RESEARCH SUMMARY

Commercial Space Capabilities and Market Overview

The Relationship Between Commercial Space Developments and the U.S. Department of Defense

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ISSUE

The U.S. Space Force (USSF) and U.S. Department of Defense (DoD) are considering various ways to leverage commercial space capabilities as part of their policy goals to promote the U.S. space industry and improve the resiliency of the national security space architecture. The commercial space sector offers a range of capabilities and services, including emerging technologies. The commercial capability, commercial capacity, and demand signals from the U.S. government have rapidly evolved recently for many space capabilities. As the USSF and DoD face choices about leveraging commercial space capabilities, they need to be aware of the current capabilities and trends of the commercial space sector.

APPROACH

The analysis was conducted by reviewing past assessments of commercial space capabilities and open-source literature to characterize capabilities, technological innovation, and trends of the space sector. Where needed, we collected additional new information from relevant government organizations and space service providers. We reviewed the commercial space capabilities of satellite communications (SATCOM), space launch, remote sensing, environmental monitoring, space domain awareness, data transmit/receive networks, and space logistics. Commercial capabilities were limited to U.S. companies or companies with a U.S. subsidiary.

CONCLUSIONS

- More-established commercial space sectors are growing in capacity and capability. The SATCOM sector has begun using high-throughput satellites and is planning proliferated low earth orbit constellations. The space launch sector has had two new National Security Space Launch (NSSL)–class entrants, is developing super-heavy launch vehicles (LVs), and has a growing number of small LV entrants. The remote sensing sector has a quickly growing number of multi-satellite constellations and diversity in sensor phenomenology and analytic products.
- New entrants are also responsible for recent growth in the commercial space industry. The growth and evolution of new entrants have been driven by small satellite technologies and the proliferated constellation

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model, advanced manufacturing, use of artificial intelligence and machine learning, and venture capital investments.

- Among the new space sectors, some will serve commercial space operators, while other new space sectors will primarily target government customers. Driven by the commercial proliferation of space, space domain awareness entrants will offer enhanced collision warnings, and ground station entrants will provide data-transport services to offer timely downlink of high-volume data (i.e., for remote sensing satellites). Environmental monitoring entrants are collecting Global Navigation Satellite System Radio Occultation (GNSS-RO) data for the National Oceanic and Atmospheric Agency (NOAA) and DoD. Space logistics entrants are planning space debris–removal services and on-orbit servicing for satellite life extension, both of which garner interest from government space programs.

RECOMMENDATIONS

- All space sectors we reviewed have experienced changes in the past five years (see the table below), indicating that it is important for DoD and other stakeholders to periodically update their information about the industry. These industries changed quite a bit during our research alone, so it may be necessary to update information annually when startups are involved.
- DoD and other stakeholders should track several technology-development and commercial-viability factors going forward, because these will have significant impacts on the space market (see the table below).

Sector	Changes in Recent Years	Futures to Watch
Satellite communication	• Increased commercial capacity with increased market demand	• Added global broadband capacity from non–geosynchronous satellite operator constellations
Space launch	• Increase in the number of launch-service providers across all launch classes	• Technology developments: reusability, on-orbit reignition, increase lift capacity • Effect of NSSL Phase 2 contract award on the market
Remote sensing	• Expansion in current and planned proliferated low earth orbit launches	• Size of commercial market and financial viability of startups
Environmental monitoring	• NOAA and DoD focus on GNSS-RO • Success in some GNSS-RO launch and operations—commercial and government • Lack of progress in hyperspectral soundings	• New startups with developments in microwave, electro-optical/infrared, and space weather capabilities
Space domain awareness	• Increased demand with more entrants into space domain	• Size of commercial market and financial viability of startups • Space proliferation driving demand and/or collaboration
Data transmit/ receive networks (ground stations)	• New U.S. companies offering ground stations as a service for commercial and government customers	• Electronically steered antennas/multiphase array • Optical communications technology
Space logistics (on-orbit servicing)	• Launch of only one company • Developing niche capabilities from a few companies	• Realization of technological developments, enabling on-orbit refueling, assembly, and manufacturing

SOURCE: RAND analysis of open-source reporting.

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