

Emergency Physician Parazynski Boldly Goes . . .

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There's frontier medicine, and then there's *frontier* medicine. Scott Parazynski, MD, is the world's foremost practitioner of the latter. After flying 5 missions into orbit aboard the space shuttle and making a daring spacewalk to the edge of the International Space Station, he became the first astronaut to climb Mt. Everest, plying his trade all the while.

Trained in emergency medicine, Dr. Parazynski said those skills prepared him for a career that has taken him to the top of the world, and beyond.

"It's the perfect preparation for medical care in remote environments," he said. "It just takes a little bit different mindset. In space, and also on Everest, you don't have a fully stocked crash room, a place where you wheel a patient who is in extremis, and you've got the intubation kit on the wall, the fluids, and everyone is ready to pounce on the patient. And if you think about working in space, if you were to set something down, it's not going to be there when you come back for it."

Dr. Parazynski's 2-decade career as an astronaut and mountaineer have come at a time when, even as emergency medicine has increasingly become an evidence-based discipline in hospitals, its practice has been wholly extended around and above the world. The space shuttle has made the extraordinary, blasting into space, seem routine. The National Aeronautics and

Space Administration (NASA) has accordingly had to develop the practice of medicine in space. On Earth, through telemedicine, a physician in New York can guide an emergency procedure in Antarctica. As humans and their technology have gone farther, they have brought modern emergency medicine with them.

Dr. Parazynski has had a front-row seat for these changes, giving him a unique view of the practice of emergency medicine in extreme environments. He's



Scott working on the space shuttle middeck with life sciences experiments. This was his first mission, STS 66, in 1994. Credit: NASA.

now eager to apply some of those lessons he's learned about emergency medicine closer to sea level. Dr. Parazynski, 49, recently left the astronaut corps to return to medicine, taking the position of chief medical and technology officer at the Methodist Hospital Research Institute in Houston, elevation 42 feet.

"One of the things I've always talked about is how science fiction precedes life and technology," he said. "I want to push the boundaries of sensing or diagnostic technologies that we can apply both emergently and for diagnostic care."

PUSHING BOUNDARIES

Dr. Parazynski has always pushed against boundaries. As a child he comingled his interests in medicine and exploration. He read a lot, and in addition to Pasteur, Crick, Watson, and Pauling, childhood heroes included astronauts John Glenn and Neil Armstrong, mountaineers George Mallory and Edmond Hillary, and explorer Jacques Cousteau.

In college, he studied biology at Stanford University and graduated with honors from Stanford Medical School in 1989. Dr. Parazynski served his medical internship at the Brigham and Women's Hospital of Harvard Medical School before beginning the Denver Affiliated Residency Program in Emergency Medicine, practicing at various hospitals, including Denver General, the University of Colorado, and St. Anthony's. Dr. Parazynski said he would have preferred neurosurgery as a career in medicine but also had a love for the space program and dreamed of flying into space.

He figured the skills of an emergency physician would serve as better preparation for a career in space.

"In both the emergency department [ED] and outer space you have to be able to handle any type of emergency," he said. "On the ground, whatever comes through the door next is what you need to be prepared for. I think the approach to patient care in emergency medicine is very similar to the worst-case simulations put upon us in astronaut training. They throw the kitchen sink at you, and you have to triage and prioritize very quickly and address the life threats and work your way down."

Dr. Parazynski was also mindful of what might make him most desirable as a candidate to join the corps, which in the early 1990s was expanding. NASA began to fly about 6 missions a year as the program recovered from the Challenger disaster in 1986.

"They select people that are very well rounded, people who are quick studies and can pick up a lot of different skills," he said "You don't become an expert in any one particular area. One of the fun

parts for me was to learn about oceanography, meteorology, astrophysics, planetary science. We would touch on a lot of different fields. Emergency medicine is very much a generalist approach as well. You've got to know a lot of things to a reasonable level of depth."

The approach worked. After he applied to become an astronaut in 1991, NASA accepted him in March 1992. He had completed 22 months of a 36-month residency program, and while he expressed regret at not completing the residency, the realization of a dream left him with little choice.

Two years later, he was in the air as Payload Specialist 4 on STS-66, a mission during which the crew studied the energy of the sun and how it affects the earth's climate and environment. During the mission, Dr. Parazynski got his first taste of medical care in orbit.

"The best way to describe it is common things occur commonly," he said.

In microgravity, the back aches as the spinal column elongates and spinal disks swell from a lack of compression and gravity. Because bodily fluids have gone haywire, astronauts painfully retain urine and have sinus congestion, runny noses, puffy faces, and mild headaches. And then there's the motion sickness, which is treated with a shot of Phenergan before bed, after which crewmembers typically sleep like babies, waking up the next morning free of motion sickness for the remainder of the flight.

Although he reveled in spaceflight, Dr. Parazynski wasn't quite ready to give up his practice of emergency medicine. Even while training and flying missions, Dr. Parazynski obtained a license to practice medicine in Texas and moonlighted for a couple of weekdays each month at a Level I trauma center in Houston, Memorial Hermann Hospital. He worked there and at San Jacinto Hospital until 2001, when his second child was born. At

that point, keeping up with family life and the changing practice of emergency medicine, in addition to his successful career as an astronaut, became too much.

So he traded the EDs of Houston for the shuttle sick bay, full time.

The shuttle carries a fairly capable pharmacy, with nonsteroidal anti-inflammatory drugs, pain medications, antibi-

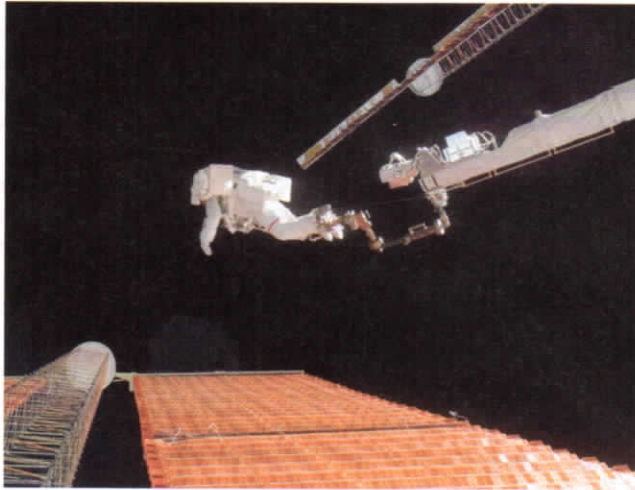
heard a loud thud as he floated into the airlock. He tried to shake it off like nothing happened, but he had this big glob of blood on his forehead. Transiently I was really excited because I thought I was going to get to do the first surgery in space. I thought I was going to get a chance to sew him up. But it turned out he only needed a butterfly bandage. We were really thinking we could write this up as a case report, video it, and the whole bit."

Surgery in space presents a significant problem. In absence of gravity blood would travel in line of sight. In a surgical wound blood could form a big bleb, making visibility a challenge. And then there's the issue of cleanliness, with particulates, hair follicles, and other detritus floating around the cabin.

"The lack of gravity makes a real difference," said James P. Locke, MD, a NASA flight surgeon and emergency physician. "As they prepare for a procedure, crew members really have to prepare ahead. With a more complicated procedure, let's say you want to suture someone, there's no bed, and you have to restrain yourself and the patient. And then you have to have your tools all taped down. Nothing is simple in space."

Most shuttle flights have 6 or 7 crewmembers, and 6 astronauts now inhabit the International Space Station, but oftentimes there's no physician in a particular crew. For that reason, a flight surgeon maintains a console in Mission Control to deal with health problems that arise in space. Each crew, whether aboard the shuttle or station, has 1 or 2 dedicated medical officers who receive some very basic field medical training. For shuttle crewmembers, this entails about 8 hours, and for space station crewmembers, who spend about 6 months in space, there are 30 to 40 hours of field training, Dr. Locke said.

Such training is a pittance, of course, compared with the 1,200 to 1,800 hours of training paramedics receive, Dr. Locke observed. But it is enough to gain some



Scott at the edge of the space station, near the site of the solar array repair during STS 120, in 2007. Credit: NASA.



Scott at the summit of Everest in 2009. Credit: Scott Parazynski.

otics. There's a basic airway management set, a straight catheter for urine retention, nasal packing equipment, and some basic surgical laceration repair. On his third flight, Dr. Parazynski said, he almost got a chance to use the surgery kit.

"One of the crew members really clocked his head," Dr. Parazynski said. "I

basic training in Houston-area EDs to handle basic suturing, catheterizations, intravenous lines, and intramuscular injections, he said.

"The most common procedure, in fact, is an intramuscular injection for nausea," Dr. Locke said. "Our crew medical officers give a lot of those shots. For some of them, it can be very anxiety provoking to give those shots, so we give them a lot of training. We let them come into the clinic here at NASA to give vaccinations to let them get comfortable."

On orbit, of course, Dr. Parazynski's primary responsibilities did not entail practicing medicine. He became something of a specialist at extravehicular activities (EVAs), or spacewalks. He ventured outside the airlock during his second, fourth, and fifth flights, for a total of 7 spacewalks. His total EVA time of 47 hours 5 minutes ranks him seventh all time among astronauts for time spent outside a spacecraft.

The experience, Dr. Parazynski said, is unparalleled.

"It really is the most exciting and intense human experience I can imagine," he said. "From a professional perspective, I liken it to doing surgery. It's carefully scripted and you've got to have backup plans. As Story Musgrave (also a physician-astronaut) used to say, the only unexpected thing about an EVA is the unexpected. Without fail, every EVA that has been conducted, something doesn't go as expected."

Dr. Parazynski faced his greatest challenge during his final spaceflight, STS-120, a 2007 mission during which space shuttle Discovery delivered the Harmony module to the space station.

During the flight, a tear was discovered in one of the station's large solar arrays. NASA engineers feared the rip in the solar panels would propagate and worsen over time, precluding further expansion of the space station, bringing a halt to its construction even as NASA sought to finish building the orbiting laboratory and retire the space shuttle by 2010.

"We were concerned that almost anything we did, docking, undocking, any

kind of maneuvers with the shuttle and the station, the tear would propagate," said Pam Melroy, MS, commander of the STS-120 mission. "The issue is we weren't able to get out to that solar array because we never planned to do a spacewalk out there. So we had to kluge together the boom and space station robot arm, and then we put Scott on the tip of the boom. It was further than we've ever sent someone from the airlock. It was 45 minutes away from the airlock when flight rules call for a maximum of 30 minutes. There were just a lot of different elements to the spacewalk itself that made it quite dangerous."

In addition to the difficulties of reaching the solar array, there were no tools on the station to fix the tear. So Dr. Para-

got to go out to the edge of the space station where we've never been before, then you've got to rely on the team approach NASA does so well."

Dr. Parazynski left NASA in 2009 to make his second attempt to climb Mount Everest, another lifelong goal. He'd had to turn back the previous year at 24,500 feet after he ruptured a disc in his lower back. He wanted to go on but realized he would be jeopardizing his life and the summit chances of his climbing partners as well.

He made it successfully to the top of the world in 2009, becoming the first astronaut to do so.

During both the 2008 and 2009 climbs, he had the opportunity to perform several medical procedures, from treating a subungual hematoma in a Sherpa to pulmonary edema to serious bilateral nosebleeds that almost killed a climbing partner.

"Like space, the mountain is a different environment," he said. "You have to be a team leader to direct your lay team members to help you, and be specific about what you need, so there's more of a MASH-type approach. When things do start to go south, you need to be much more engaged on a lot of different levels, because you're probably the only doc there."

Dr. Parazynski has since returned to sea level, where his new job at Methodist entails

working with investigators to help them obtain funding and use the best technologies to meet their needs.

For emergency medicine, he sees potential in telemedicine to improve the triaging of medical care, as well as to allow for collaborative medicine in remote environments. And he envisions other advanced tools that will help emergency physicians as well.

"With the new health care system, the focus is on cost-efficiency and making difficult decisions but perhaps not with the conventional algorithms or diagnostic tools," he said. "You may not be able to order all of the scans that you would have wanted to in the past. I think increasing the sensitivity and specificity of diagnostic tools is going to be really important,



Scott at his new position at The Methodist Hospital Research Institute. Credit: Methodist Hospital.

zynski and his crewmates, at the direction of mission control, improvised materials and then had the station's robotic arm grapple the shuttle's inspection boom.

Despite these challenges, Dr. Parazynski traveled to the edge of the station, and the cobbled-together materials fixed the array. It's still catching photons to this day.

"I felt like my entire career led up to and prepared me for that spacewalk," Dr. Parazynski said. "It was completely unscripted, but it also was a validation of the training we do. We go through the intellectual exercise of addressing different failure modes. We have a mindset of being prepared to the best of our abilities. When things really go wrong, and you've

and there are some really interesting things coming down the pike in that regard.”

Then he digresses into a discussion of one of his favorite ideas, Star Trek’s medical tricorder, which provided Starfleet physicians with an instant diagnosis by simply waving it over the

patient. Despite all of his accomplishments, Dr. Parazynski is still a geek at heart.

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