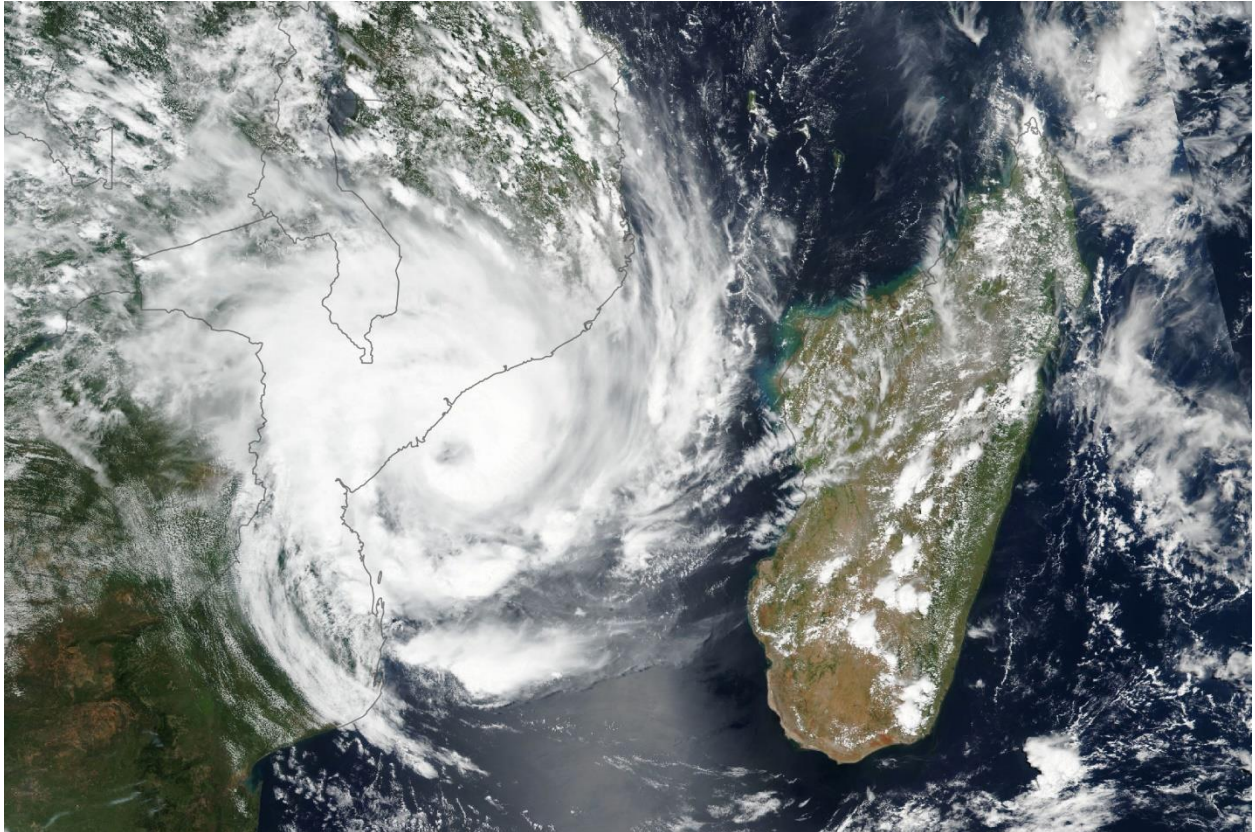


GEOSPATIAL INTELLIGENCE

A Test Case For Washington's Emerging Industrial Policy



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Findings in Brief

- The commercial geospatial-intelligence industry is growing rapidly. However, most of the growth is happening outside the United States, where foreign providers are matching and surpassing the offerings U.S. companies.
- Geospatial intelligence (GEOINT) is imagery of activities in relation to the Earth's geography, usually collected from satellites or aircraft. It is a "dual-use" technology in that it can be useful to both military and civilian users.
- As with many other industries where the U.S. was once dominant, foreign providers of GEOINT have increased market share in part by exploiting subsidies from their governments. China in particular is investing heavily in methods of collecting and analyzing GEOINT.
- According to a recent study by MITRE, if Washington does not move to counter gains by other countries, the United States will soon lose its ability to control supply chains and set standards. Foreign providers could use predatory pricing to force U.S. companies from the market.
- GEOINT is an obvious candidate for inclusion in any industrial policy aimed at preserving U.S. technological dominance. Washington should recognize that U.S. providers are competing at a disadvantage, and take steps to preserve the industry by favoring domestic sources, streamlining regulations, and encouraging investment.
- None of these steps necessarily requires new federal funding. However, if policies do not evolve, America's lead in geospatial intelligence may soon be gone.

Geospatial intelligence is vital to economic and military security.

In December 2020, the Chinese company Changguang Satellite disclosed it had raised \$375 million to build a constellation of 138 remote-sensing satellites offering high-resolution imagery of objects on the Earth's surface. When completed in 2030, the constellation will be capable of revisiting any item of interest every ten minutes.

Changguang's announcement was just the latest in a series of developments signaling that the U.S. geospatial intelligence industry is being overtaken by foreign competitors. Once the unrivaled leader in orbiting spacecraft capable of monitoring the Earth, America is now only one among several players. For instance, there are currently 16 commercial satellites in orbit around the globe capable of using radar to penetrate darkness and cloud cover in pursuit of Earth observations, and 15 of them are foreign-owned.

Although the U.S. intelligence community is known to operate Earth-observing satellites utilizing various sensing technologies, the resulting collections are highly classified. The information generated by commercial remote-sensing companies, on the other hand, is generally available to anyone who can afford it. A [recent study](#) by MITRE counted over 150 commercial companies engaged in marketing such information. Many are headquartered outside the United States.

Geospatial intelligence has a wide variety of uses, from mapping to mineral exploration to commercial logistics, but it is especially valuable to military consumers seeking to understand the activities of potential adversaries. It was, for example, used to identify the location of Soviet nuclear weapons during the Cuban Missile Crisis in 1962.

This report is about the waning of U.S. leadership in commercial geospatial intelligence, and what can be done to reverse the erosion in America's standing. That erosion is largely traceable to actions by foreign governments in support of their domestic industries that have not been matched by Washington. Because the decline of U.S. geospatial intelligence capabilities has important implications for both national security and

economic competitiveness, it is an obvious candidate for inclusion in any industrial policy aimed at preserving America's technological supremacy.

America's technological edge over other nations is steadily eroding.

When the Cold War ended 30 years ago, the United States was unrivaled in virtually all of the technologies thought to define the future of civilization. That is no longer the case. Several subsequent developments, such as China's entry into the global trading system on a most-favored-nation basis, began a steady decline in U.S. technological leadership. That, in turn, has contributed to a deterioration in the country's economic performance. In 2001, the year that China became a member of the World Trade Organization, America accounted for over 30% of global GDP; by 2010 it had fallen to 22%, where it remains today.

The decline in U.S. economic strength wasn't caused solely by a leveling in technological capabilities, but the rise of innovation elsewhere certainly played a role. The United States has seen its trade balance in technology-intensive goods deteriorate continuously in recent years, despite growing awareness of the problem. A few examples highlight how far America has fallen in recent years:

- The United States buys 34% of the world's microelectronics, but only manufactures 12%; Asian nations manufacture 75%, while providing 98% of packaging and testing.
- 80% of the U.S. supply of antibiotics is made in China; production of pharmaceuticals outside China is heavily dependent on chemical precursors made there.
- 65% of worldwide lithium-ion battery production occurs in China while only 12% occurs in the U.S.; lithium-ion batteries are essential to the functioning of electric vehicles.
- China added 140,000 robots to factory floors in 2019; the U.S. added less than a quarter of that number, and ranks fourth in robotic automation behind China, Japan and South Korea.

As these examples indicate, the biggest challenge to American technological supremacy originates in Asia. But Asia is not alone in threatening U.S. leadership. European countries have followed the lead of Asian nations by subsidizing indigenous tech companies. The World Trade Organization ruled in 2010 that four European governments had illegally subsidized every commercial transport Airbus brought to market, enabling it to claim half of the global market and destroy tens of thousands of jobs in the U.S. aerospace sector.

Against that backdrop, the uncertain future of the U.S. commercial geospatial intelligence industry is just one facet in a far broader pattern. For instance, Airbus has also become the world's biggest exporter of remote-sensing satellites, a status it could not have attained without support from European governments. What makes GEOINT, as it is called, different is that the U.S. federal government is a key source of demand for such intelligence.

The systems used to collect and analyze GEOINT thus constitute a "dual-use" technology cluster. In other words, government and private-sector users are both major sources of demand. That is not the case with most dual-use technologies such as microelectronics, where the Pentagon only represents 1% of global demand. But geospatial intelligence as a competency and as an industry originated in the federal marketplace, and remains heavily dependent on that marketplace today.


That makes GEOINT a clear candidate for early treatment in any industrial policy aimed at preserving the technological sinews of national security. Before assessing how Washington can help or hurt the domestic GEOINT sector, though, it is useful to further explore precisely what geospatial intelligence is.

Geospatial intelligence is a rapidly growing field with a long history.

Geospatial intelligence involves the location and movement of any item of interest in relation to the Earth's physical features. The widely used prefix "geo" derives from the Greek word for Earth, so when combined with

“spatial” the resulting term refers to where something is in relation to the Earth – not just on land, but also beneath the seas or in the atmosphere above it. For instance, sonar systems that map the seabed are collecting a form of geospatial intelligence.

In common usage today, geospatial intelligence typically refers to the collection of imagery or measurements from satellites and aircraft. Overhead observation often reveals information not readily apparent from other vantage points. During the Cold War, such information was largely the province of the intelligence community, but there always has been a civil component to demand for such observations. When used in a civil context, the phrase usually applied is “remote sensing.”




NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

WHAT IS GEOINT?

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GEOINT is composed of information layers, which answer such questions as...



- ❖ Where am I?
- ❖ Where are the friendlies?
- ❖ Where are the enemies?
- ❖ When might they move?
- ❖ Where are the non-combatants?
- ❖ Where are the obstacles, natural or man-made, and how do I navigate among them?
- ❖ What is the environment?
- ❖ What does it mean?
- ❖ What is the impact?

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THE UNITED STATES OF AMERICA

The U.S. Geological Survey defines remote sensing as “the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance (typically from

satellite or aircraft).” Said radiation most often is in the form of sunlight, but geospatial intelligence can also be collected using microwave radar and any number of other sensing techniques exploiting portions of the electromagnetic spectrum. The U.S. Air Force uses radar planes to collect “ground moving target indications” that can be employed to track and target hostile forces on the Earth’s surface.

In the national security community, Earth-observing satellites that collect imagery are a longstanding source of geospatial intelligence. The Pentagon’s National Reconnaissance Office operates spy satellites using both electro-optical and radio-frequency (radar) technology to generate detailed information about other states and non-state actors. This information is then analyzed by the National Geospatial-Intelligence Agency and other consumers using powerful software to reveal valuable insights.

The most important development in the geospatial intelligence sector since the Cold War ended has been the proliferation of commercial enterprises marketing competencies once confined largely to government. There are now so many commercial providers of GEOINT collections and analysis that intelligence agencies routinely look to private-sector sources to supplement their organic capabilities. In the U.S., though, the transition from exclusive reliance on in-house technology to a mix of in-house and outsourced providers has unfolded fitfully, hobbling the ability of domestic companies to keep up with overseas rivals.

Federal policies have impeded the competitiveness of domestic GEOINT enterprises.

The U.S. intelligence community began contracting with commercial companies for overhead imagery nearly 20 years ago. As discussed in a recent MITRE report on geospatial intelligence, President George W. Bush issued a national security directive in 2003 committing the government to sustaining America’s lead in space-based sensing. However, only four years later Germany and Italy separately orbited radar satellites offering

sub-meter resolution to commercial customers, at a time when Washington was prohibiting domestic providers from marketing overhead imagery that provided granularity of less than a meter.

This was just one in a series of policy decisions that cumulatively dampened progress in the domestic sector while enabling foreign rivals to surpass U.S. offerings. As the MITRE assessment notes, “commercial imagery adoption was slow and hindered by a difficult remote sensing licensing process. In turn this limited U.S. remote sensing innovation, reduced domestic investment, and stymied commercial imagery utility.” For instance, almost all of the commercial radar-imagery satellites currently operated around the world are foreign-owned. Other countries now dominate that segment of the business.

As in many other technology areas where the U.S. once led the world, the basic problem with policy in the GEOINT arena was that it failed to keep pace with market developments. In its zeal to protect sensitive intelligence-gathering technology and activities, Washington hobbled its domestic industry. The danger today is that commercial progress in other countries, especially China, will enable those countries to dominate supply chains, set standards, and gradually drive U.S. companies from the marketplace.

China is actively leveraging its participation in international organizations to encourage that outcome. It is partnering with the United Nations to establish a major geospatial intelligence complex in Zhejiang Province, and has attempted to dominate standards-setting bodies within the U.N. system. Washington barely managed to avert a campaign that would have installed a Chinese national as director-general of the World Intellectual Property Organization. Beijing already leads the International Telecommunication Union and the International Civil Aviation Organization.

While these moves by no means assure China’s ascendancy in activities such as the generation of geospatial intelligence, they reflect an ongoing campaign to supplant the United States as the leading global player in a wide range of technologies. If the United States is to preserve its

technological edge in areas like GEOINT, it will need to frame an industrial policy that moves beyond the platitudes of the past about free trade and shared interests. In particular, it will need to provide tailored solutions to the challenges that specific technology sectors face. GEOINT should be an early target of such exertions, given its importance to national security and the competitive pressures the domestic industry is already facing.

Five steps are required to revitalize U.S. commercial GEOINT.

The Biden administration and Congress can fix most of the problems facing America's commercial geospatial intelligence industry without spending additional federal funds. The first and most important step is to recognize that U.S. providers are not competing on a level playing field with foreign rivals, because countries such as China have failed to live up to the commitments they made as members of the World Trade Organization. It is not realistic to expect that private companies in the U.S. can compete successfully with offshore entities that are heavily subsidized by their governments. China is by far the worst offender, but other entities such as the space and defense unit of Airbus are also beneficiaries of market-distorting behavior by foreign governments.

A second essential step is to recognize that, independent of its economic impact, geospatial intelligence is crucial to national security. That fact does not change if the intelligence in question originates outside the government rather than from classified organic sources. Although the commercial providers that the U.S. intelligence community taps may be selling similar services to private users, where agencies are looking and what kind of information they are seeking is a sensitive matter. It therefore is not prudent to rely on offshore sources that have business relationships and supply chains tied to Russia or China. Indeed, it may be dangerous to rely on any foreign provider of GEOINT that operates in locales where the security of products cannot be rigorously established.

A third step is, as a matter of policy, to favor indigenous sources of commercial geospatial intelligence. That is the practice of many other

countries, not only because of national-security concerns but also because they wish to benefit their local economies. The United States should be no different. When commercial GEOINT meeting federal needs is available from domestic sources, that is where it should be acquired for both economic and security reasons. If the U.S. alternative to offshore sources is occasionally more expensive, that will likely reflect the pricing differential enabled by government subsidies to foreign sources. If domestic sources are forced from the market by predatory pricing by their overseas rivals, though, U.S. intelligence and military consumers will have little pricing leverage with foreign sources in the future. In other words, going offshore may save money in the near term at the expense of creating much bigger costs over the long term.

A fourth step necessary in revitalizing U.S. commercial GEOINT is to streamline the process by which domestic operators are licensed to orbit remote sensing satellites with advanced capabilities. One reason foreign providers are catching up with their U.S. counterparts is that the federal government has taken too long to license innovations such as synthetic aperture radar imaging and electro-optical systems with quarter-meter resolution. If a country like China is selling overhead imagery on the open market with sub-meter resolution and ten-minute revisit rates, it is hard to see what benefit the United States gains by preventing domestic enterprises from doing the same. America cannot remain competitive in commercial GEOINT unless its regulatory policies reflect existing market conditions. And if it ceases to be competitive, that will inevitably have negative consequences for national security.

Finally, Washington should take steps to encourage investment in the commercial GEOINT sector. As MITRE observed in its October 2020 report, “the United States has fallen behind, and foreign investment, largely funded by foreign governments, has begun to dominate the industry.” That does not necessarily mean that the U.S. government has to invest in the domestic industry, but it should foster conditions that make the industry attractive to private investors. This can be accomplished by sustaining robust federal demand for the sector’s products, encouraging agencies such

as the Export-Import Bank to assist companies in exporting, and sharing the benefits of government research with providers on a preferential basis. If these measures require infringing on traditional interpretations of free trade, it is only because the domestic GEOINT industry is struggling to survive in a global market where other players receive extensive benefits from their home governments.

Over the last generation, the United States has steadily lost ground in an array of industries, from shipbuilding to machine tools to semiconductors. All of these industries have some relevance to national security. However, few are so clearly linked to intelligence gathering and military preparedness. If the United States cannot take effective steps to preserve its commercial geospatial intelligence sector, its prospects for remaining the world's sole superpower will be dim indeed.