

Quick off the mark

Rapid prototyping technology continues to provide returns for the companies that invest in it, reports Mike Farish

At the beginning of June last year rapid prototyping (RP) bureau Prototype Projects in Royston, Herts, was approached with an urgent request by Stowmarket-based manufacturer of domestic products Atco-Qualcast, part of the Bosch group. The company had designed a new, low-cost garden strimmer but had barely a couple of months to turn a device that existed at the time as no more than a 3D model in CAD system into something more tangible that it could show off to the buyers from the major retail chains if it was to get it in the shops this year.

Geometry

After preliminary discussions Atco placed an order with Prototype Projects early in July and provided details of the product's geometry in the STL format used to drive the operations of rapid prototyping machines. The order required Prototype Projects to manufacture 20 facsimiles of the intended product's outer casing in colour. Each of the casings, moreover, was composed of five distinct parts – two side panels, each of which was split into two halves, and a bottom guard into which the side panels fitted. There was a time when such a timescale would have been impossible. But the first completed units, reports Prototype Projects sales manager Roger Bone, "were delivered two and a half weeks later." Rapid prototyping technology was essential to the sequence of events that saw the target achieved. Polymer models of the intended parts were manufactured on the company's Viper stereolithography machine from 3D Systems and then used as masters to support RIM moulding of the final parts in polyurethane. Atco had its facsimile units to demonstrate to its customers the following month and the product was in the shops ready for this year's amateur gardeners to use to keep their lawns neat and tidy.

The speed with which the project was carried out was, concedes Roger Bone, "unusual". But it was not extraordinary

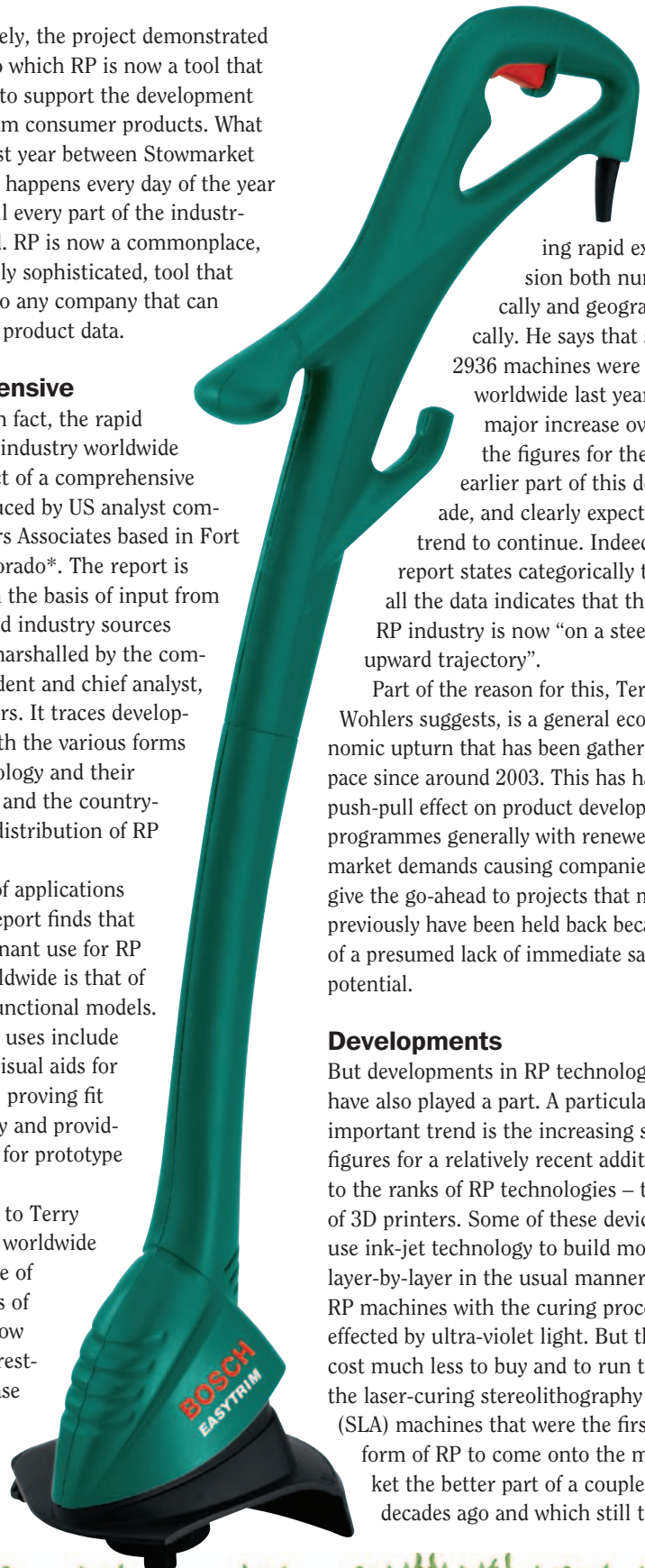
and, ultimately, the project demonstrated the extent to which RP is now a tool that can be used to support the development of mainstream consumer products. What happened last year between Stowmarket and Royston happens every day of the year in pretty well every part of the industrialised world. RP is now a commonplace, though highly sophisticated, tool that is available to any company that can generate 3D product data.

Comprehensive

Each year, in fact, the rapid prototyping industry worldwide is the subject of a comprehensive report produced by US analyst company Wohlers Associates based in Fort Collins, Colorado*. The report is produced on the basis of input from academic and industry sources worldwide marshalled by the company's president and chief analyst, Terry Wohlers. It traces developments in both the various forms of RP technology and their applications and the country-by-country distribution of RP systems.

In terms of applications this year's report finds that the predominant use for RP systems worldwide is that of producing functional models. Other major uses include generating visual aids for engineering, proving fit and assembly and providing patterns for prototype tooling.

According to Terry Wohlers the worldwide installed base of RP machines of all sorts is now 14,381. Interestingly that base now also appears to be undergoing



ing rapid expansion both numerically and geographically. He says that some 2936 machines were sold worldwide last year, a major increase over the figures for the earlier part of this decade, and clearly expects the trend to continue. Indeed the report states categorically that all the data indicates that the RP industry is now "on a steep upward trajectory".

Part of the reason for this, Terry Wohlers suggests, is a general economic upturn that has been gathering pace since around 2003. This has had a push-pull effect on product development programmes generally with renewed market demands causing companies to give the go-ahead to projects that might previously have been held back because of a presumed lack of immediate sales potential.

Developments

But developments in RP technology have also played a part. A particularly important trend is the increasing sales figures for a relatively recent addition to the ranks of RP technologies – that of 3D printers. Some of these devices use ink-jet technology to build models layer-by-layer in the usual manner of RP machines with the curing process effected by ultra-violet light. But they cost much less to buy and to run than the laser-curing stereolithography (SLA) machines that were the first form of RP to come onto the market the better part of a couple of decades ago and which still tend

to form most people's image of the technology in action.

The price disparity between 3D printers and SLA machines is, in fact, little short of startling. Starting prices for 3D printers, notes Terry Wohlers, can be as low as \$25,000, whereas SLA machines begin at around \$180,000 and go up to over \$500,000.

Justified

Hitherto, though, the differential in cost between the two types device has been justified by considerable differences in key performance parameters. SLA machines have tended to score heavily over 3D printers in terms of the comparative accuracy and smoothness of the models each can make, the durability of the cured materials and the size of model each can manufacture. But the gap, though still real in many instances, is now beginning to narrow. An Israeli company Objet Technologies, for instance, is now marketing 3D printer systems capable of a resolution as fine as 16 microns, though admittedly at a price of around \$100,000.

A prospect that is opening up, therefore, is of low-cost RP machines based on ink-jet technology becoming commonplace items of design office equipment, as much as fax machines or PCs already are, rather than being regarded as another form of capital equipment like a CNC machine. In this scenario design engineers might order an RP machine close by their desk to make a

physical replica of a 3D design stored in a CAD system much as they might now order a printer to produce a paper print-out.

But at the same time the RP arena also currently exhibits some evidence of a quite different trend getting underway – that of a move towards RP-type technologies being used not just for modelling, whether directly or as an intermediary stage in low-volume moulding processes, but as a direct manufacturing technique in their own right.

The latest Wohlers Report mentions an example of this involving a UK car-maker, which used laser sintering to produce 1,800 plastic clips in a 48-hour period in six operations of 300 parts each time. The process obviated what would otherwise have been a six-week delay to

produce the necessary tooling and carry out injection moulding and saved the company the equivalent of \$81,000.

The figures are impressive and are not devalued by the fact that the company was MG Rover.

Opportunity

This is a trend that could be further accelerated by developments in the laser sintering of metal powders, already an existing RP process though as with SLA at the top-end of the price range for relevant machines. There is certainly an opportunity, comments Terry Wohlers, for this technique to replace casting in some instances though how far and how fast such a development might proceed is impossible to predict.

But if these two trends really do take off then a quite feasible future scenario is that the current dominant form of RP – that of SLA machines - might get squeezed out. This is not a prospect that Terry Wohlers discounts. "There is a possibility SLA machines could disappear over time," he agrees.

Circumstance

Nor would such a circumstance be entirely unprecedented. RP technologies are no more immune to being made obsolete by developments elsewhere than any other. One RP technique that was once seen as state-of-the-art but which has now virtually disappeared,

for instance, is that of laminated object manufacture (LOM).

This was the process in which layers of paper were laid on top of each and glued to form models that behaved as if they were made out of wood. The main supplier of the machines, however, went bust four years ago and little has been heard of the technique since.

**Wohlers Report 2005. Price (outside USA) \$445. More information at*

**www.wohlers
associates.com**



Prototype Projects used 3D Systems' Viper machine to meet Atco-Qualcast's stringent timetable