

CST 2020 Grant Support of MAE SmallSat Program

Mike Galvin

CST generously provided 2020 funding for the continued maturation of my MAE undergrad SmallSat lab and program. In 2020, the funding was devoted to the purchase of our first spaceworthy solar panel and our first spaceworthy radio communications & GPS system.

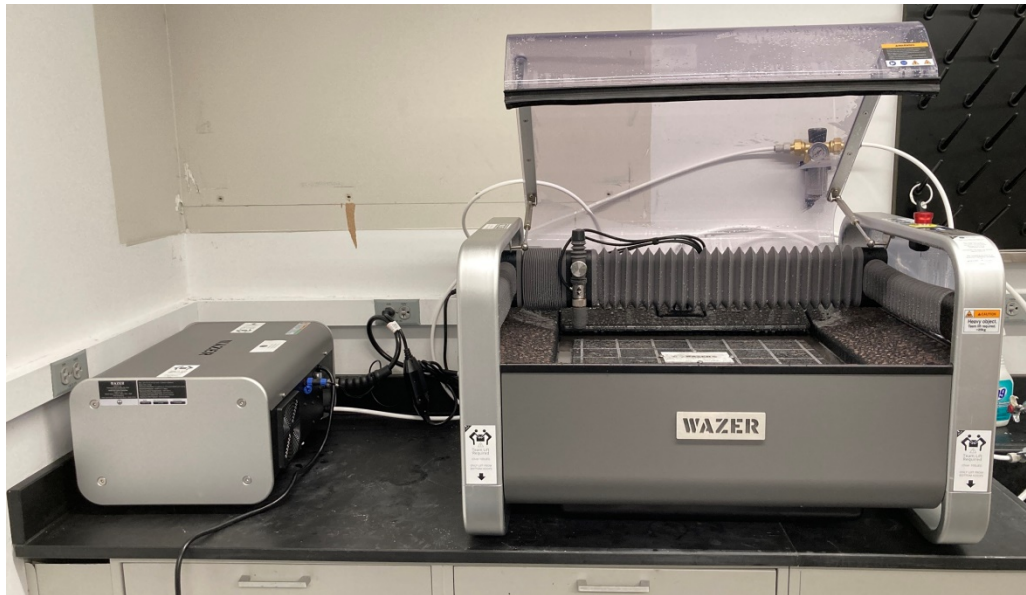
You can see the delivered first solar panel leaned against the bottom right of (not yet firmly integrated onto) our first cubesat structural frame ("chassis"):



More details about how the solar panel was used as a specific interface definition to accommodate onto our structural frame are outlined in Appendix A (MAE standout undergrad Michael Hauge's junior Independent Work report summarizing his design of this frame).

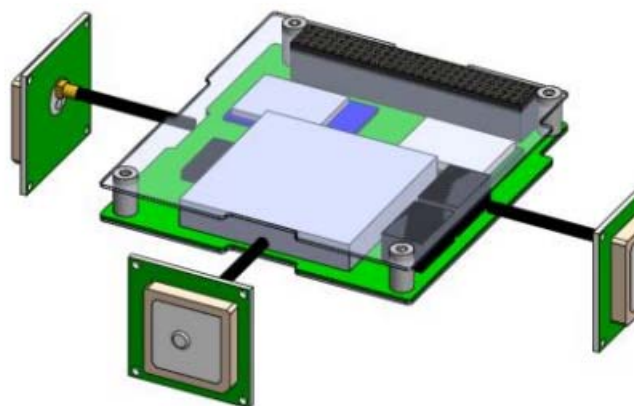
The solar panel was also intended for use as the basis of Shannen Prindle's Independent Work project this year. She was going to use it as the basis for designing and fabricating our own much cheaper (but

still spaceworthy) DIY solar panels, fabricating them using the SmallSat Lab's waterjet cutter (also purchased with generous CST support as part of the grant cycle prior to this one):



Unfortunately, due to covid, Shannen had the mixed blessing to choose to take a gap year for an exciting yearlong aerospace internship. She'll be back to use all this great equipment with me next year.

The remainder of my 2020 CST funding was earmarked towards the purchase of the world's first GlobalStar radio (with integral GPS) in a cubesat form factor, for by our first cubesat in sending science data back to Earth and navigating its position. The radio will look as follows:



This radio is actually still in the R&D phase, which I'm still very actively supporting on a month-to-month basis. Completion of the radio design will benefit not only Princeton's cubesat program, but the global cubesat community. I have devoted part of the CST funds to supporting the vendor's (NSL) R&D towards a specific version of this radio tailored for our Princeton cubesat project needs. The fruits of this R&D thus far (a mature 15- page Interface Control Document, specifying Princeton version of the upcoming radio product) is a proprietary document, but available for review as appropriate. A publicly-available paper describing the upcoming product is in Appendix B. I've held the remainder of the 2020 CST funding in reserve to cover the final purchase of the radio when available (reportedly within a few months from now).

At a more top-level, pedagogically, the above such activities advancing Princeton University's cubesat expertise is enabling us to provide more and more advanced mentorship to our local partner high schools, to the point where this year we even mentored Princeton High School (PHS) and Montgomery High School (MHS) in their successful proposal to the Department of Education's CTE Mission CubeSat challenge, in which they were now declared one of only 5 finalist schools nationwide:

- a. <https://www.ctemissioncubesat.com/>
- b. <https://youtu.be/yrJs017wlll>

The DOE's CTE (Career Technical Education) program is aimed at supporting educational programs across the country in integrating core academic knowledge with technical and occupational knowledge to provide students with a pathway to postsecondary education and careers. The winning Princeton High School/Montgomery High School CTE team was composed entirely of minority girls.