

## EDITORIAL

# Space, still the final frontier

This week in Pasadena, California, the International Science Council will convene its Committee on Space Research (COSPAR) Scientific Assembly to promote the exchange of results, information, and opinions in space research. Since its creation 60 years ago, on the heels of the 1957 launch of Sputnik by the Soviet Union and of Explorer 1 by the United States in early 1958—events that marked the dawn of the space age—COSPAR has nurtured partnerships between nations pursuing space science. There is a new space age now—one with many more players and exciting technologies to harness. New capacity-building endeavors at universities worldwide are providing opportunities for involvement in space missions, both great and small.

At the height of the Cold War in the 1960s and 1970s, space science and human space exploration offered a channel for citizens from the East and West to communicate and share ideas. Space has continued to be a domain of collaboration and cooperation among nations. The International Space Station has been a symbol of this notion for the past 20 years, and it is expected to be used by many nations until 2028. By contrast, there have been recent trends toward increased militarization of space with more—not less—fractionalization among nations. As well, the commercial sector is becoming a key player in exploring resource mining, tourism, colonization, and national security operations in space. Thus, space is becoming an arena for technological shows of economic and military force. However, nations are realizing that the Outer Space Treaty of 1967 needs to be reexamined in light of today's new space race—a race that now includes many more nations. No one nation or group of nations has ever claimed sovereignty over the “high frontier” of space, and, simply put, this should never be allowed to happen.

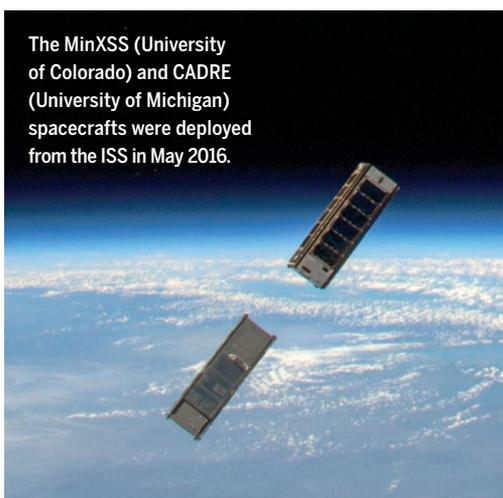
The good news is that there is room to further expand interest in space research. In addition to the huge missions run by the U.S. National Aeronautics and Space Administration, the European Space Agency, or private

entities like SpaceX, small space activities are burgeoning. Today, there are many academic space science programs around the world because of growing student interest in the relevant education and training. To create sustainable space programs at universities, capacity building is required that goes beyond space engineering. For example, the International Satellite Program in Research and Education (INSPIRE) grew out of courses at the University of Colorado to teach aspiring students not only about

the design and development of small spacecraft, but also the outstanding science that can be accomplished with such missions. Since 2015, INSPIRE has brought together universities to both fund and develop real hands-on space missions. It now has member universities and institutes from over a dozen nations (predominantly in Asia). Together, these partners secure funding and contribute complementary technological know-how and resources to launch new small space missions. Four separate “smallsat” projects currently involve the University of Colorado at Boulder in the United States, Nanyang Technological University in Singapore, the Indian Institute of Space Science and Technology in India, and National Central University in Taiwan. For universities in developing nations, showing that one can design, build, launch, and operate a spacecraft that can contribute to new advances in Earth and planetary sciences demonstrates that one truly deserves a “seat” at the proverbial international table. Beginning on a small scale of cooperation on microsattelites could open doors to collaboration on bigger scientific and technical programs and opportunities, fortifying relationships that may one day play a key role in other diplomatic interactions.

As was true during the Cold War, there are still political differences on Earth, but in space we should together seek to push forward the frontiers of knowledge with a common sense of purpose and most certainly in a spirit of peaceful cooperation.

—Daniel N. Baker and Amal Chandran



The MinXSS (University of Colorado) and CADRE (University of Michigan) spacecrafts were deployed from the ISS in May 2016.

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# Science

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