BACKFILL

Tools in Space

by Jon Vara

The International Space Station (ISS) isn't exactly your typical modular home. The astronauts now working to assemble the 500-ton station — which will eventually provide long-term living space for up to seven crew members — are faced with some unusually challenging conditions. Temperatures at the job site range from a sweltering 150°F on the sunny side to a numbing 100°F below in the shade. All the work must be done with cumbersome, pressurized space-suit gloves. In the zero-gravity environment, a dropped object instantly becomes an irrecoverable piece of space junk.

As you would expect, the job involves some highly sophisticated tools and equipment. They include a 55-foot robotic arm capable of "inchworming" from place to place; a jet-pack "life jacket" that enables an accidentally untethered astronaut to jet back to safety, and a portable battery-powered bolt driver that can be programmed to deliver precisely the right number of turns at precisely the right torque to any given fastener.

But the ISS also contains an assortment of surprisingly simple — some might say crude — devices that are thoroughly familiar to every earthbound construction worker. NASA engineer and tool expert Phil West calls them "contingency tools" — the rough beasts of the toolbox that get called into play when the going gets tough.

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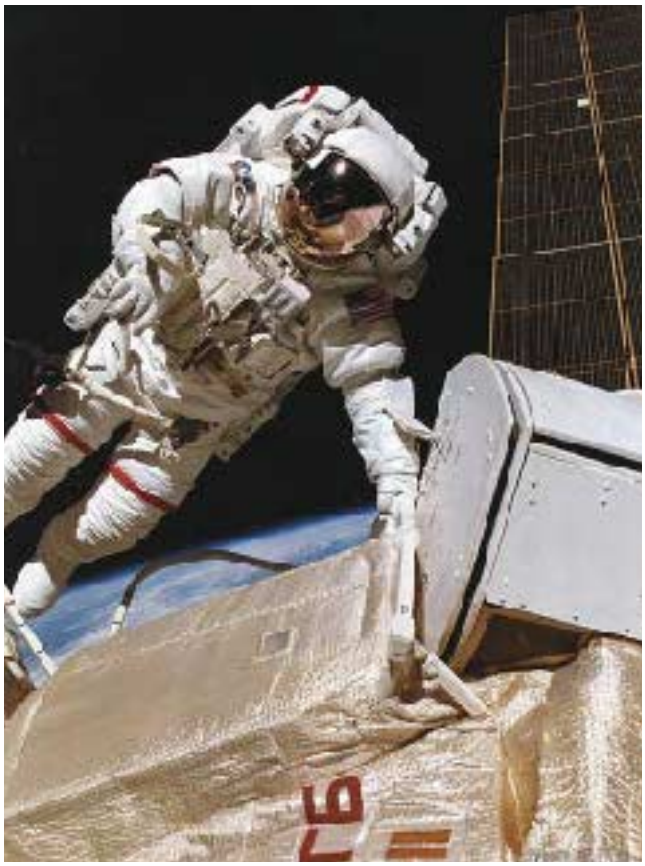
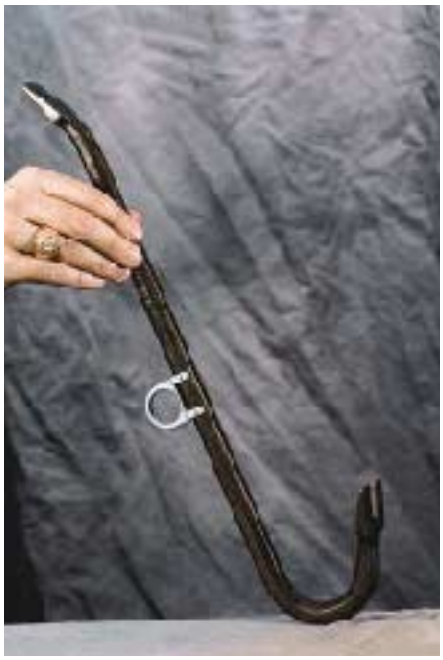
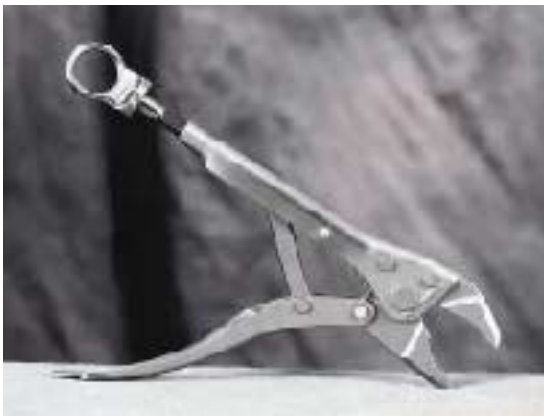


Everyone looks pretty much alike in a space suit, so astronauts working on the International Space Station wear visual identifying marks — in this case, the red bands around the astronaut's thighs. Note the spring-loaded safety tether and the chest-mounted tool belt.

Even when your screw gun has the equivalent of a Master's degree in construction management, the occasional bolt is going to get cross-threaded. When it does, this hefty bolt puller — made from beryllium copper, which doesn't become brittle in extreme cold — is just what the doctor ordered.





You didn't think anyone would try to run a job without a few pairs of these, did you? Like the bolt puller, these stainless-steel locking pliers are actually an off-the-shelf item that has been adapted for use in space. "We get these from a medical equipment supplier," Phil West says. "I can't tell you what they're ordinarily used for. I don't think I want to know."

"Where the heck did you put the tin snips?" That question never comes up in space, because each astronaut carries a pair of heavy-duty scissors in a thigh pocket at all times. They can be used for cutting sheet metal, plastic, cord, and other materials. Like a scuba diver's utility knife, they're seen as a vital safety tool in case an astronaut becomes tangled in material while on a space walk.

At the end of each spacewalk, NASA's 24-volt pistol-grip tool, or PGT, can be linked to an on-board computer, which downloads and records the number of turns and degree of torque delivered to each bolt. Tightening fasteners in zero gravity takes some experience: Unless the astronaut remembers to clip into a restraint system before squeezing the trigger, both user and tool may find themselves revolving freely around a stationary bolt.

The hammer is said to be humankind's oldest tool, and even in the year 2001, in orbit 250 miles above the earth's surface, it's as indispensable as ever. If something won't fit or turn or open or anything else, a smart rap with this nicely machined dead-blow hammer could work wonders.