat of liquid photosensitive polymer rises to the surface. The fluid bubbles up through the platform, and a blade sweeps across, leaving a film. An ultraviolet laser beam, directed by a mirror, traces out the first cross section, converting precise portions of the coating into a solid. The platform drops slightly, and the blade smooths the liquid just over the solidified area. The laser hardens the second layer on top of the first, and so on, building up the structure. Support columns are added as needed and are later removed.



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## MAKE IT FAST

**BEFORE manufacturing** a new product, companies craft models or prototypes to check designs, assess appearance, test fit and function with other parts, or fine-tune molds and dies for the production line. For decades, prototypes have typically been made by hand from drawings, a slow and expensive exercise. But in recent years, various rapid-prototyping techniques that automatically produce three-dimensional parts from computer-aided-design data have reduced the time from weeks to days or hours.

Automotive, consumer-products and medical-device engineers are among the most avid users, along with service providers that make models for clients. Objects are built additively as a series of very thin layers of resin, extruded plastic or powder that are hardened [see illustrations].

Stereolithography was the first process and is now the most widely employed. "Maybe 30 other processes have been attempted, but only five or six" have prevailed, says Ron Barranco, owner of Stereolithography.com, a service in Palo Alto, Calif. Stereolithography machines may range from \$180,000 to more than \$500,000.

Object size is typically less than 24 inches along the X, Y and Z axes, but larger machines are emerging. Some can build commercial goods directly, eliminating the need for molds, dies and machining, but most products still struggle to match the mechanical, thermal, durability or low-cost properties achieved by traditional manufacturing. Nevertheless, "if production cost is high, volume is low and the object's shape is complex," then rapid prototyping can excel, says Terry Wohlers, president of Wohlers Associates, prototyping consultants in Fort Collins, Colo. For example, most in-ear hearing aids are made this way, because each piece must be custom-fit to each patient's ear canal.

The **RAPID PROTOTYPING** market is growing fast. Proponents say rapid manufacturing is the next step, as tougher materials and still greater precision are demonstrated. -Mark Fischetti

**COMPUTER-AIDED-DESIGN** software may define an object as a series of triangles, fine mesh is better, please request the STL export instructions, in part to encode a designer's raw solid modeling data. A stereolithography machine would then redefine the model as layers for fabrication.

FINE MESH

COARSE MESH

