

A UAV Build-Up

An affinity for rapid prototyping is helping laser sintering enter A&D

By Michael Mecham

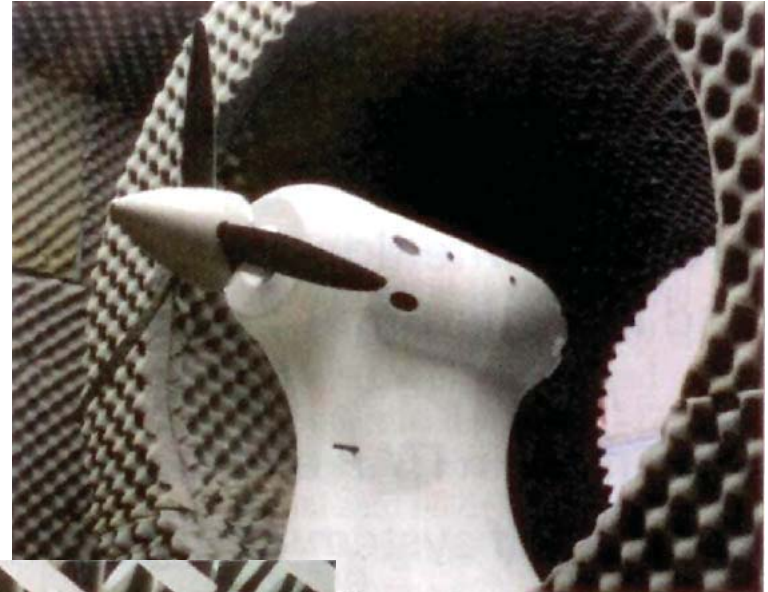
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Selective laser sintering (SLS) is an additive manufacturing process that is an offshoot of stereo lithography from the 1980s. By scanning cross sections of a part in a 3D computer design, engineers are able to use high-power lasers to fuse powdered materials to make the actual part. Unmelted powder acts as a mold; the completed part is lifted away from it.

“It’s like building a loaf of bread slice by slice,” says Alex Dick, vice president of operations for five-year old Northwest UAV Propulsion Systems, which makes nylon parts for unmanned aerial vehicles in McMinnville, Ore. Boeing’s Insitu, which makes special-mission, catapult launched UAVs across the Columbia River in Bingen, Wash., is a customer.

From the first SLS experiments in the mid-1990s it took some time before the process’ production materials, lasers and step motors matured, recalls Jim Williams, president and CEO of Paramount PDS of Langhorne, Pa., another UAV specialist. But laser sintering’s affinity for rapid prototyping of complex, thin-wall parts that are lightweight and high quality was a natural fit for specialized designs, like those in UAVs. So far, the attraction extends only in the transition from design to reality and not into production, says Ahmad Ziada, Insitu’s director of engineering and projects.

First applied in dentistry, SLS has spread from automotives to architecture, says Udo Behrendt, who leads aerospace accounts at EOS of Krailling, Germany, which manufactured the sintering machines used by Northwest UAV and Paramount. A&D applications began early in the decade on fighters such as the Boeing F/A-18.



Paramount uses a glass-filled polyamide powder from EOS to produce UAV control vanes (left); Northwest UAV Propulsion is working on variable pitch propeller designs (top) from nylon.

A breakthrough in commercial jets waited for FAA regulatory approval and the emergence of a project open to new processes. That came two years ago with Boeing’s 787, says Frederick Claus, business development manager at Solid Concepts of Valencia, Calif.

But UAVs have been the big news lately. Two factors help: UAVs do not face the same certification issues as manned aircraft and the industry’s culture makes it a natural fit, says

Dick. "There's more of a 'let's try it' [attitude]," he says. "It's very non-aerospace-like."

It is in this arena that small- and medium-sized companies like Paramount (40 employees), Northwest Propulsion (25) and Solid Concepts (300) operate.

SLS manufacturing is dominated by two key players: EOS, and 3D Systems of Rockhill, S.C., which provide both raw materials and processing machines. Their powdered polymers or metals are as much a part of their intellectual property as their machines.

Northwest focuses on nylon for propulsion parts such as injectors, ducts and shrouds. Recently, it began adapting the tough, flexible plastic to variable pitch propellers with as much as a 2-ft. dia.

Paramount's roots are in the 1960s as a toy and model builder, but it now focuses on "anything that is custom, that is for aerospace and the military," says Williams. Customers include Honeywell Aerospace for its T-Hawk micro air vehicle, which uses control vanes for anti-rotation. But it also sees potential weight-saving applications on the F-35 Joint Strike Fighter. "In the Northrop Grumman section forward of the wing there are 1,600 parts that are eligible," he says.

The caveat, he adds, is meeting production requirements.

At Solid Concepts, which uses machines from EOS and 3D Systems, the client base is so broad it even includes yard and garden implements. But A&D work has grown to a third of its \$40-million annual revenues.

Behrendt is seeing General Electric, Rolls-Royce, Pratt & Whitney and Snecma beginning to use SLS in their development cycles and predicts GE will use a SLS alloy fuel injection system by 2013.

3D Systems has been on an acquisition tear to meet demand, says Vice President for Marketing Cathy Lewis. It had forecast A&D growth to account for 10-15% of its \$130 million anticipated revenues this year, but now thinks surging sales will lift that portion to 15-20%, she says. Helicopter makers are among the newest manufacturers interested.

Most A&D work is for non-structural parts but Solid Concepts is starting to go after structural/non-flight critical work. Give the industry 20 years and it will be applying titanium to flight critical parts, Claus says. "There is no tooling, changes can be made on the fly and a virtual inventory reduces part count. There's a lot going for [laser sintering]. It's only going to get better."