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International Small Satellite Developments Point to Opportunities for Intelligence Gathering

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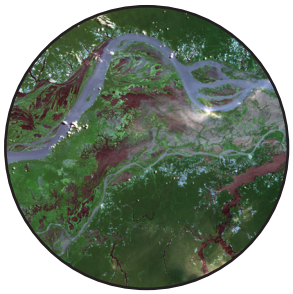
Small satellite (smallsats), or satellites under about 200 kilograms, are quickly becoming the spacecraft of choice in the space sector, particularly for those countries and organizations previously excluded from access to space. Because smallsats have shorter development cycles and lower development and launch costs than more traditional larger satellites, they are considered more expendable, enabling riskier experiments and different applications than larger, more costly satellites. A team of researchers from the IDA Science and Technology Policy Institute (STPI) studied ongoing and potential future international and private activities in the smallsat sector. Our goal was to identify global trends in the sector as a way of helping the intelligence community determine targets for its future data collection efforts surrounding the space sector.

A survey of the open literature and interviews with experts in government, industry, academia, and finance led to selection of four potential future archetypical scenarios for the smallsat sector. Analyses of these four scenarios yielded primary drivers that fell into four broad categories: market demand, access to space, competing alternatives, and government policies. The STPI team examined trends within each of these categories, alone and in combination, to assess the likelihood of their contributing to the realization of the selected scenarios. The scenarios, in order of their likelihood of being realized, are portrayed below.

Scenario 1

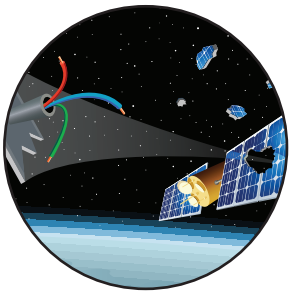
One or more large, primarily broadband smallsat constellations in low Earth orbit are providing affordable global broadband internet with low latency.

Scenario 2



Smallsats are nearly on par with large satellites in terms of remote sensing as a result of such capabilities being available commercially outside the United States, resulting in broader access to space.

Scenario 3



The number of smallsats make low Earth orbit unsafe and no longer viable for satellite operations, so larger, costlier satellites are being built for different orbits.

Scenario 4

Persistent platforms in low Earth and geostationary orbits provide on-orbit capabilities in servicing, assembly, and manufacturing, giving industry the flexibility to design, build, and deploy the satellites best suited for the desired application without dedicated launches.

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An analysis of these four scenarios led to identification of 62 drivers that were organized into four categories for discussion purposes. The first category is demand for LEO-based services, such as space-based communication, imagery-based intelligence, and situational awareness. This demand, in turn, drives the perception of profitability and consequently injection of funding and talent into other drivers, including the development of new technology, low-cost approaches, and infrastructure. The second is access to space, not just with respect to the cost of launch but also to the availability of reliable launch options, which drives whether the four scenarios can come to fruition in the timeframe of interest. The third is competing alternatives, such as terrestrial and airborne platforms, as well as incremental and breakthrough innovations in large satellites, which drive the relative value proposition offered by smallsats and can either make or obviate the need for them. The fourth category is government policies related to spectrum allocation, radio frequency interference, protectionism and mercantilism, debris mitigation standards, on-orbit regulation, and space traffic management. These policies are driving private sector interest—both positive and negative—in the smallsat ecosystem.

Key trends to watch are: (1) rising demand for communication and imagery products and services; (2) reduction in cost of satellite constellation systems; (3) implementation of policies on spectrum allocation, situational awareness, and space debris; (4) development of terrestrial options to services based in low Earth orbit; (5) emergence of new means (beyond cost reduction) of providing more users with access to space; and (6) lower cost methods of transmitting more data from small space platforms. **Information on these and other developments will shed light on how the U.S. can maintain its information advantage even if it loses its technological advantage in the space sector.**

Based on IDA P-8638, *Global Trends in Small Satellites*, B. Lal, E. de la Rosa Blanco, J. R. Behrens, B. A. Corbin, E.K. Green, A. J. Picard, and A. Balakrishnan, July 2017. Research sponsored by Office of the Director of National Intelligence.