

WHY SALAD IN SPACE MATTERS

A PORTABLE GARDEN ABOARD THE SPACE STATION CAN BE CRITICAL TO ASTRONAUTS' PHYSICAL AND MENTAL HEALTH

YES, YES, THERE WAS A DARING SPACE walk outside the International Space Station on August 10, as cosmonauts Mishu Kornienko and Gennady Padalka spent six hours performing a range of maintenance and inspection tasks.

But news of a different kind was made inside when the station's other crew members did something historic: they ate lettuce. Specifically, red romaine lettuce. More specifically, red romaine lettuce that was grown onboard—and that's a big deal.

Space has never been a place known for good eating. Certainly the food now is better than it was in the pureed, shrink-wrapped, sucked-from-packets days of Mercury, Gemini and Apollo, and that says something. The ISS has hot water, a food heater and the "ISSpresso" coffemaker.

But fresh fruits and vegetables, which take up room and spoil quickly, are another matter. While apples and carrots are sometimes sent up on cargo ships, those supply runs are infrequent, and when a ship fails to arrive—as has happened three times in the past year and a half—the veggie fast can go on and on.

NASA knows that during longer trips into deep space, particularly to Mars, fresh produce is good for not only the crew's physical health but also their mental well-being, giving them a comforting taste of home. That means growing the crops onboard.

To investigate how this could be done, NASA partnered with ORBITEC, a technology company based in Madison, Wis., developing a unit known straightforwardly as Veggie, which consists of a growth chamber and so-called plant pillows containing prepackaged seeds.

The unit is collapsible and includes a flat panel of red, blue and green LEDs. Technically, the first two colors are the only ones needed if your sole goal is to grow plants.

"Blue and red wavelengths are the minimum needed to get good plant growth," said Ray Wheeler, the lead scientist for Advanced Life Support at the Kennedy Space Center, in a NASA statement. "They are probably the most efficient in terms of electrical power conversion."

But plants aren't the only living things that factor into this equation. There are human beings too, and the red and blue lights bathe the



▲ Astronauts Kjell Lindgren (left) and Scott Kelly sample red lettuce grown aboard the space station. An earlier crew grew a similar crop and shipped the plants home first to test for safety and palatability.

plants in a sticky glow, making them altogether unappetizing until they're harvested. So green lights are added to "enhance the human visual perception of the plants," said Wheeler.

Nothing, however, goes onto the astronauts' menu—or into their bodies—without being rigorously tested first. In May 2014 an earlier crew germinated the first plant pillows, grew them for 33 days, then plucked and froze them and shipped them home on a returning spacecraft in October. Scientists on the ground certified them fit to eat, so Kelly germinated a new

"THE FARTHER AND LONGER HUMANS GO AWAY FROM EARTH, THE GREATER THE NEED TO BE ABLE TO GROW PLANTS FOR FOOD."

—SCIENTIST GIOIA MASSA

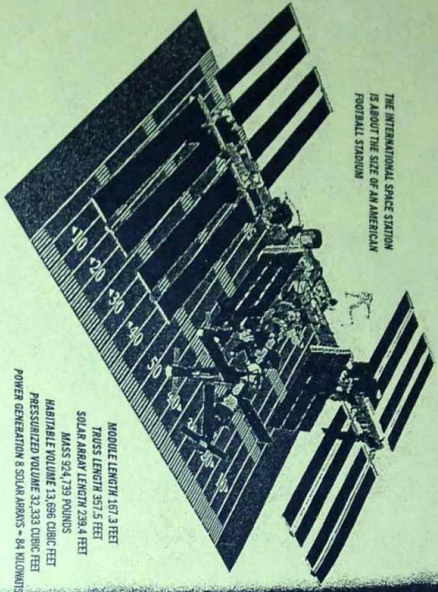
batch on July 7, and he and crewmates Kjell Lindgren and Kimiya Yui sampled them on August 10. They pronounced them fine.

There is one more reason to keep a garden running in space—and that explains why there are other pillows containing zinnia seeds aboard. The flowers are edible, yes, but they're also beautiful and colorful and fun to tend. Gardening is a very earthy grace note and has long been thought of as a relaxing and satisfying way for astronauts to keep themselves busy on long-duration missions that can quickly settle into repetitiveness and drudgery.

"The farther and longer humans go away from Earth, the greater the need to be able to grow plants for food, atmosphere recycling and psychological benefits," said Gioia Massa, Veggie's payload scientist. "I think that plant systems will become important components of any long-duration exploration scenario."

That's a whole lot of expectation riding on what is, today, just a few leaves of red romaine. But early homesteaders got their start with just small garden plots too. There's no reason their 21st-century heirs can't do the same.

// THE INTERNATIONAL SPACE STATION BY THE NUMBERS



THE INTERNATIONAL SPACE STATION IS ABOUT THE SIZE OF AN AMERICAN FOOTBALL STADIUM

MODULE LENGTH: 187.2 FEET
 TOTAL LENGTH: 353.5 FEET
 SOLAR PANEL LENGTH: 294.4 FEET
 MASS: 504,239 POUNDS
 HABITABLE VOLUME: 13,686 CUBIC FEET
 PRESSURIZED VOLUME: 12,333 CUBIC FEET
 POWER GENERATION: 3 SOLAR ARRAYS - 84 WATTS

LIVING AND WORKING IN ORBIT ON THE INTERNATIONAL SPACE STATION

Crews have eaten about **25,000 MEALS** since the first crew's arrival in 2000

Approximately **7 TONS OF SUPPLIES** support a crew of 3 for about **6 MONTHS**

Astronauts and cosmonauts have spent more than **1,000 HOURS** aboard the spacecraft

Within and outside the station, more than **1,500 scientific investigations** have been performed

ONE THING YOU CAN SAY ABOUT THE INTERNATIONAL SPACE STATION...

It's big—larger than a **6-BEDROOM HOUSE**. Has the internal volume of a **BOEING 747**.

Weights almost a million pounds (equivalent to more than **320 AUTOMOBILES**). Travels a distance equivalent **TO THE MOON AND BACK** in about a day.

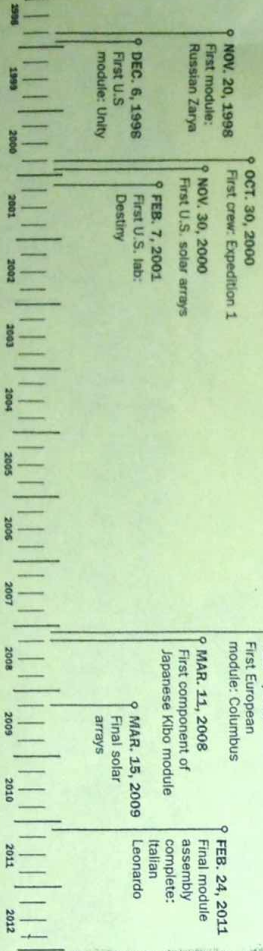
THE INTERNATIONAL SPACE STATION

Is a global program visited by more than 200 people from 15 nations



INTERNATIONAL SPACE STATION TIMELINE

It was November 1998 when the first modules for the space station were carried into orbit. Back on Earth, Google was brand-new and the iPod was still three years away.



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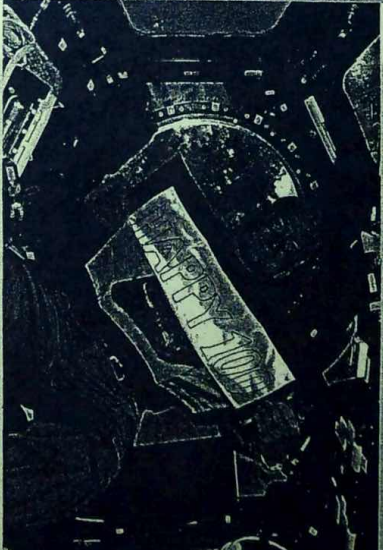


INTERNATIONAL SPACE STATION BENEFITS FOR HUMANITY

- ADVANCED ROBOTIC SURGERY**
- CLEAN DRINKING WATER** for people living far from water-treatment facilities
- REMOTE MEDICAL DIAGNOSTICS**
- EDUCATIONAL EVENTS:** 42 million students reached

THE LONGEST TRIP

Scott Kelly holds the world's title... for now
 BY JONATHAN D. WOODS



EXACTLY 216 DAYS AFTER NASA ASTRONAUT SCOTT Kelly strapped into a Soyuz rocket in the middle of the Kazakh desert, he broke the record for the longest single stay in space by an American astronaut. The record had previously been held by Spanish-American astronaut Michael López-Alegria, who spent 215 days in orbit in 2007. (Soviet cosmonaut Valeri Polyakov holds the overall record of 437 continuous days in 1994 and 1995.)

From the time Kelly got to space on March 28, 2015, until the time he came home on March 2, 2016—logging a total of 340 days aloft—the speed around Earth once every 88 minutes, or 16 times every day, aboard the International Space Station. “I kinda forgot what it’s like to live down there” (that’s Earth), says Kelly of his record-breaking stay.

Space travel is not supposed to be about bragging rights, as Italian astronaut Samantha Cristoforetti insisted when she set the record for the longest stay by a female astronaut, at 200 days. But what space is supposed to be about and what it is about are often two different things, and from the moment Yuri Gagarin became the first human being in orbit on April 12, 1961, astronauts have been competing (sometimes quietly, sometimes not) to go higher, faster and farther. Kelly knows his record can’t stand forever—and Polyakov’s can’t either—if human beings are ever going to make the two-and-a-half-year journey to Mars and back. And that’s how it should be. There was a time, after all, that America’s great space marathoner was Gordon Cooper, who went aloft in a Mercury spacecraft in 1963. His record stay in low-Earth orbit: 33 hours.