

T-Splines for Rhino

Freeform Mold Design with T-Splines and Rhino 4

T-Splines cuts design time by one-half: Millenium Mold Design

The Challenge

Millennium Mold Design, Inc. (MMDI) has served the mold making and molding industries for over 10 years. These industries require highly specialized design work to produce the tooling required for manufacturing molded piece parts. MMDI's goal is to provide a cost effective, quality-oriented solution to these specialized design problems.

MMDI has standardized on NX CAD software from Siemens PLM to produce 3D solid part models. In general, this software works well for their clients' needs. However, occasionally they have projects that require freeform shapes that are difficult and time consuming to achieve with NX.

Recently a client requested that MMDI design a freeform watering can based on an existing physical model (there was no CAD data available). He also gave certain criteria that needed to be maintained in the new design:

1. The overall dimensions of the existing part could not be exceeded in the new part so the packaging materials could be reused.
2. The watering can volume needed to be the same as the original design.
3. The spout detail needed to be the same as the original design to enable the reuse of the original sprinkler head and seal.
4. The client wanted a "very flowing" design and an "ergonomic" handle, possibly with finger grips.
5. The client wanted to see multiple iterations of the design to choose the most appealing one.
6. The client wanted a part suitable for blow molding.

MMDI encountered a number of road blocks during the design process.

- First and foremost, providing multiple iterations became a hassle. The design process with a constraint-based CAD system was so labor intensive that providing multiple versions for review quickly became impossible, not to mention economically unviable.
- Second, it was difficult get a transition where the handle met the body that the customer fully bought into. It always appeared too mechanical. The "flowing" design was nearly impossible to achieve to the extent the customer desired.
- Third, MMDI was up against the clock. They literally had one week to design the part, no more! The tool construction needed to commence on a date set in stone to make delivery of product in time for a housewares show. The more options they could provide the customer in that one week, the happier he would be. He wanted "choices," not an evolving design, but multiple designs to choose from.
- Finally, the customer had originally wanted to be able to have a stylized plant-like feature on the side of the watering can; MMDI ruled that out at the beginning of the project because they had no way whatsoever to model an organic shape such as that.

When the deadline approached, MMDI had created the design below, which was manufactured. While the design was satisfactory to the client, it involved significant effort; MMDI ended up spending 22 hours actually modeling this project.



The Solution: T-Splines

MMDI was not satisfied with their ability to respond to the customer's demands in this project and embarked on a search for new CAD modeling tools, where they came across T-Splines for Rhino. In a conversation between David Quinn, President of MMDI, and T-Splines, Inc., David explained his past difficulties with freeform modeling, highlighted by this watering can project. T-Splines, Inc. volunteered to redesign the watering can using T-Splines, according to the original design requests, to illustrate how it may be easier to create a freeform surface using T-Splines and Rhino 4.

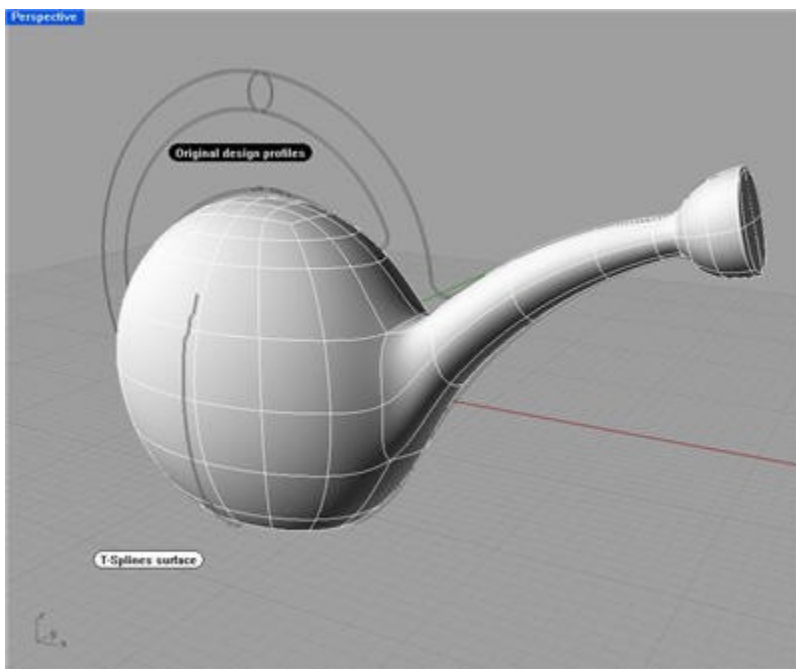
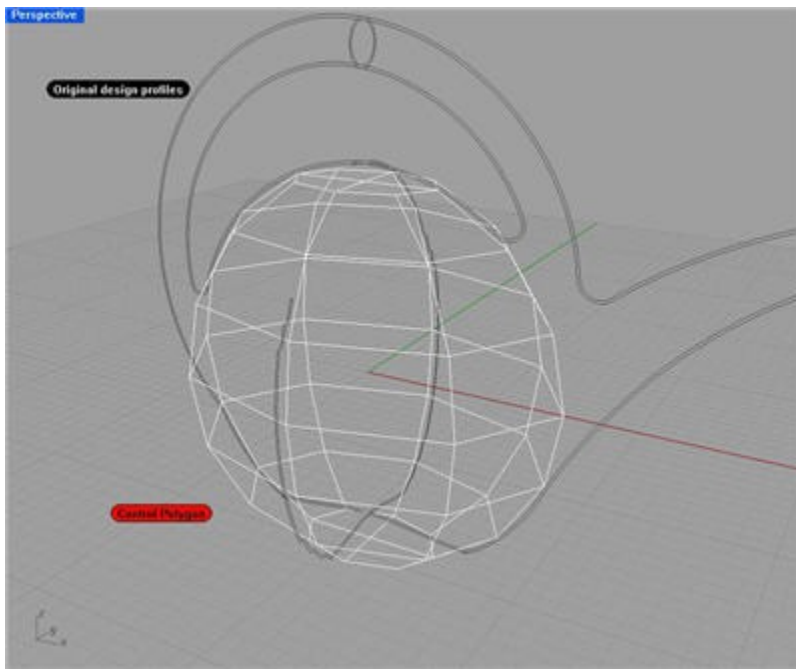
The results were impressive. Juan Santocono at T-Splines spent 12 hours redesigning the watering can to incorporate more freeform aesthetics, while still respecting the original customer criteria. He was able to get the transition where the handle and the spout met the body to truly appear freeform. He also added some finger grips on the handle and provided some options for the artwork on the side of the watering can, offering both a flower and a terrace option.

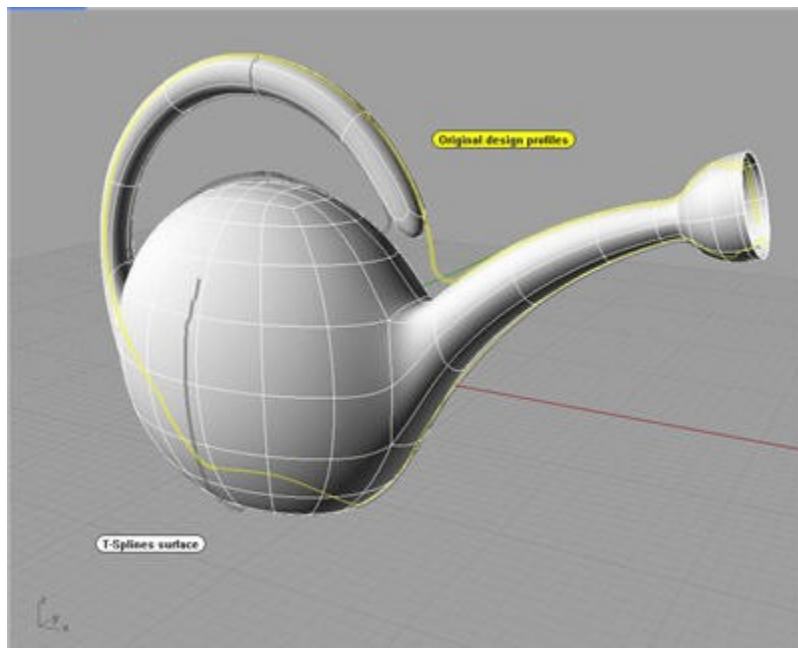
Future Direction

The customer was very impressed when MMDI showed him the new watering can design created with T-Splines. Based on the results, the customer has agreed to send future design projects to Millenium Mold. T-Splines has enabled Millenium Mold to become more responsive to its customers and more rapidly generate complex organic designs. David Quinn plans to incorporate T-Splines for Rhino across MMDI as part of their standard design tool portfolio.

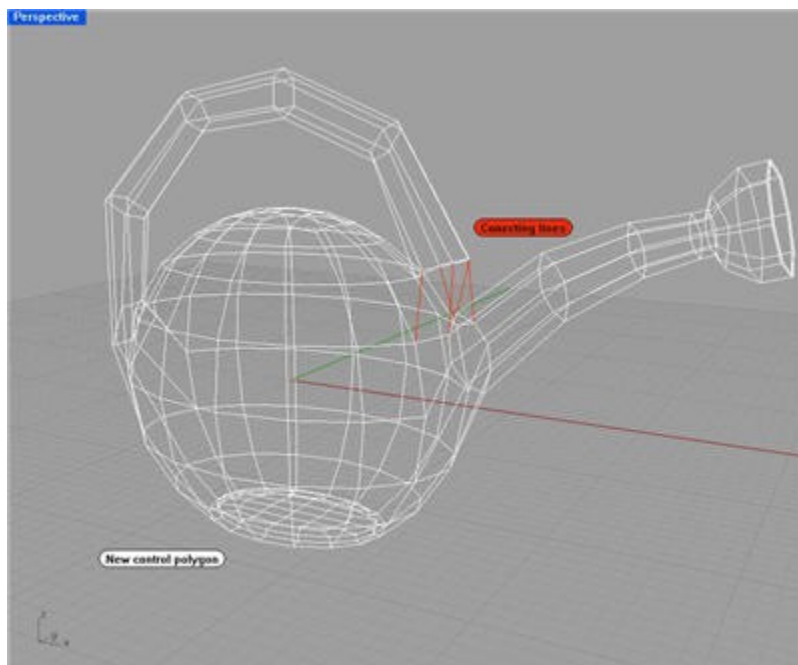
The Process

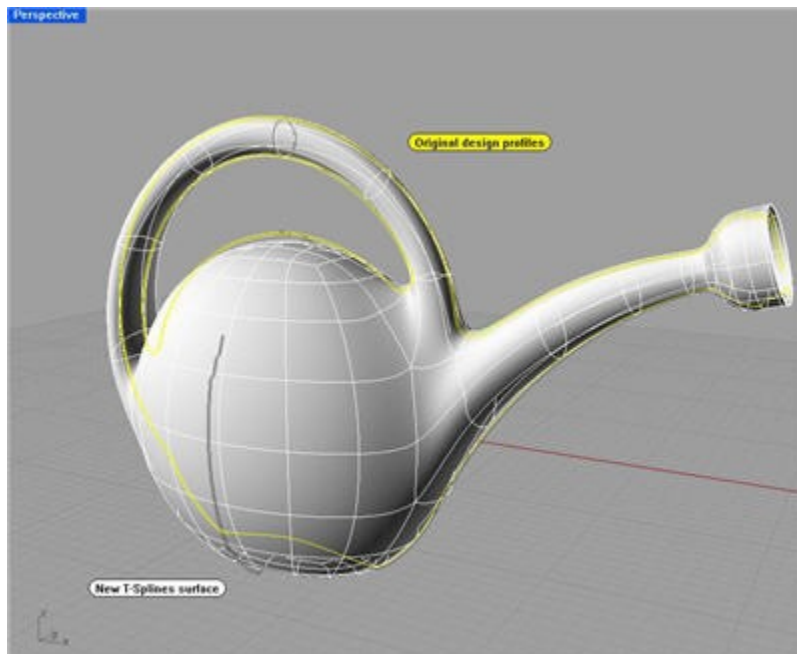
The watering can was constructed by transforming an ellipsoid into a T-Splines surface and extruding and shaping faces to generate the spout and the handle. The original watering can design was regularly referred to in order to keep the correct dimensions.



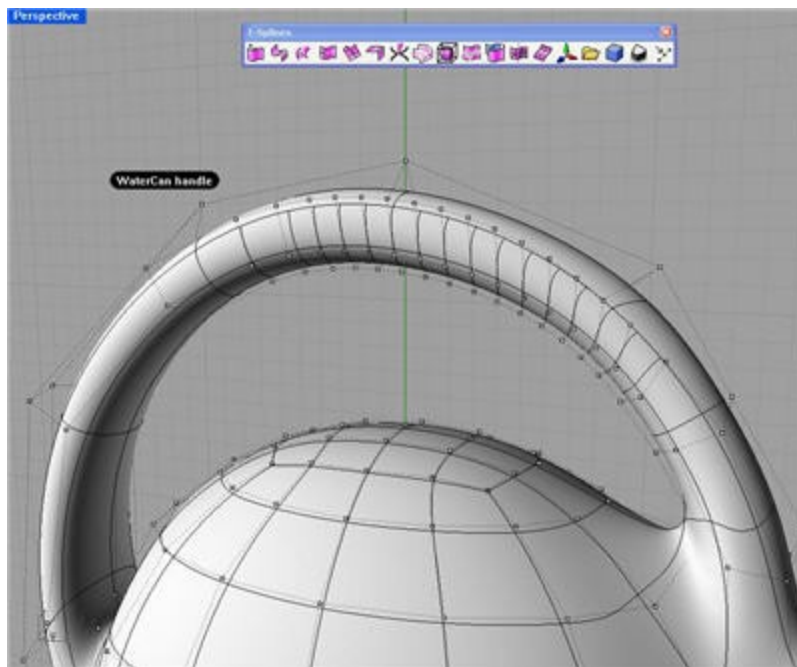


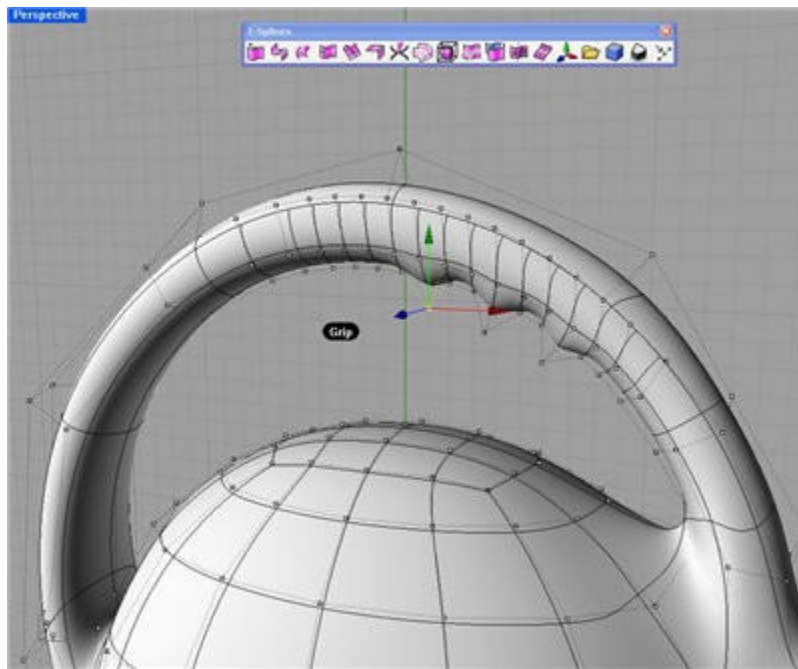
The handle was joined with the body and spout in a perfectly smooth union that gradually washed out into the rest of the body, a key specification of the client.



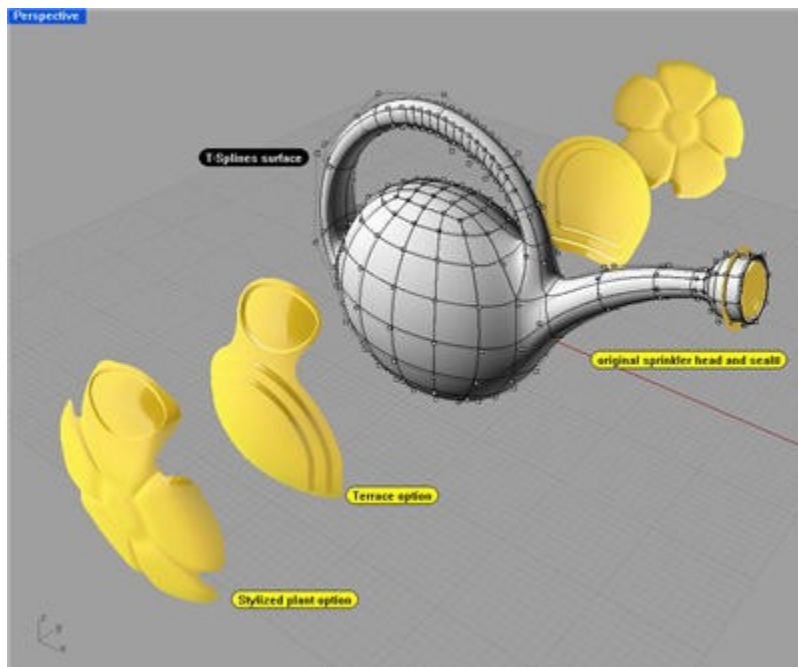


Another key feature whose inclusion T-Splines simplified was the finger grips. By allowing a concentration of control points just in the grip area, T-Splines gave the advantage of having detail where it was needed while keeping the overall number of control points in the surface manageable. The finger grips were shaped by moving the control points with the T-Splines manipulator. This makes it simple to experiment with different shapes and designs.





Once the main body was modeled, the remaining parts were added. T-Splines' 100% compatibility with NURBS allowed NURBS to be used for mechanical parts like the sprinkler head as well as for blending the decorative sides, which were modeled separately, with the body.



The result was a versatile watering can model ready for further modification, shelling, or manufacturing.

