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# Rocketing Out of the Library and Putting A Satellite In Orbit

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# Rocketing Out of the Library and Putting A Satellite In Orbit

***by** Dean Walton, PhD*

Dean Walton is a science librarian at the University of Oregon where he is the subject specialist for Departments of Biology and Geology and the Environmental Studies Program. He is also a past field biologist and has a strong interest in the use of GIS and remote sensing for research and disaster relief efforts.

How does a librarian get involved building and putting a real, honest-to-goodness, satellite into orbit around the Earth? Simply interest, desire, and of course bringing something to the table. But what can a librarian bring to a table full of physicists and engineers? I claim many things: from identifying funding sources, to website design, to communication and science education outreach.

As a science librarian, I cover the areas of biology, geology, and environmental studies. I love to investigate all the tools associated with research in these areas. However, my foray into rocketry and astronomy started, as it did for many folks, when I was a kid building and launching model rockets. I chose the Estes™ Sprite, a small rocket, for my first project. It was the size of 16 oz. coffee cup with a circular band connecting the three tail fins together, giving it a unique and radical appearance. This rocket appealed to me in particular because it didn't use a parachute. At apogee, the final blast of the engine that would usually push out a parachute, instead would push the engine backwards 3 cm out the back of rocket. The net effect of this is that the center of gravity changes allowing the rocket to tumble back to the ground instead of falling nose first at a high velocity. This was my first entry into why some rockets flew straight and others didn't.

Jump ahead 30 years to the 1990s and I saw an issue of *Popular Mechanics* that highlighted a bunch of enthusiasts, mainly from the San Francisco area, who would go out to the Black Rock Desert to launch their rockets, which were really big for your average hobbyist. These rockets can be 3 meters or more tall, and as of last year have flown to heights exceeding 120,000 ft. Upon my move to Oregon, I was now near this desert and could go visit the event, that is, if it was still going on. Turns out it was.

Now let's jump to 2010. Not only were people still launching large rockets in the desert but those rocketeers were also promoting STEM related contests in a program called ARLISS (A Rocket Launch for International

Student Satellites: http://www.arliss.org/) which encourages students to design sensors, fold-up quadcopters, and rovers that could potentially explore extraterrestrial worlds. Students from around the globe were coming to this dry lake bed to test their skills. It was an amazing place to be.

*ARLISS team members readying a rocket for launch by loading it onto the launch rail. The rail will be lifted vertically once the rocket is ready.*

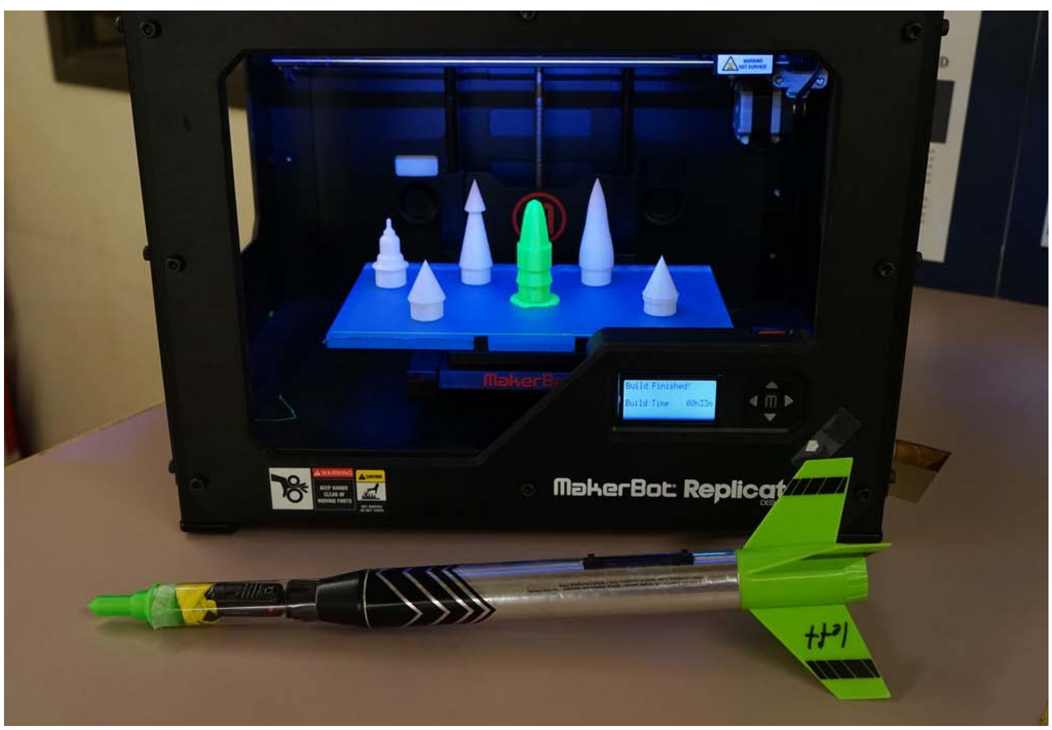
The first few years I was solely a spectator at the event, but as one colleague I met at the event said, "There is no way to be a spectator for very long." It was true. Since then, I have built up a group of colleagues, all of whom are interested in rocketry and space research. Although I am a biologist by academic training and focus mostly on conservation biology as a research area, I do enjoy electronics. I became a licensed amateur radio operator many years ago, helped form a local robotics group back in 2007 that merged with others into a local maker-space several years later, and just generally like to build things.

I had already helped the University of Oregon's Science Library acquire a 3D printer and had acquired grant money from our newly formed STEM center on campus to train students on how to design and 3D print nose cones for model rockets. I developed a tutorial on nose cone design using the computer assisted design program Rhino5TM, took the printer on tour out into the K–12 school system, and got students making nose cones. With my help, the students then tested their designs by flying the noses cones on small rockets and recording the results with on-board data loggers that provided us with the maximum velocity and acceleration of the rockets. The money even provided for funding a week-long science camp on rocketry for 4th–6th graders and the staff to run it. I was looking at new roles for libraries and librarians.

One important aspect of the future of librarianship is the notion of embedded service. As a science librarian I work closely with many of our researchers. Many of these researchers receive funding from the National Science Foundation and are required to show greater impact of their research. This greater impact is often equated with science education outreach. Additionally, not every researcher has the time, interest, or skills to do that outreach even if she or he believes it is very important. So, you have a librarian, trained in the sciences, who likes to make things, and who also teaches science research classes to a wide variety of audiences, and you have a potential for an outreach and maker specialist.

At the University of Oregon we also have a science technology engineering and math (STEM) Center called STEM CORE, and I was invited to participate with the group. I was already active with the Oregon Academy of Science (OAS) and co-chair of the science education section. Through the UO STEM CORE group, I became more involved with science outreach in the K–12 system. Additionally, the University of Oregon is in the process of building a new science library, one envisioning the future of libraries and one that includes a maker-space. The vision is of a communal space where students and researchers can work with each other, utilize community owned tools like 3D printers and laser cutters, learn new software skills, and visualize data on wall sized high definition screens.

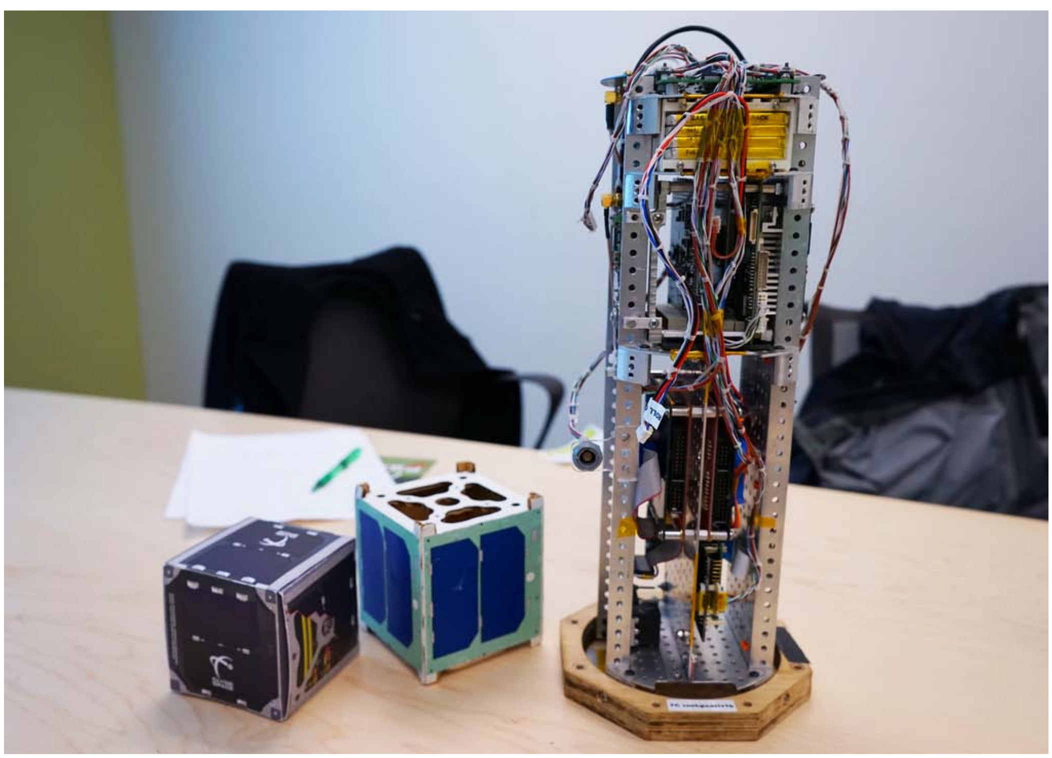
In trying to embrace this vision, the library looked internally and externally wondering how it could also serve the greater Oregon community. Again, outreach was an idea, and getting students from our state (some of whom have not had family members ever go to college) on to campus to let them see a future possibility of their lives, was one way we approached it. Showing students that research is most easily conducted in a supportive environment that includes library space and provides opportunities to learn new skills was important. And so outreach became one of our goals and we identified the use and sharing of our communal technology as one outreach tool. In the process we began working much more closely with our STEM program and learned new skills we could utilize. The end result was that the Science Library staff could offer their outreach and research skills to programs such as the Oregon Small Satellite initiative (ORSSI), a consortium organized to put an Oregon student designed satellite into space.




*One of the University of Oregon's 3D printer showing off a series of rocket nose cones designed by elementary school kids during a science summer camp on rocketry.*

Like many things, the more you work on a project the deeper you get into it. My interests in 3D printers, maker-spaces, and rocketry has brought me to a point where my skills as a librarian and my connections with the space community are paying off in bigger ways. I am currently exploring work with one of two maker-spaces in the Eugene area and hope to add a few physics students from UO and our community college to build what is known as a CanSat, not to be confused with a CubeSat. Imagine a soda-to-coffee can sized device that holds a series of sensors or a rover, all of which are ejected from a rocket at 10k–40k feet. This is a CanSat. You can build a CanSat with an Arduino controller for probably less than $100, well within the range that many school clubs can afford. And imagine showing kids that you can launch these devices on 10 foot tall rockets that roar into the sky and then let them watch the event live from the launch site or anywhere with an internet connection. They are hooked on science and engineering research.

A CubeSat, though, is designed to be an actual satellite, an object that will be in space, orbiting Earth, for what could be a long time. It also has a much bigger price tag. NASA wants more space engineers. So, how do they get more space engineers? They provide grant money to form space consortia between schools of higher education within a state. They look for places that have yet to produce many space engineers and tell them that if their school can get together to build a CubeSat, there is a good chance that NASA could put it aboard a rocket and launch it into orbit. Talk about an incentive for schools either to compete against each other or work together to get this done. However, there is a catch: NASA also wants these consortia to find some of their own funding and to develop outreach programs to get more people involved in space engineering. Outreach to minority groups involved in STEM



*Portland State's satellite control circuitry. The goal is to shrink it to the size of the 10 X 10 X 10 cm cubes to the left, hence the name CubeSat.*

activities is a must. NASA believes if they are going to put some set of schools' satellite into space, then all the schools in the area should know about it, and all the schools should be involved in some way however minor. Unfortunately, most of the engineering folks involved are spending their time trying to solve very technical questions and aren't quite ready to do outreach or work on funding. That's where I have something to offer.

There is a statewide space grant helping to fund space research at most of the state universities. This current initiative under the umbrella of the space grant involves Portland State University (http://psas.pdx.edu/), University of Oregon, Oregon State University, and Portland Community College. I was approached by team members to write an outreach plan to maximize the impact of the multi-university project to build a satellite. Team members were also interested in additional funding opportunities, and I was able to show them the Foundations database from which I identified additional funding sources. I will be actively grant writing to fund more of the project and creating content for ORSSI webpage. On the technical side, I identified a scientific direction for the project to measure the impact on micrometeorites on satellites and will be forming a team to review our collected data.

Building multi-institutional relationships provides greater communication with researchers that might not otherwise have worked with a librarian and increases the awareness and reputation of the science library in these communities. Work on the physical building of the satellite will be taking place at the Portland State University, while many of the administrative activities will likely be coordinated at Oregon State University. The education outreach associated with building to the satellite, well … that's where a librarian comes in to play.

http://www.nasa.gov/mission_pages/smallsats/elana/
http://psas.pdx.edu/
http://blogs.oregonstate.edu/oregonspacegrant/
http://www.arliss.org/

*All pictures were taken by the author, Dean Walton.*

*Liftoff of an ARLISS rocket to launch a small CanSat test unit at 12,000 feet.*