HOW SPACE CAN IMPROVE LIFE ON EARTH

Future space applications promise revolutionary improvements in our quality of life. BY DR. STAN ROSEN

The National Space Society is committed to promoting the use of space resources to benefit humanity, as a fundamental element of the society's vision. We know that in the future, many resources will be discovered on asteroids, planets, and possibly the moons of our solar system that can be exploited for their contents. But space resources are not limited to mining materials and lunar soil. Valuable space resources also include space itself, which can host satellites with the ability to see and efficiently communicate with large areas of the Earth's surface. This resource has spawned many applications of space systems that improve life on Earth every day. Some of the space program's greatest success stories offer even greater promise for the future.

Here's an important distinction to keep in mind when we talk about the use of space to improve life on Earth. Sometimes the contributions of space to our day-to-day needs are referred to as "space spin-offs." But this term more appropriately describes ancillary uses of the technologies developed for space systems, rather than the direct use of the systems themselves for their original purpose. This direct use of space technology is more accurately called "space applications."

Space applications support both private and government users of space services. They now represent billions of dollars of business for industries that provide satellite communications (VSAT business communication systems, mobile telephones and data, direct-to-home TV, satellite radio, wideband data services, etc.), remote sensing (including mapping, agriculture, resource management, land use, etc.), and a growing set of industries that provide positioning, navigation, and timing services based on the Global Positioning System (GPS) and other related capabilities. It has been estimated that these services provide over $65 billion of value around the world annually. And this number doesn't include the value of system manufacturing, launch, and operations businesses, or support for government functions.

Government users, of course, exploit space for military and other national security-related purposes, as well as a number of well known civil government functions. The most notable are communications (such as provided by NASA's Tracking and Data Relay Satellite System); remote sensing of the Earth's resources, weather, and climate monitoring; and a number of government applications of the GPS systems for positioning, navigation, and timing services.

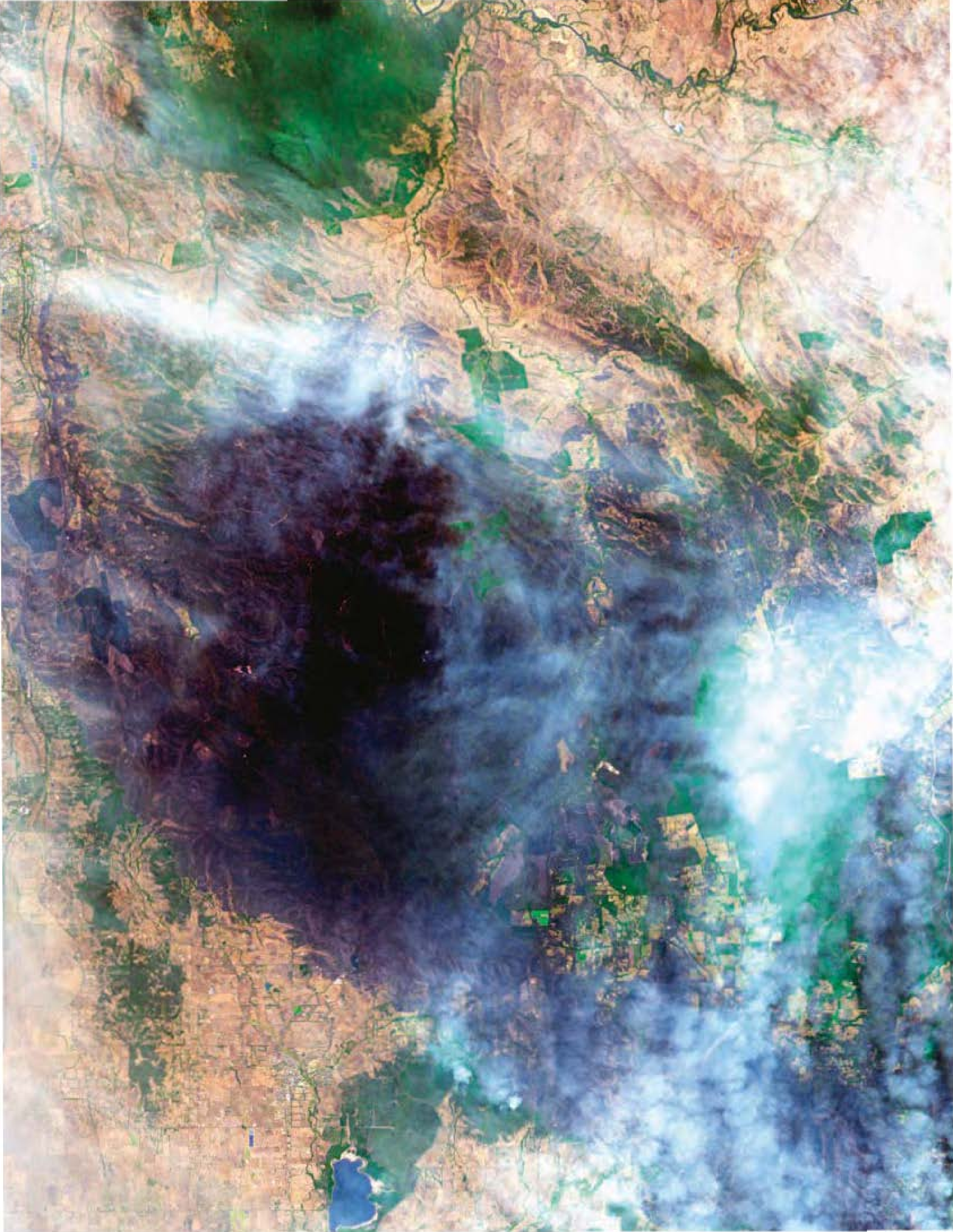
The important point is that new space applications are developing more rapidly than ever. The future holds exciting prospects for modern space capabilities to improve life on Earth. Some of the rapidly changing needs that are being or can be addressed by the use of space systems include: energy, food, water, security, communications, entertainment, process efficiency, disaster recovery, crime fighting, and education.

Rapidly maturing space technologies enable us to provide services that were impossible only a few years ago. Some of these technological developments include high power and highly efficient power-transfer systems, distributed spacecraft constellations, large and precise antennas, very large data throughput capabilities, new active and passive sensors, ultraprecise positioning, and high capacity onboard data processing. Additionally, improved lightweight materials, in-space processing and manufacturing facilities, routine human space operations in Earth orbit, and lunar and cislunar human operations lie ahead.

Based on such rapidly developing technological capabilities, many new space applications may be on the horizon, including:

- Improved weather applications, such as regional climate change characterization and possibly weather conditioning to weaken hurricanes, tornadoes, etc.
- New biotechnology and materials development advances using the low gravity environment found in Earth orbit
- New mobile and broadband communications capabilities to lower the cost of uses including better digital medical file transmission to remote areas, distance learning, home security and automation
- Improved remote sensing and navigation for precise farming and mining operations, disaster/problem avoidance while driving, response to emergencies, traffic management (including air vehicle traffic control on the ground and in the air), etc.
- New surveillance capabilities from space, such

The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) instrument aboard NASA's Terra spacecraft captured this 30-square-mile swath of charred land northeast of Melbourne, Australia, on February 14. Images from ASTER are used by a broad range of scientific disciplines to study the dynamic conditions of the planet's surface.



as space radar for domestic border surveillance and support of counter-drug operations, precise fire monitoring from space, marine/wildlife resource management, better data for Google Earth, etc.
- Improved signal processing to enable services such as earthquake detection and warning.
- Lower cost, safe transportation for suborbital, orbital, and circumlunar rides
- Energy generation in space and sunlight reflection to Earth

Two specific examples of new space applications that will soon change our life on Earth are a new satellite-based air traffic control system known as Automatic Dependent Surveillance Broadcast (ADS-B) and a weather satellite system called NPOESS (National Polar Orbiting Environmental Satellite System).

ADS-B will use satellite-based navigation to let air traffic controllers reduce separation standards between aircraft, significantly increasing the number of aircraft that can safely be managed in the nation's skies. In October 2007, the FAA proposed that all aircraft flying in the nation's busiest airspace must have satellite-based avionics by 2020.

NPOESS is a new joint program being built by the National Oceanic and Atmospheric Administration (NOAA), NASA, and the U.S. Air Force that will collect extremely precise atmospheric and environmental measurements from space in massive quantities. Beginning in about 2013, this data will allow scientists and forecasters to monitor and predict weather patterns with greater speed and accuracy than ever before, benefiting citizens in areas such as aviation, agriculture, and disaster planning and response.

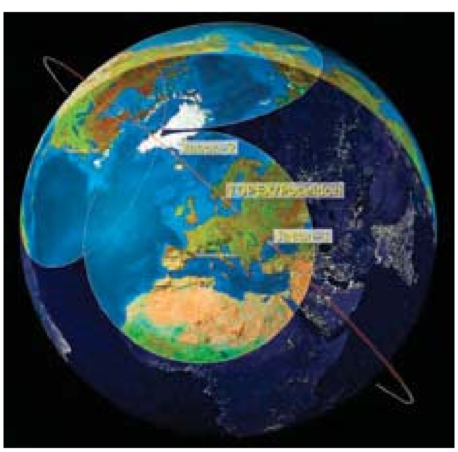
Looking even farther into the future, we can envision possible applications of near-Earth space capabilities to provide additional "revolutionary" capabilities such as:
- Weather modification and control
- Production of unique products in orbital factories
- Famine avoidance
- Global water management
- Global integrated transportation systems
- Global border integrity
- Earthquake avoidance
- Planetary defense
- Orbital and lunar excursions
- Orbital and lunar resorts
- Lunar-based surveillance and management of the cislunar environment
- Helping to meet Earth's energy needs
- Commercial lunar and asteroidal resource exploitation

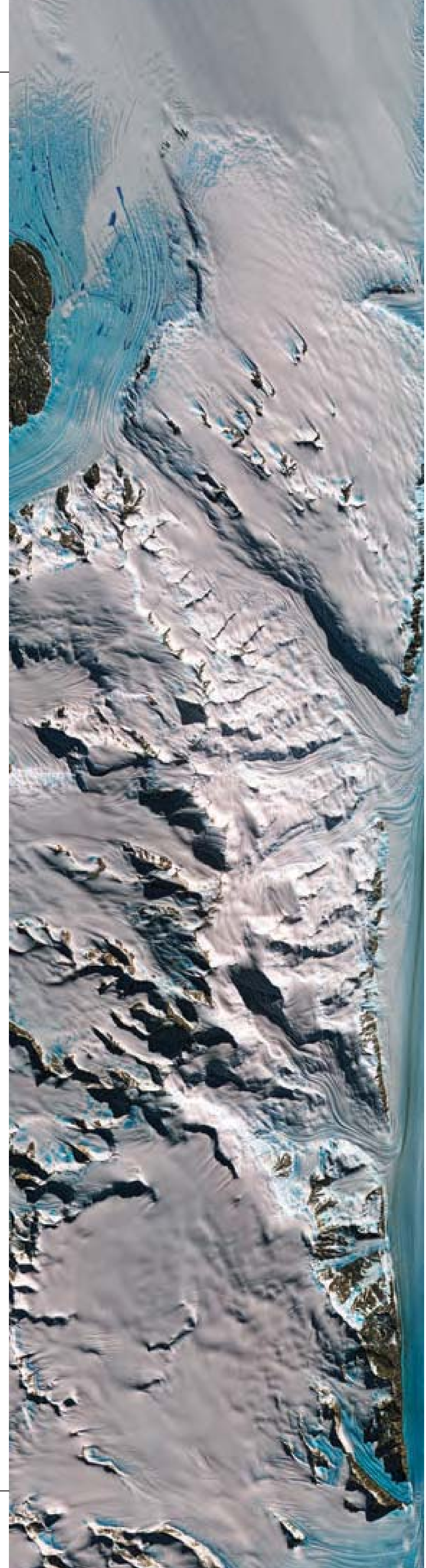
Clearly, space applications have become a foundation for the improvement of our national and global well-being. For the incoming administration and Congress, these possibilities offer exciting and rewarding areas for investment. Well-crafted programs and policies that develop the technical and operational infrastructure are needed by both the government and the private sector in order to capitalize on these opportunities, keeping the U.S. in the forefront of 21st-Century space applications.

As an integral part of the society's strategic plan, NSS continues to identify and foster these kinds emerging applications. If you'd like to be involved in this activity, please contact the NSS staff for information about NSS's Space Applications Working Group and other initiatives in place to promote new space applications to benefit life on Earth.

You can also visit the NSS Web site for extensive information about the use of space systems to collect solar energy for transmission to Earth.

After a 40-year career in national security and commercial and civil space activities, Dr. Rosen is currently on the NSS board of directors. He is president of the Association for Strategic Planning and professor of acquisition management at the Defense Acquisition University.





Left: An illustration depicting three ocean-mapping satellites: Topex/Poseidon, Jason-1, and Ocean Surface Topography Mission/Jason-2. The circles on the Earth's surface represent the ranges of the different ground stations that track the three satellites. Right: An image taken by ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) of the 84-mile-long Byrd Glacier in Antarctica in November 2008. Opposite, top: On July 26, 2005, the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Terra spacecraft photographed this dust cloud partially obscuring the Red Sea. Near the top of the image, the turquoise shoreline areas are concentrations of coral reef. Opposite, bottom: A photograph of Hurricane Ike taken from the International Space Station on September 5, 2008, before the hurricane had passed over Cuba and the Gulf of Mexico.