Collaboration Is the Key To Success in 3D Development Project

In the early 1990s, MIT graduate student Thomas Massie, along with Kenneth Salisbury, then a principal research scientist at MIT's Artificial Intelligence Laboratory, developed a haptic device for touching 3D computer data as Massie's thesis project. The device, named Phantom, achieved wide recognition at MIT and within the wider research community for its ability to "touch" and manipulate virtual objects on a computer screen.

by bill petch

IN 1993, MASSIE FOUNDED **SENSABLE Technologies, Inc**. (Woburn, MA) to build and market the *Phantom Desktop*, shipping the first unit the same year. Next, the Phantom Desktop unit was designed, based on high-volume production processes, in anticipation of wide acceptance of SensAble's FreeForm Modeling system—a unique 3D touch-enabled computer-aided sculpting system that allows users to rapidly produce highly detailed organic models. But the company was just five years old, available project capital was limited, and exact production volume—which was dependent on market acceptance of the new product design—was still uncertain.

The Road to Success

In 1998, after talking with a local die caster, SensAble approached **Armstrong Mold Corporation** (East Syracuse, NY). Armstrong specialized in development applications and had decades of experience producing functional prototype and short-run components in metal and plastics. As a first step, Armstrong engineers facilitated a first-round design application review for the three critical new components of the Phantom Desktop—base, front cover, and back cover. DFM (design for manufacturability) guidance was provided to avoid production problems. Armstrong's rubber plaster mold (RPM) process was used to make the three components as aluminum castings. RPM provides castings with the appearance and properties of die-castings, but tooling costs are lower by an order of magnitude, and lead-time is only two weeks, as opposed to two to three months. SensAble placed an order for prototypes, and

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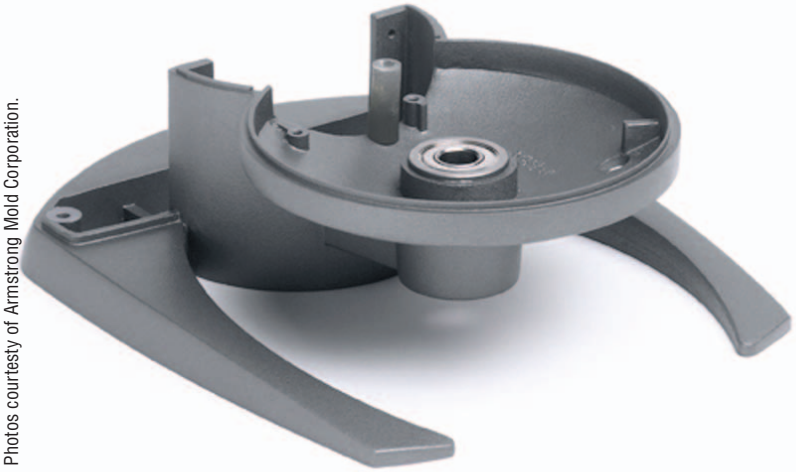

Photos courtesty of Armstrong Mold Corporation.

provided CAD files for Armstrong Mold to use to produce stereolithographic models to develop the silicone rubber patterns used in the plaster mold foundry. Within three weeks—at minimal cost—a prototype Phantom Desktop device was assembled, fully functional, and ready to present to the design community. It had not been necessary to compromise the "look and feel" of the design in any way.

"The FreeForm system was an instant success, and was increasingly well received in the marketplace," said Tom Massie, president of SensAble Technologies. "Armstrong Mold continued to produce small-lot casting orders to meet the required assembly rate without delays, and with no need to hold large parts inventories. As the volume of orders increased, Armstrong engineers suggested converting the two cover castings to their graphite permanent mold process. When we did this, it provided a higher production rate and a reduced piece price, but still with only a modest investment in tooling."

Further Market Growth

SensAble saw further market growth in their future, so in early 2003 Armstrong Mold hosted a one-day cost reduction initiative meeting at their plant to plan for the unfolding product development path. As a result, cost reduction modifications to the RPM tooling were introduced as an interim measure, and plans were made to migrate the two covers to other manufacturing processes. The front cover was converted to Armstrong's short-run die-casting process, while the back cover was produced by the kirksite plastic injection molding process. Further growth in production rates will be achieved when needed by substituting regular production die-castings and injection-molded parts. It will not be necessary to change the appearance or function of the assembled Phantom Desktop device.

"Introducing a new product to market involves making early decisions that critically affect the success of the whole project," says Paul Armstrong, Director of Sales and Marketing of Armstrong Mold. "Sophisticated industrial design and strong styling are important to communicate product credibility—in the marketplace, and possibly also to investors. Thus, prototypes should look and function like the final product. Investing up-front in production tooling—such as steel dies—involves a major commitment of capital and lead-time before a single part can be produced; simulating a mass-produced product with a short-run process is usually a much better option."

The apparent piece/price advantage of the high-production process only occurs as a function of large production runs, and is offset by the cost of holding large inventories. An additional advantage of the short-run processes is that design changes can be made rapidly and inexpensively should they be required based on experience or feedback from the marketplace. **TCT**

*For product and corporate information for **Armstrong Mold** (East Syracuse, NY), visit their Web site at www.armstrong-mold.com. For **SensAble Technologies, Inc**. product and corporate information, visit www.sensable.com.*

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Critical components for the Phantom Desktop. Armstrong Mold took these parts from CAD and quickly turned them into functional prototypes.