

# Spartan Superway Speeds Ahead

an

ATRA Pulse Article

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## Summary

The research and development work for the Spartan Superway solar-powered automated transit system continues on many fronts with the short term goal of the construction of a full-scale test track.

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A previous ATRA newsletter article in January 2016 (<http://tinyurl.com/y83wqbjc>) described the genesis of the Spartan Superway project and its first three years of development (2012 - 2015) largely by students at San José State University. Since 2015 there has been significant progress in developing and demonstrating solar powered automated transit as well as presenting the technology at professional meetings and exhibitions.

In May of 2016, the Superway team exhibited a half-scale, pinched-loop guideway and bogie model at Maker Faire Bay Area 2016 (Figures 1 and 2). The half-scale model featured a 17° sloped off-line station with the idea to demonstrate that a vehicle could be brought down from elevation to ground level and return to elevation. The bogie and guideway design were inspired by the pioneering work by Bengt Gustafsson (<http://www.beamways.se/>). The model also featured solar panels and a grid-tied 48 V battery charging system. While the guideway and solar construction were successful, flaws in the design and fabrication of the bogie that only became apparent at the exhibition prevented the bogie and active suspension from being operational. [Improvements to the bogie and suspension were made and successfully demonstrated the following year as described below.]

Also shown at Maker Faire in 2016 was an improved 1/12th scale model (Figure 3). This model demonstrated autonomous operation of multiple 3D printed vehicles traveling between four offline stations. Batteries for the vehicles were charged from solar panels.

In the summer of 2016, we hosted a large international contingent of interns from Brazil, South Korea, France, and the U.S. Notable accomplishments by the interns included exploratory planning for a full-scale test track and guideway placement for a network that would connect the north and south campuses of San José State (Figures 4 and 5), power requirements and solar PV sizing for the proposed pilot network, and analysis of the shading by buildings along the proposed network. Papers on the PV sizing and shading analyses were presented at the American Solar Energy Society conference that took place in conjunction with Intersolar 2016 in San Francisco. Links to the papers are listed in the References section at the end of this article.

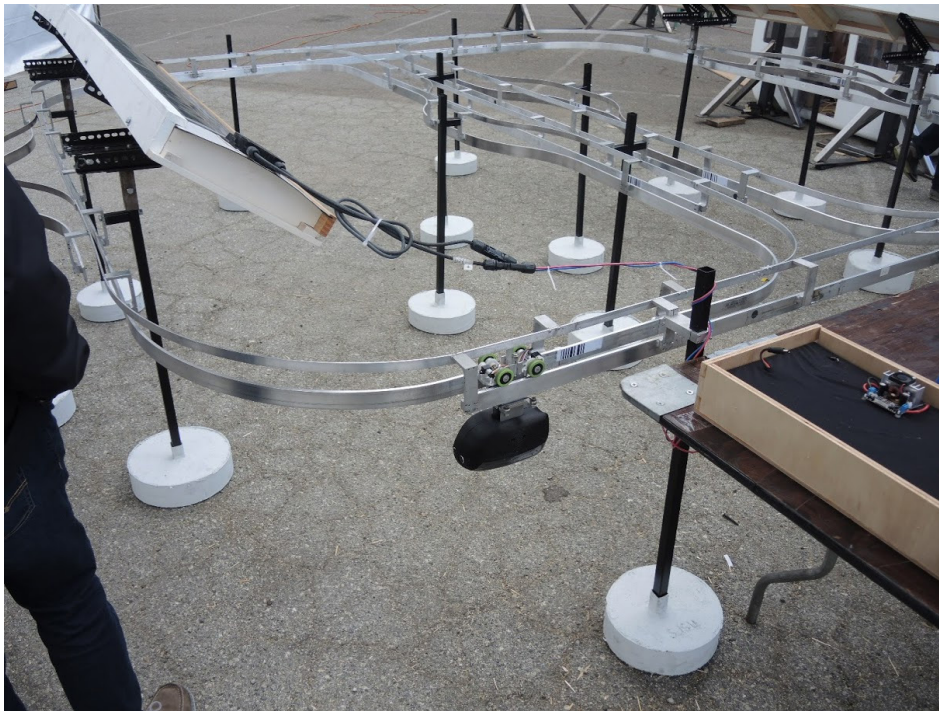


**Figure 1. 2016 Half-scale demonstration model.** The half-scale model exhibited at Maker Faire Bay Area 2016 featured an off-line station at ground level.

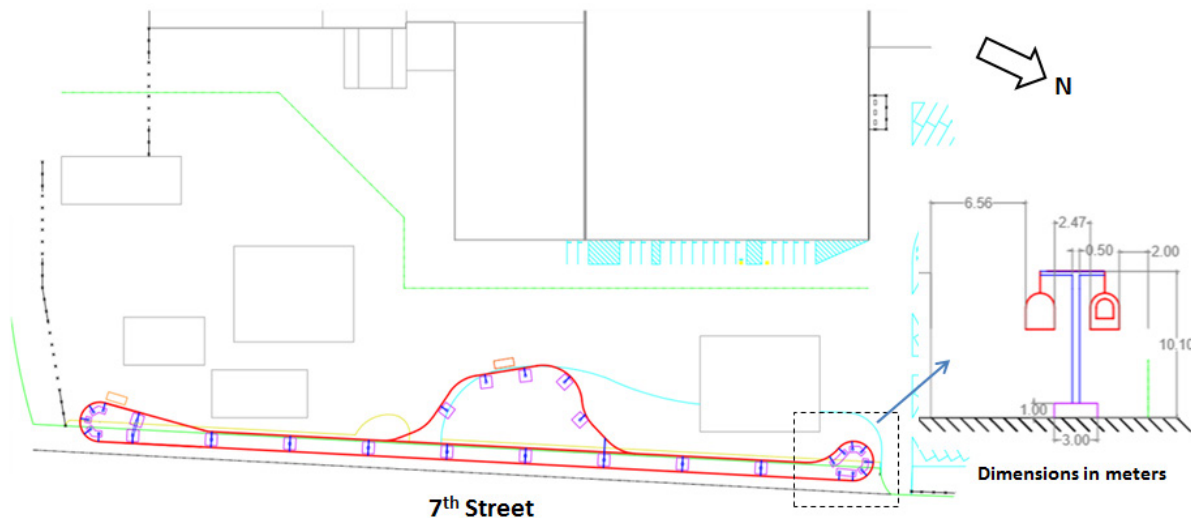


**Figure 2. 2016 Bogie and active suspension at Maker Faire 2016.** Half-scale model showing vehicle at ground level.



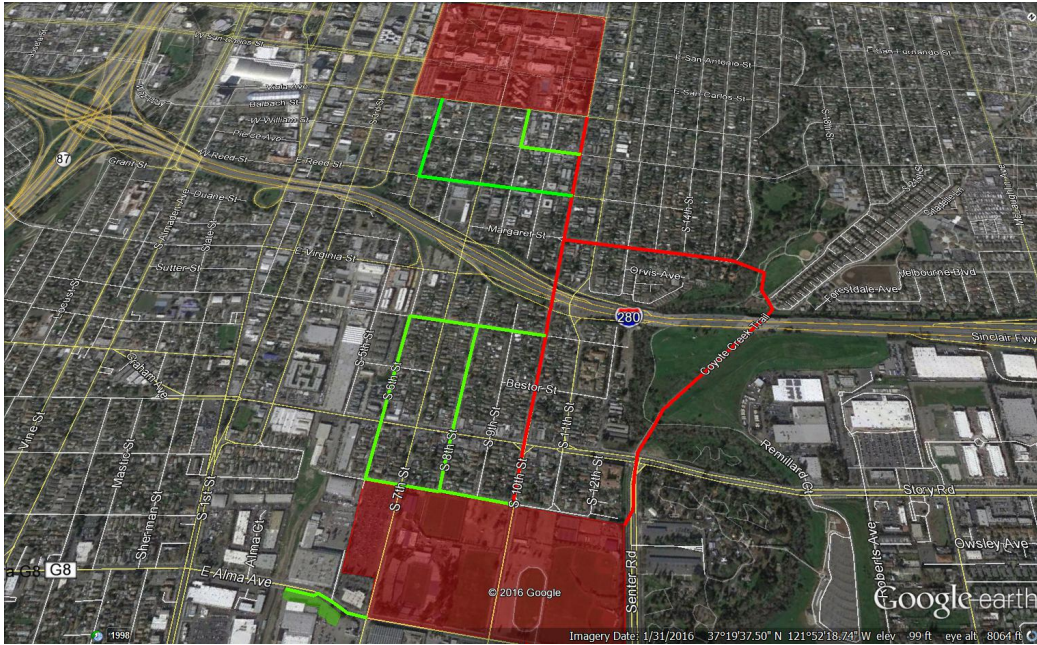


**Figure 3. Improved 1/12 scale model at Maker Faire 2016.** Improvements included multiple 3D printed vehicles traveling autonomously to four offline stations.



**Figure 4. Initial layout of a full-scale test track for the Spartan Superway.** The pinched loop guideway layout was chosen to fit in a strip of land vacated by the city of San José near the south campus of SJSU.

Work over the 2016-2017 academic year led to improvements in the bogie and suspension system for the half-scale model, such that a moving bogie was successfully demonstrated at Maker Faire in May 2017 (Figure 6). Also new this year was substantial progress on a mobile app that allowed a user to interact with and control the 1/12 scale model. Figure 7 shows mockups for iOS and Android.



**Figure 5. Routing alternative for a guideway network to the connect the north and south campuses of San José State University.** The paper by Branco, et. al. listed in the References describes the sizing of the solar PV to operate the proposed network.



**Figure 6. Operational bogie on half-scale model at Maker Faire Bay Area 2017.** Improvements made over the 2016-2017 academic year allowed the bogie to traverse a 17° slope





**Figure 7. Mobile app development.** Work is ongoing to demonstrate how a user can interact with an automated transit system via a smart phone app.

In November, 2016, the Superway leadership team delivered a webinar for the US DOT Intelligent Transportation Systems Joint Office T3e webinar program on Solar Powered Automated Transit. [See 'Links to Additional Information on the Project' at the end of this article for a link to the recorded webinar.]

For the 2017-2018 academic year, SJSU students will be designing and fabricating an 18 m long section of full-scale guideway and a solar PV canopy that will be used for early prototyping of hardware for the test track. Separately, a preliminary application for a building permit has been submitted to the city of San José, and we expect to begin construction of the first phase of the test track in 2018.

Additionally, several MS architecture students under the supervision of Prof. Shannon McDonald along with several SJSU MS Urban Planning students will be doing a detailed design study to understand, visualize, and model how a solar powered automated transit system could be integrated into the area connecting the north and south SJSU campuses. Particular emphasis will be given to prototypical station design, building integration, and developing heuristics / guidelines for urban integration.

Stay tuned for the results of this year's work!<sup>1</sup>

<sup>1</sup> The instructors and students working on Superway document and communicate progress on the project through an online blog, <http://spartansuperway.blogspot.com>. The blog website has a wide range of relevant photos, links to an online library of research and reports, a list of sponsors, and more! The Spartan Superway organization also has engaged with international universities such as the University of Johannesburg in South Africa and the Instituto Tecnológico de Monterrey in México to kick start similar educational programs to promote research and development in sustainable ATN systems internationally. Blogs for the international teams can be found at <http://www.solarskyways.net/>.

## References

Alvarez, R., et. al., 2016. Spartan Superway: A Solar Powered Automated Public Transportation System (available at: <http://tinyurl.com/jbla3hz>)

Branco, L., Rosenfeld, E., Neto, D., and Furman, B., 2016. Case Study of a Solar Power Installation on an Automated Transit Network in San José. ASES National Solar Conference 2016, San Francisco, CA, USA July 10-13, 2016 (available at: <http://proceedings.ises.org/paper/solar2016/solar2016-0020-Branco.pdf>).

Furman, B., 2016. The Spartan Superway: A Solar-Powered Automated Transportation Network. ASES National Solar Conference 2016 Proceedings, San Francisco, CA July 10-13, 2016 (available at: <http://proceedings.ises.org/paper/solar2016/solar2016-0019-Furman.pdf>).

Furman, B., 2016. Innovating Automated Transit Technology with Students. ATRA Pulse January 2016 Newsletter (available at: <http://www.advancedtransit.org/wp-content/uploads/2016/01/ATRA-Pulse-Article-for-January-2016-Innovating-Automated-Transit-Technology-With-Students.pdf>)

Gendler, I., 2016. A study on the effects of urban shadow impingement on solar powered transportation systems. ASES National Solar Conference 2016 Proceedings, San Francisco, CA July 10-13, 2016 (available at: <http://proceedings.ises.org/paper/solar2016/solar2016-0021-Gendler.pdf>)

Swenson, R., Furman, B., 2016. Solar Transport on the Critical Path to 100 Percent Renewable Energy. American Geophysical Union, San Francisco, CA December 12, 2016

## Links to Additional Information on the Project

- [https://www.washingtonpost.com/video/sponsored-video/dt-at/2017/06/16/e03a1908-5297-11e7-b74e-0d2785d3083d\\_video.html?utm\\_term=.efba8a2a906e](https://www.washingtonpost.com/video/sponsored-video/dt-at/2017/06/16/e03a1908-5297-11e7-b74e-0d2785d3083d_video.html?utm_term=.efba8a2a906e)
- [https://www.pcb.its.dot.gov/t3/s161117\\_Solar\\_Powered\\_Automated\\_Transit\\_Networks.asp](https://www.pcb.its.dot.gov/t3/s161117_Solar_Powered_Automated_Transit_Networks.asp) (webinar and slide deck)
- <http://www.cctv-america.com/2015/11/24/california-technologists-are-developing-the-podcar>
- <http://abc7news.com/traffic/engineers-flock-to-mountain-view-to-discuss-future-of-podcars-/1070840/>
- <http://blogs.sjsu.edu/today/2015/spartan-superway-may-be-the-ride-of-the-future/>
- <http://spartansuperway.blogspot.com> (Spartan Superway blog)
- <http://www.solarskyways.net/> (International blog, links to participating universities)