Career of the Month

October 2007, Science in the Workplace: Based on Interviews *by Megan Sullivan*

Space Architect

Drawing knowledge from many fields—including science, engineering, and art—space architects such as Constance Adams design structures for nonterrestrial environments. In one such project at NASA, Adams works on elements for the International Space Station (ISS), which is currently b assembled, and inhabited, in outer space. For Adams, anc eryone involved with ISS, each week brings new, unantic ed challenges as scientists learn about the orbital environr 330 km above Earth and what it takes to exist there.

The work: An overview

An architect is trained as a generalist, whose job it is to understand not only the engineering and technical requirements of a project but the aesthetic and functional/operational aspects as well. With this knowledge, we analyze the requirements of a structure; create a design concept to meet technical, aesthetic, and functional needs; develop a process for construction that respects various logistical requirements; select materials; and support the construction phase with oversight and management.

A space architect does all of these things for spacecrafts and habitats in nonterrestrial environments, such as microgravity conditions, interplanetary transit, and lunar and planetary surface locations. The environmental concerns of space architecture are much more challenging than for terrestrial architecture, mainly because we are still trying to understand the conditions and best responses for environments beyond our home planet.

Applying science

Planning, designing, and overseeing projects intended for use in space allows me to constantly learn new things. While facing the challenges of my work, the basics of science are a very real part of daily life. For instance, every action has an equal and opposite reaction. When my team designs a restraint for the ISS crew to use in space, we have to remember that if a crew member had to push down on the device, that action would send him or her flying across the module! Also, in microgravity or "free fall" there can be no air convection, so, hot air does not rise and cold air does not fall. We have to consider what that means for moving air around, especially in places such as the exercise area—even sweat floats in space. During my school days, those scientific principles were always just theoretical ideas I had to memorize; now, I really have to apply those principles every day.

Solutions from nature

Working on a component designed for space typically requires solving several different problems at once. Essentially, the resulting product must be very light, usable, simple to install, easy to see, and somehow less time-consuming or expensive than the current state-of-the-art component. Often my approach to solving the various problems is to put the current version out of my mind completely, start at the beginning, and think about what the element really is, what it must do, and how it may have to function. Usually a solution already exists in nature. Nature is a genius at achieving what I call an *optimized solution*—one that not only solves several problems at once, but does so elegantly and in a reproducible way. Therefore, it often makes sense to study and apply nature's design when creating a modern system or technology (*biomimetics*).

Advice for students

A space architect must be fully qualified to practice architecture and, in addition, should have practical experience and special training in engineeri science. Interested students mus on top of what is happening in sc and, specifically, space research. because architects collaborate a many disciplines, the ability to municate clearly is a fundamental The worlds of engineering, sc and architecture differ widely in i values, goals, and terminology.

We are at such an early sta space research, I imagine myself like the masons of the middle ages laid the foundations and cornersto cathedrals. Those people knew th value of their work would not be for generations and that their gr accomplishments would not n much in their lifetime. But like th do my best and hope that my wor constitute a useful foundation for who will come after me. With a start, we may yet learn to live app ately on Earth and take that know to the exploration of our solar s and beyond. Today's students ar future space explorers, researchers architects. (To read about a typica in this career, visit *www.nsta.org school/connections.aspx*.)

BONUS POINTS

Education:

BA, social studies; MA, architectur licensed and registered architect

On the web:

ISS *(spaceflight.nasa.gov/station*

Related careers:

structures engineer, materials scie landscape architect, aerospace-m technician, aerodynamicist