



ATHLETIC TRAINING BEYOND THE ATMOSPHERE

ATs condition crew for physical demands of the “Final Frontier”

BY JAIMIE SIEGLE

PHOTOGRAPHY BY RENÉE FERNANDES/NATA

Inside NASA's Neutral Buoyancy Laboratory at the Sonny Carter Training Facility in Houston, two men help David Saint-Jacques climb into the top half of his space suit. It's not an easy task. The bulky white suit, called an EMU (extravehicular mobility unit), adds about 300 pounds the smallish frame of the Canadian astronaut. Because of the suit's weight and rigidity, it takes a village to help the astronauts get dressed.

NASA athletic trainers Jamie Chauvin, MEd, ATC, Bruce Nieschwitz, ATC, LAT, and David Hoellen, MS, ATC, LAT, watch the astronauts closely as the crew loads him into his space suit for the day's training run. As members of the Astronaut Strength, Conditioning and Rehabilitation team (called “ACSRs” for short and pronounced “Acers”), the athletic trainers work to ensure the safety of the astronaut at all times— including the part of the day when the astronauts suit up. “We've seen a lot of injuries just from getting in and out of the space suit,” Chauvin explains.



From left: Bruce Nieschwitz, Jamie Chauvin and David Hoellen stand in front of Saturn V inside Rocket Park at Johnson Space Center. Standing more than 36 stories tall, it's one of the most powerful rockets ever built and operated.



From navigating cumbersome uniforms to thriving in zero gravity situations, astronauts face many physical challenges during a normal workday. As a result, the NASA athletic trainers have one of the more unique jobs in the athletic training profession, providing health care for world-class athletes whose jobs take them out of this world. It's enough to make your head orbit!

ABOUT THE ACSRS

Chauvin, Nieschwitz and Hoellen are employed by Wyle and contracted to provide medical services to the entire astronaut corps based at the Johnson Space Center in Houston. The ATs assist astronauts as they prepare for, adjust to and recover from the rigors of life in space. Nieschwitz said the job has three main components: 1) injury prevention/injury treatment, 2) pre-flight, in-flight and post-flight strength and conditioning for individual astronauts and 3) "off-season" training, or general conditioning. "We probably do more conditioning work

than ATs in more traditional settings," he said, pointing out how much the body needs to be specially conditioned to adapt to the zero gravity situations the astronauts will face during their six-month stints on the International Space Station.

Like ATs in every setting, they work closely with the athletes and develop strong relationships, which makes them valuable to the NASA Flight Surgeons who observe and work with the astronauts. "[The flight surgeons] really value our input because we're the ones who see them every day," Hoellen explains. Some NASA employees will work their entire careers at Johnson Space Center and never see an astronaut. As an athletic trainer, "you see them at their best and at their worst times," Hoellen said.

Within the three main components of care the ATs focus on each day, the tasks can vary depending on which phase the astronauts are going through at that moment, whether it is pre-flight, in-flight or post-flight. Picture it like a bell curve: The astronauts

go through intense training to prepare for their next flight, working diligently while in the Space Station to retain muscle mass and bone mineral density. Upon returning to Earth, they'll go through a tough series of exercises to re-acclimate their bodies to gravity. The ATs maintain an integral role throughout the entire process, helping each astronaut to be as physically prepared as possible to withstand the extreme demands of space travel.

PRE-FLIGHT PHASE

A large part of the pre-flight training takes place inside the Neutral Buoyancy Lab (NBL), a 6-million gallon pool inside the Sonny Carter Training Facility. Under the surface, full-scale replicas of the International Space Station allow astronauts to practice important repairs and tasks before they take flight. The average extra-vehicular activity (EVA) training run keeps the astronaut underwater for six hours per day. The astronauts become

neutrally buoyant when underwater, which is the closest way to train for the zero-gravity conditions they will soon face.

We watch Saint-Jacques continue the tedious installation into the space suit before he is lowered into the pool. Not only do the astronauts have to bend their bodies into unnatural positions to wriggle into their cumbersome uniforms, but the weight and design of the suit also adversely affects the astronaut's movement and posture. "The suit tends to rotate the shoulders forward," explains Chauvin. That shoulder rotation can be problematic when astronauts need to reach in a certain direction or hold a drill for long periods of time. The suit's design, which has remained the same for decades, wasn't initially made to accommodate the range of motion being used by astronauts today.

Once lowered into the water, the astronauts navigate the 40-foot deep pool to practice certain repairs. The simple task of operating a drill is painful when done for hours at a time with bulky gloves, so the ATs often deal with injuries to the hand, elbow and shoulders during the pre-flight phase.

Away from the NBL, the ATs condition the astronauts inside the AT facility and gym. As astronauts train prior to launch, Chauvin, Hoellen and Nieschwitz will develop strength and cardiovascular

training programs based on their VO2 max. The baseline tests prior to the mission helps the ATs tailor both a cardiovascular and strength & conditioning program for the in-flight phase and gives them a goal to strive for during the reconditioning phase once they land.

IN-FLIGHT PHASE

The ACSRs' work doesn't end when the astronauts go to space. If they're not training their athletes on the ground, Chauvin, Hoellen and Nieschwitz are managing in-flight exercise programs and troubleshooting any issues related to the devices on the space station.

The NASA athletic training facility contains three exercise devices nearly identical to the ones used in the space station. When they're on space station, all astronauts are required to exercise 2.5 hours per day, six days a week in order to prevent muscle atrophy, and bone mineral density and cardiovascular losses. "Aside from sleeping, [exercising] is the most time-consuming activity of an astronaut's daily schedule in space," Nieschwitz said.

There are no fancy bells or whistles on the treadmill (called the T2 by ATs and NASA employees), although it features a rotating belt that moves with or without resistance – a feature not commonly seen in a standard public gym. "In weightlessness

at zero gravity, it makes running on a treadmill more effective," Nieschwitz said.

Like the treadmill, the stationary bike appears to be a no-frills version of one that might be found in a recreational gym; the only components it lacks are handles a seat, the latter of which isn't needed in space as long as the individual's feet are anchored to the bike. "To keep them in place," he said, "they wear cycling shoes that clip to the bike's pedals."

Finally there's an advanced resistive exercise device (ARED), which resembles the prototype of a Bowflex or similar at-home gym, with a bench and weight resistance levels provided by two vacuum cylinders. The ARED is a recent replacement of the iRED, a less-advanced device that maxed out at a meager 300 pounds. The ARED, in comparison, carries up to 600 pounds of resistance, rendering it a much more effective machine. "The high load is needed because we have to compensate for no body weight in zero gravity," Nieschwitz explained. As they complete their daily workouts, performance statistics will be sent to the ACSRs to review. Once the exercise has been completed, the data is store on the device and reports are sent to the ACSRs weekly.

Although daily strength training is non-negotiable in space, astronauts are able to choose their cardio workout – the



Collaborating with NASA

Although his responsibilities aren't necessarily "hands-on," the other AT you'll find at Johnson Space Center is Josh Yellen, EdD, ATC, LAT, director of the master's degree athletic training program at the University of Houston. At NASA he provides organizational leadership for the ASCR team, visiting JSC about once a week to ensure best practices. But as director of the first master's ATP in Houston, he's looking to build relationships he hopes could lead to graduate assistantship opportunities with NASA, as well as other major industrial and commercial organizations based the area. "Our new program is completely competency-based," Yellen said. "It also allows students to look at more emerging settings where ATs have the skills to care for industrial athletes." Yellen said he's received 20 applicants so far, and classes will begin this summer. He added that in addition to NASA, the program is looking to foster relationships with Houston's professional sports teams like the Astros, Texans and Rockets. Visit <http://www.uh.edu/class/hhp/graduate-programs/masters-athletic-training/> to learn more.

T2 treadmill or the bike. One of the ATs' challenges is developing cardio and strength programs around this special equipment, which has been specifically engineered to absorb even the slightest vibration that could send the space station off its precise course. "Even something small like strides on a treadmill could literally break the space station," Nieschwitz warned. This caveat presents a minor challenge for Nieschwitz and the other ASCRs, but it forces them to be creative when prescribing an exercise regimen and gives them a unique role as a liaison between engineer and athlete, so to speak. "We exploit the engineering specs for human performance," Hoellen explained, and troubleshooting those problems is one of his favorite parts of the job. "When you come to work, you never know the problem you'll have to solve."

The ATs speak with the astronauts via video conference technology once a week while they are in space, checking to see how the athletes are feeling and if the exercise regimen needs to be adjusted. The astronauts can also call the ATs' cell phones directly for health advice or other needs. "Sometimes they just want to talk," Hoellen said. "We'll chat with them about who won the game that week or whatever else might be going on. They are following current events from space since they have internet access."

POST-FLIGHT PHASE

As the astronauts are hurling toward Earth in a capsule at the end of a mission, the pressure of gravity inundates them almost immediately, and its weight can be physically exhausting. Dizziness and nausea are not uncommon. "It feels like there's an elephant on their chest, or their arm weighs 100 pounds," Nieschwitz said. Although some astronauts will feel out of breath after walking just a few minutes, others adjust back to life on land more quickly. "It's similar to what you would see in rehabilitation of an athlete," Nieschwitz said. "It's not really an injury per se, they just have a diminished capacity to some extent in performance." Their standard rehabilitation/reconditioning program lasts 45 days, but astronauts usually return their baseline numbers by 30 days after they land.



Top: Canadian astronaut David Saint-Jacques is lowered into the pool at the Neutral Buoyancy Laboratory inside the Sonny Carter Training Facility. Saint-Jacques's training run will last up to six hours underwater.

Bottom: Nieschwitz explains the mechanics and engineering of the ARED, the strength training device used by astronauts in space. The ARED replaces the IRED, an older version of the machine that offered only half the amount of weight resistance as its successor.

"We try to stress proprioception and balance exercises to account for loss of balance and coordination," Chauvin said, adding that these issues are also a result of the inner ear, which stops working almost immediately after a launch.

It's evident that all three ATs love what they do. Judging by the collection of "thank you" plaques and autographed photos addressed to the ASCRs from various crew members, it appears their dedication to caring for the astronauts doesn't go unappreciated. "The [ATs] are the core of

the musculoskeletal team," said Dr. Rick Scheuring, a NASA flight surgeon who's been working with the ASCRs since 2010. "They make the ASCR program what it is."

Perhaps even more rewarding than daily interaction with and gratitude from the astronauts and receiving occasional phone calls from space (a "pretty cool" moment, Nieschwitz said) is the notion that their role is making a difference for future scientists, astronauts and athletes. As Nieschwitz explained: "I feel like I'm a part of something very big here." §