HIGH-PERFORMANCE PROTOTYPING AT 3PAR

You've heard it before: "If it looks too good to be true, it probably is." That's what Eugene Hsue thought when he first read about rapid injection molding. Hsue is the product design manager at 3PAR, a leading provider of Utility Storage solutions that deliver a simple, efficient, and massively scalable tiered-storage array for utility computing environments. 3PAR's expansive growth over the past few years has enabled penetration of their Utility Storage arrays into leading Fortune/Global 1000 accounts around the world. As a result of this tremendous growth, 3PAR had to find a prototyping solution that provided true functionality with rapid response times. Protomold's rapid injection molding fit that need perfectly.

Hsue has plenty of experience in plastics design and product development. Before going to work at 3PAR, he was a product designer at SGI. When he read in a journal about Protomold's promise of injection molded parts in just three days, it definitely seemed to be one of those 'too-good-to-be-true' solutions. Despite his doubts, however, Hsue investigated further.

"Developing parts for 3PAR InServ" Storage Servers while working to get our systems to market quickly and at reasonable development cost is tricky," says Hsue. "Most of the mechanical components are critical to system functioning, have to withstand physical loads of various kinds, and are subject to a variety of environmental conditions. Everything we develop needs to be thoroughly tested before being put into production, and tooling for prototypes can be very expensive. But the biggest problem we generally face during this process is delay. Traditional machining for injection molding could take eight to 12 weeks. When you add that on top of the lead times for models and functional testing, designing in a plastic part could mean sacrificing time to market."

"During the prototyping process we did our best to use Protomold's standard delivery time of three weeks," says Hsue. "However, there were times when we utilized its fast-turnaround service to get parts in days instead of weeks. The company has come through for us time and time again, even on short notice."

Functional testing at 3PAR covers a variety of structural and material attributes. To measure a part's ability to withstand mechanical stresses, they are subjected to both static and dynamic loads. In an enclosed environment, they can also be subject to accumulated heat, which can affect performance. To meet regulatory requirements, parts must also be tested for variety of safety issues such as flammability and electrical performance.

"In a competitive market like ours, the service Protomold provides is a great fit," says Hsue. "Tooling is a big deal in our business. It can be a large capital expense and affect the return on our investment. Unlike SLA or some of the other rapid prototyping methods, Protomold can give us parts in a variety of finishes and in any resin we want, and they can do it without the delay of traditional injection molding. Real injection molded prototypes in the same resin used for production makes testing a lot more useful. And best of all, once the design is proven, we can use Protomold's tooling to go right into production while we wait for standard steel molds to be made."

Hsue offers the example of an air duct that was being developed for use in a new product. A thermal analysis of the original design showed the need for additional ducting to maintain the required thermal margins. The group was already in the middle of the

design process and the change was totally unplanned. A quick reaction was needed to avoid holding up the entire process. Until that time, the designers had always used Protomold's standard turnaround of three weeks, but in that case they asked for and received parts in less than a week. They tested and validated the new ducting, got the thermal performance that was needed, and kept the project on schedule.

In another case, the 3PAR team was designing a polypropylene air duct with a living hinge. The prototypes from Protomold fit the specification, but in testing they ran into problems with hinge breakage. They worked with a Protomold process engineer, and with some slight design modification produced a hinge that passed testing and could be put into production. "The company's automated quoting is quick and easy and provides plenty of design feedback," says Hsue. "But when we needed live engineering help it was there."

Protomold's design expertise proved useful again when Hsue's group was developing a retention bracket designed to hold a hot-swappable fan in place with a couple of snaps. The design looked perfectly workable, but in testing of the actual prototype it became obvious that two snaps weren't going to be sufficient. The addition of two more snaps solved the problem and eliminated the possibility of future failures. In another instance, the selected grade of plastic turned out to not have the correct flammability rating for its application. Hsue and his team were able to get new parts made of a more suitable resin in a matter of days.

"Over time, the actual number of changes we've had to make after testing prototypes has been small," says Hsue. "Most of the time, testing has verified the validity of our original design, but those occasional changes remind us of the importance of functional testing with parts that match our production specs. Rapid prototyping processes like stereolithography can provide prototypes quickly, but the types of functional testing you can do with an SLA part are limited. Machining is another option, but a machined part is often idealized because you don't see things like warpage or molded-in stresses. Our production parts are typically ABS, nylon, polypropylene, or polycarbonate and we need to know how the actual resins will perform. Rapid injection molding gives us molded parts in actual production resins."

When Hsue and his group first began working with Protomold, rapid injection molding was limited to parts that could be produced in straight pull molds. Hsue is aware of the added ability to produce more complex parts in cam-equipped molds with up to four side actions per mold, but has never had to use that capability. "The ability to do side actions is interesting," he says, "but we try to keep part design simple. For the types of parts in our designs, we can usually achieve a needed undercut using a shutoff instead of a side pull."

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"We've been especially pleased at how adaptable Protomold's process has been for bridge tooling. At first glance, the company's web site may give the impression that their process is just for prototypes. In fact, it has also been a big help to us in initial production. We've found it to be cost effective for hundreds, even thousands of parts. And, as with prototypes, the speed of turnaround has been a huge benefit."

"Protomold has become our go-to vendor for quick-turn plastics. We know we can count on good parts at a reasonable price with excellent lead times. The company's services have made a big difference for our entire business. Our operation is just part of product development. We work in cooperation with every group in the company. Because there are so many processes feeding into a finished product, a holdup anywhere in the process affects everyone. When we can solve problems affecting some aspect of the process without impacting development schedules, everybody benefits."