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New Perspective

U.S. Space-Based Earth Observations in 21st-Century Science Diplomacy

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Science diplomacy can take the form of cooperation or competition.[1] As the global community faces new challenges, ranging from dangerous changes in Earth's climate to increasingly coercive authoritarian regimes, civil space-based Earth observations offer the United States unique opportunities to employ science diplomacy in cooperation and competition. Investments in space-based Earth observations will be a great benefit as the United States orients itself to the diplomatic challenges of the 21st century.

Background

In an early example of successful cooperative science diplomacy, NASA took a leading role in the international technical response to a threatening hole in the high-altitude layer of ozone that protects the Earth from damaging ultraviolet radiation.[2] Space-based measurements revealed the continental scale of the problem and contributed to the development of the Montreal Protocol and codicils that phased out the commercial chemicals responsible for the damage.[3]

Beginning in the 1990s, the formalization of NASA's full and open data sharing policy and growing public access to the data of other U.S. government agencies set an example for other nations.[4] These policies can be viewed as a cooperative example of science diplomacy that also offers a competitive advantage. For instance, when data from NASA and the U.S. Geological Survey's Landsat program was made freely available in 2008, it created economic benefits and scientific breakthroughs across government and private enterprise that would not have been possible otherwise.[5] As a consequence of these policies, civil Earth observation data now touches nearly every sector of the global economy, including weather, agriculture, food security, water resource management, and financial markets.[6] Advancing NASA's critical Earth observations and maintaining consistent and transparent data policies builds trust and serves as a collaboration tool.[7] As former U.S. Ambassador to the United Kingdom Matt Barzun observed, NASA is invariably among the top three things that international students associate with the United States.[8]

The Future Role of Space-Based Earth Observations in Science Diplomacy

Looking to the future, civil space-based Earth observations can play key roles in science diplomacy as climate change gains momentum and the international community attempts to avert dangerous changes to the climate system.[9] Scientists and decision-makers around the world will require access to time-sensitive data in order to model, predict, and mitigate the impacts of climate change, which are affecting nearly every aspect of human activity and leading to increasing instability.[10] Some of this data is already available from research and operational meteorology satellites. Under the umbrella of the new Earth System Observatory—a combination of future radar, lidar, hyperspectral, and gravity-measuring satellites and airborne field campaigns—the United States can continue to lead the international community.[11] Indeed, the U.S. called for a "revolution" in international Earth observation and monitoring at the COP26 climate conference to address climate change.[12] Collaboration across nations will address the cost and complexity of collecting and making use of the

necessary high-quality space-based data—making it not just freely available, but also "analysis ready." This critical data will be open to all scientists and decision-makers around the world who can make use of it.

U.S. investments in Earth observations will also create opportunities for innovative businesses focused on climate change risk forecasting and precision agriculture. Innovative space-based Earth observation ventures like these have the potential to create new markets worth billions of dollars.[13] International science and technology developments led by the United States, along with a commitment to accessible data and technology transfer, can ensure that a wide range of developing nations can tap into these opportunities and strengthen global economies. An open approach, such as NASA's evolution from open data to an increasingly inclusive, transparent, and collaborative open-source scientific process, denies competitors the opportunity to use the benefits of Earth observations in the service of coercion. These partnerships also build and strengthen U.S. networks of allies and partners in scientific, economic, and public-policy spheres.

What is Needed to Realize the Benefits of Space-Based Earth Observations to U.S. Science Diplomacy?

Realizing the opportunities for science diplomacy that arise from space-based Earth observations does not require engineering any great changes, but it will require sustained leadership. First, in order for the United States to maintain its influence as a leader in Earth science, NASA must continue to lead on Earth-focused, globally oriented space missions. Proposed Earth observing missions, such as a cutting-edge global hyperspectral imaging mission (currently under study), will offer opportunities for scientific advances and economic innovations in the space-based service industries. These efforts continue the lineage of U.S.-led space missions from NASA, the Department of Defense, and other agencies, enabling technological breakthroughs as varied as GPS, telecommunications, and Earth system modelling that created global industries and established the United States as an influential technology powerhouse.

The U.S. must also continue to lead international civil-space partnerships, and nurture new ones. Such partnerships can make the cost and complexity of gathering scientific data needed for a collective global response to climate change manageable. The United States has a proven record as a reliable and responsible partner in space-based Earth observations. The ability to undertake new international partnerships of enormous technical complexity is a unique cooperative capability.[14] It is also a useful competitive instrument. Nations around the world seek to partner with the United States in all aspects of Earth observations because of its history of creating scientific and economic value. The United States can take advantage of this interest in newly competitive regions where space-based observations are needed.[15] In a competitive diplomatic environment, the United States' ability to lead and partner can maintain its position as a global science and technology leader.

Finally, the U.S. must develop new partnerships with the civil and commercial space industry. NASA and the National Oceanic and Atmospheric Administration (NOAA) have taken the first steps to incorporate commercial Earth observing data into scientific programs, such as NOAA's recent award to Spire Global Inc. to provide radio occultation data to support improved weather forecasting.[16] Ongoing investments in technologies and partnerships that expand commercially available measurements and improve data will enable new data and service markets for commercial entities in the United States and around the world.

Looking ahead

Civil space-based Earth observations can play an important role in 21st-century science diplomacy. At present, the United States enjoys significant advantages in this area. The quality, accessibility, and transparency of its civil Earth observation data is unimpeachable, and the global nature of the data allows users anywhere in the world access to locally relevant environmental data, products, and information. Additionally, open data and, increasingly, open science policies, underwrite extraordinary value for science, policy, and economic innovation. Leading and partnering on the international stage to enable Earth observing missions and make space-based Earth observation data affordable, accessible, and actionable, are essential future elements of U.S. science diplomacy. They

will enable collective action on global challenges while also denying competitors the opportunity to use Earth observations as a tool in geopolitical competition. The United States should continue to invest in all aspects of Earth observations to leverage the full benefits to its science diplomacy.

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Endnotes

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