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GPS ALTERNATIVES

DOD Is Developing Navigation Systems But Is Not Measuring Overall Progress

GAO Highlights

Highlights of GAO-22-106010, a report to the Committee on Armed Services, U.S. Senate

Why GAO Did This Study

DOD primarily relies on GPS for accurate PNT data, which is essential to effective military operations. However, multiple threats can render GPS data unavailable or inaccurate. DOD recognizes the threats to GPS and is taking steps to address them by developing more robust GPS capabilities and alternative PNT technologies.

GAO was asked to review DOD's acquisition of alternative PNT technologies. This report discusses (1) the threats facing GPS; (2) DOD's alternative PNT efforts and their business cases; and (3) DOD's oversight of its PNT portfolio. This is a public version of a sensitive report that GAO issued in April 2022. Information that DOD deemed to be sensitive has been omitted.

GAO compiled and analyzed GPS threat information from relevant organizations and DOD officials; analyzed DOD documents; reviewed DOD PNT portfolio plans and strategies; interviewed DOD officials; and sent a questionnaire to DOD PNT program officials and analyzed results.

What GAO Recommends

GAO recommends that the Secretary of the Navy ensure the Navy's alternative PNT efforts have complete business case elements, such as an acquisition strategy. GAO also recommends that the PNT Oversight Council establish strategic objectives and metrics to measure the progress of its PNT portfolio overall. DOD concurred with one recommendation and partially concurred with the other. GAO maintains both recommendations are valid.

View GAO-22-106010. For more information, contact Brian Bothwell at (202) 512-6888 or BothwellB@gao.gov, or Jon Ludwigson at (202) 512-4841 or LudwigsonJ@gao.gov.

What GAO Found

The U.S. military relies on its Global Positioning System (GPS) to provide position, navigation, and timing data crucial to its operations. Access to these data, collectively known as PNT, and GPS face multiple threats, including: (1) anti-satellite weapons, (2) jamming, (3) spoofing, and (4) cyber. Given GPS's vulnerabilities, the Department of Defense (DOD) is modernizing GPS by adding a stronger encrypted signal, known as M-code, and using technologies like anti-jam antennas. Even with upgrades, vulnerabilities will remain.

The military services are developing alternative PNT capabilities to complement GPS. Of the five PNT efforts that have started development, four efforts had incomplete business cases (see figure). Specifically, the Navy had incomplete business cases for its four alternative PNT efforts, as the Navy either did not have or was drafting business case elements. A complete business case gives decision makers information at the start of product development to set the program up for success and can limit cost, schedule, and technical problems.

Status of Business Case Documents for Alternative Position, Navigation, and Timing (PNT) Efforts in Development

Effort	Requirements documentation	Acquisition strategy	Assessment of technology risk	Assessment of schedule risk	Independent cost estimate
Navy's Automated Celestial Navigation System	●	●	○	○	●
Navy's PNT upgrade to Cooperative Engagement Capability	●	●	●	○	●
Navy's Inertial Navigation System	●	●	◑	◑	●
Navy's PNT upgrade to Global Positioning System (GPS) based PNT Service	◑	●	●	●	●
Air Force's Resilient-Embedded GPS / Inertial Navigation System	●	●	●	●	●

● effort has business case element ◑ effort is drafting business case element ○ effort does not have business case element

Source: GAO analysis of Department of Defense information. | GAO-22-106010

In addition to the above efforts, DOD is at the advanced prototyping stage for several alternative PNT efforts, including improved clocks, and satellite systems.

DOD's overall PNT portfolio is managed by the PNT Oversight Council, a statutorily established senior-level body. However, the Council has largely prioritized modernizing the existing GPS system over alternative PNT efforts during recent meetings and has no strategic objectives or metrics to measure progress on the alternative efforts. Defined objectives and metrics would help the Council better measure overall performance and mitigate any potential gaps in PNT capabilities as the military transitions to using M-code.