

Introduction:

STS Technical Design has been providing engineering solutions to clients for more than 45 years. The company specializes in delivering end-to-end engineering support and additive manufacturing solutions, and the company continues its remarkable growth thanks, in part, to its ever-expanding additive manufacturing materials, tools and technology.

Additive Design Capabilities:

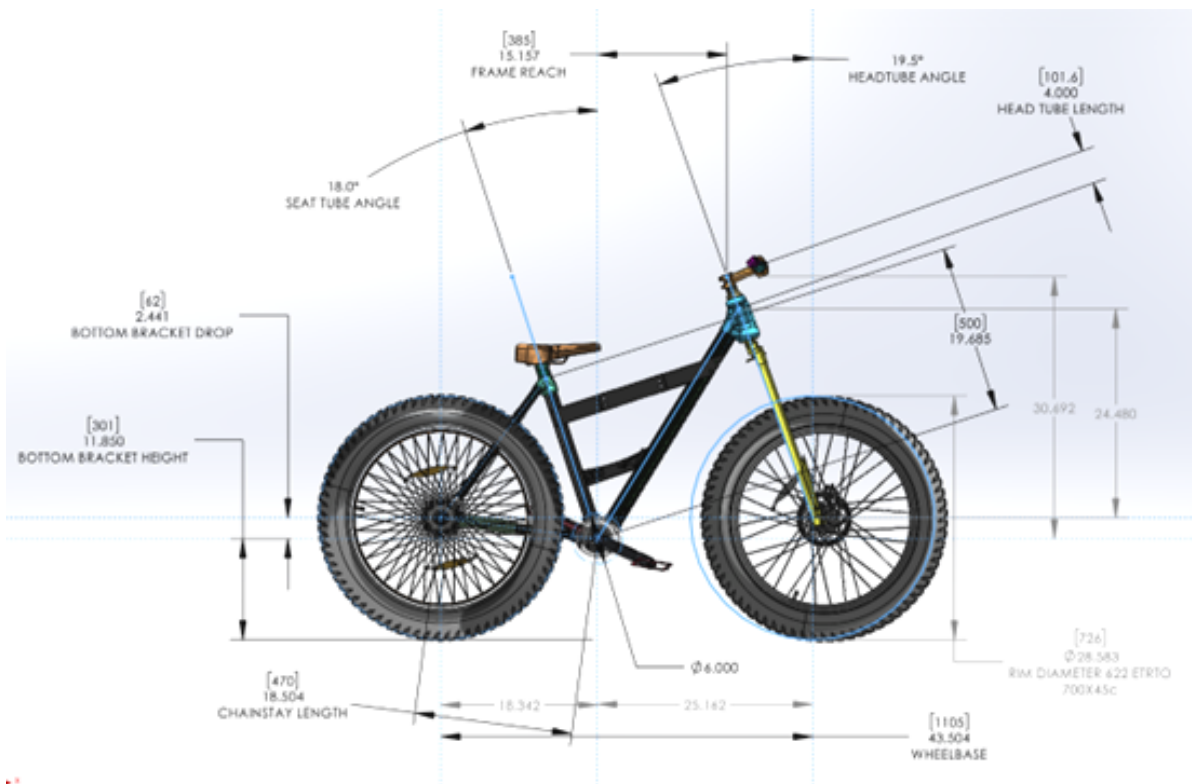
Capabilities of additive manufacturing are growing quickly. Additive manufacturing has many advantages over traditional machining methods, and we've highlighted a few of them below.

- Capable of complex designs
- Quick and inexpensive prototyping
- Rapid design to production turnover
- Minimalized production waste
- Enhanced quality control, parts manufactured in succession
- Sustainable, 3D printed materials are recyclable

Utility Trike:

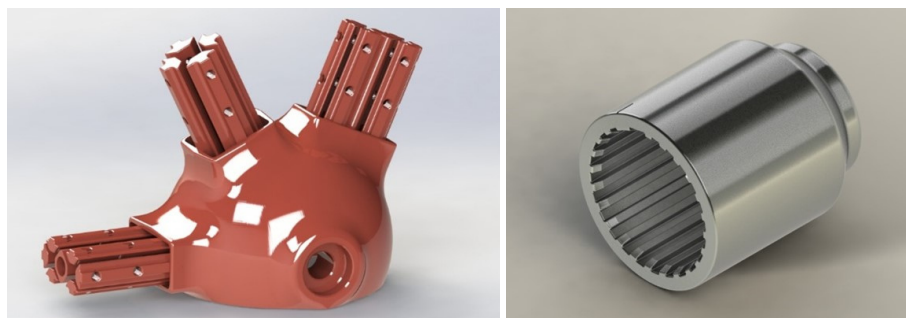
The design of the STS Utility Trike was driven to showcase the capabilities of the additive manufacturing and design capabilities of the STS engineering service team [TK1]. The STS Utility Trike frame utilizes modular aluminum extrusions allowing quick assembly and easy modifications. With the combination of the simple t-slot shapes of the extrusions and the endless printable shapes that can be achieved with additive manufacturing, the trike's frame can be adjusted quickly to achieve a rigid, easy to assemble, ergonomic design. The flexibility of additive manufacturing allows quick concept to creation lead times while enabling the engineering staff to create designs with unconstrained creativity.





Utility Trike Continued:

The STS Utility Trike was designed in SOLIDWORKS 3D software and exploits the programs abilities to automate the frame design by controlling a few key dimensions in a master sketch. The master sketch drives connection angles, part placement, extrusion lengths, and driveshaft lengths. [TK1] This allows us to easily and quickly adjust for personal ergonomics at the click of a button. The 3D printed hubs and gears can be printed again to accommodate design changes and allows the use of off the shelf mechanical parts in a custom design.

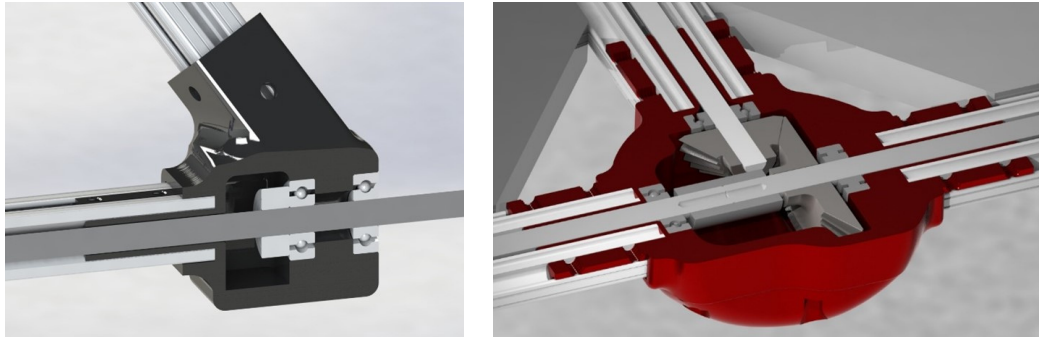


Figures 3 & 4 – Onyx pedal shaft and aluminum extrusion hub (left)[TK1] . H13 tool steel driveshaft to live differential adapter (right).





The aluminum extrusion hubs printed using the Markforged X3 are lightweight and high strength while enabling rapid design iterations with minimal manufacturing lead time. The Onyx pedal shaft and aluminum extrusion frame hub is able to be printed in 2.5 days without the need for molds, pumps, or large extrusion machinery. The H13 tool steel driveshaft to live differential adapter was printed using the Markforged Metal X System and is capable of withstanding 1420 MPa of stress.



Figures 5 & 6 – Onyx gear housing with H13 tool steel bevel gears (left). Onyx extrusion hub and bearing housing (right).

The wheels of the trike are driven by a drive shaft, where the power from pushing the pedals is transferred to the wheels by H13 tool steel bevel gears printed using the Markforged Metal X System. The bevel gears were designed to fit an off the shelf sized shaft that fit within the aluminum extrusion cavity. This allows for an internal driveshaft eliminating pinch points.

In addition, STS additive manufacturing is capable of achieving extremely intricate designs, with high precision.

Conclusion:

STS Technical Solutions offers engineering solutions with a specialty in additive manufacturing. FFF printing provides a wide variety of materials and applications. FFF printing provides a lower cost and faster lead time [TK1] alternative to traditional machining or plastic manufacturing methods while maintaining the ability to print high precision and irregular parts.



Figure 7 – Onyx support bar with exposed gyroid infill settings.

