



## Crystal Window & Door Systems expands 3-D printing usage

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For the past three years national manufacturer Crystal Window & Door Systems has used 3-D printing technology in its product design and development efforts. The technology has proved so advantageous that the company is planning the acquisition of additional 3-D printing equipment and has expanded its use to its aluminum extrusion subsidiary, Crystal Extrusions in Missouri.

"Over the past few years, Crystal has really embraced 3-D printing in our product development efforts for its many advantages," said Steve Chen, Crystal's chief operating officer. "The technology significantly speeds the design process for our new window profiles, components and accessories, and allows us to get everything exactly right before purchasing expensive new tooling and moving into mass production.

"Recent press articles on 3-D printing often portray it as a novel new technology," said Chen. "But while other window manufacturers and industries may just be discovering the benefits of 3-D printing, Crystal made the initial investment three years ago and has been using it extensively since then to transform our engineering and design processes. It's been so successful in fact, I've expanded its use to our Missouri aluminum extrusion subsidiary and we're planning a next generation printer for Crystal here in Queens."

Vincent Grieco, regional sales and technical manager for Crystal, knows the advantages it offers Crystal's sales and business development efforts. "Our 3-D printing technology's rapid prototyping gives us the capability to develop custom window frames, flanges, and installation accessory items such as panning and mullions," said Grieco. "It's a wonderful way for architects and specifiers to visualize components before they finalize designs, and it allows us to meet the needs of building owners and contractors very quickly and cost-effectively."

Crystal's current 3-D printer by Stratasys uses Fused Deposition Modeling (FDM) for building the plastic three-dimensional models. Driven by Inventor 3-D Modeling Software, from the maker of AutoCAD.

The printer operates directly from electronic file design drawings developed in AutoCAD (or other similar software) to generate the window component 3-D models. The printer extrudes ultra-thin 0.005 mm melted plastic thread material layer upon layer to build an object progressively. The maximum overall size of a model created with Crystal's current printer is 8"x8"x12", making it very useful for a wide range of window-related components such as frame and sash cross-sections and accessory prototypes.

Outfitted with window hardware and subcomponents (such as screws, balances, latches, locks and weatherstripping), the 3-D printed plastic models can be mated with actual vinyl and aluminum components to determine suitable fit and functionality. Any mistakes or oversights can be easily determined, the design altered and new inexpensive 3-D models made. The process is repeated as necessary until everything is perfected and optimized, then the expensive actual production tooling

dies are cut.

Besides reducing the product development cycle times, 3-D printing saves time for manufacturing, allowing production steps to be analyzed and refined as the actual fabrication and assembly procedures are worked through. With 3-D printing technology, Crystal has been able to expand its in-house engineering capabilities, and develop complex frame and component prototype designs that would be difficult to evaluate and test by traditional methods.

Current 3-D printing technology is significantly less expensive and smaller than earlier versions and can accommodate a variety of materials for model building. Therefore, Crystal is considering to expand investment in the next generation of 3-D printing technology that will allow metal models in addition to plastic to be created. Plastic models present different physical properties than metal ones, and with new 3-D printing equipment utilizing metal material, Crystal would be able to more accurately replicate how metal components will fit together, snap or slide into place. The new 3-D metal printing capability would enable Crystal to more effectively coordinate with its production operation and its aluminum extrusion subsidiary.

Last year, Crystal's aluminum subsidiary Crystal Extrusions invested in 3-D printing and is now also planning additional investments in this technology. "We do a lot of custom design aluminum extrusion for customers in all types of industries," said Tom Ziegler, Vice President of Crystal Extrusions. "Our 3-D printing allows us to test out designs before incurring significant tooling costs to produce a specific customer's extrusion. It also helps our customers better visualize their finished products."

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