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FISCAL YEAR 2023 SPACE FORCE BUDGET ANALYSIS: MISSILE WARNING AND TRACKING LOOMS LARGE

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This year's budget request includes a 36 percent increase for the U.S. Space Force from last year's appropriations. Despite this significant bump, much of the requested budget for the newest military service is relatively flat. The top-line increase is largely concentrated in transfers and in missile warning and missile tracking programs, which grew by more than 40 percent from last year's appropriations. The dramatic growth in missile warning and tracking has allowed the administration to pursue a new approach for the mission, including exploiting lower orbits. However, as reflected in recent congressional bills, there is not yet consensus on how DOD should transition to this new approach. Over the next few years, the missile warning and tracking programs—given their size and the number of stakeholders reliant on them—will weigh heavily in debates about the future of U.S. space systems.

Introduction

For fiscal year (FY) 2023, the administration requested $24.7 billion for the Space Force, a 36 percent increase—$6.5 billion (not adjusted for inflation)—from the enacted FY 2022 budget.* The percentage increase is the biggest among the military services, which was also the case in the president's FY 2022 request—a 13 percent bump from the prior year's budget.[1] This increase stems from two major drivers: consolidation of defense space activity and growth in the missile warning and tracking (MW/MT) mission.[2]

The request for the first time includes the personnel costs of the Space Force and the Space Development Agency (SDA), which, prior to FY 2023, reported to the Office of the Secretary of Defense. The FY 2023 request is also the first public disclosure of some of the Space Warfighting Analysis Center's (SWAC) recommendations for DOD's MW/MT architecture, the funding of which makes up nearly a fifth of the entire Space Force budget.[3]

Since the release of the budget request, Congress has put out authorization and appropriations bills that largely support the Space Force's consolidation of defense space activity. However, some of the language and proposed changes in the bills indicate there is not yet consensus around the administration's plans for MW/MT, including

*All of the dollar amounts reflect figures not adjusted for inflation. A notable characteristic of the FY 2023 Space Force budget request is that it includes future years' projected spending through FY 2027. The FY 2022 budget request did not include any future years' spending, which is common for the first year of a new administration. The reporting of outyear funding projections will make it easier to track the natural progression of a program and instances in which a political decision was made that altered a program's trajectory.

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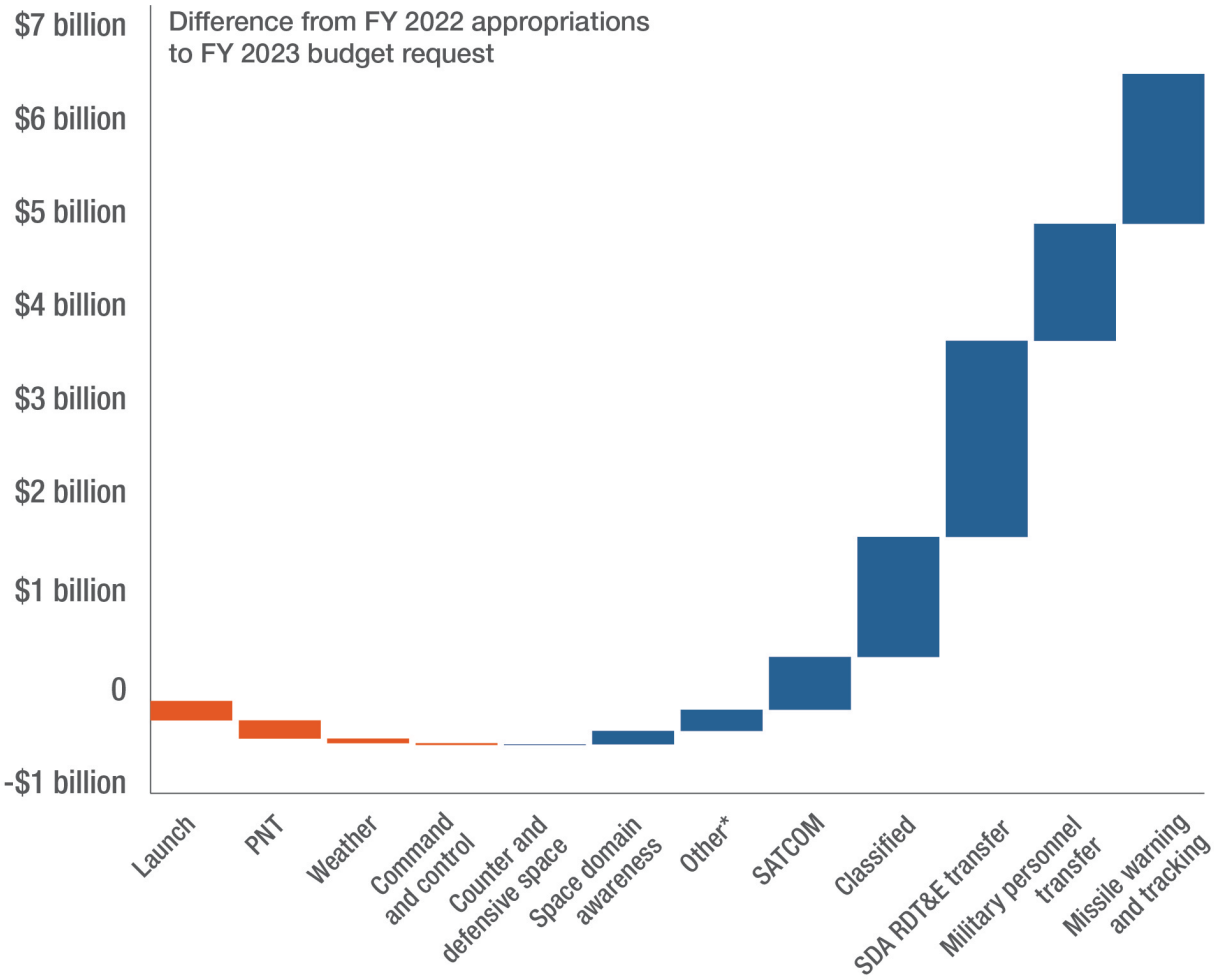
the transition from higher orbit assets to lower orbit systems. The budget request and the congressional action that has followed highlight the growing agreement around the importance of the domain and foreshadow potential fights, none looming larger than MW/MT.

Much of This Year's Budget Is Relatively Flat

Although the FY 2023 request includes significant top-line growth for the Space Force, this growth is not uniform. For most mission areas, changes in this year's budget had little effect on the overall top-line for the Space Force. In fact, the funding levels for 31 of the 85 budget lines from last year's appropriations are lower in this year's budget.[†] This year's request saw some dips in funding for launch; positioning, navigation, and timing; weather; and command and control; however, these amounted to less than $500 million dollars, or about two percent of the requested budget. The request also included growth in counter and defensive space, space domain awareness, and satellite communications, totaling $695 million dollars, almost three percent of the requested budget. As shown in Figure 1, the top-line Space Force budget would only be a modest increase from last year's appropriations except for three big moves: the increase in classified spending, the transfers of military personnel and SDA, and growth in MW/MT.



*Other is about 48 percent workforce, 12 percent facilities and maintenance, 20 percent other space operations, and 17 percent other space research.

Figure 1: The difference in funding levels from FY 2022 appropriations to FY 2023 budget request.

[†]The 85 budget lines do not include the newly transferred military personnel and SDA budget lines, neither of which were in Space Force's FY 2022 budget.

Classified Spending

Among the biggest drivers for this year's budget increase was growth in classified spending, which grew by nearly $1.2 billion. Classified spending on space programs would make up about $6.1 billion, roughly 25 percent of the overall Space Force budget. This is across three appropriations: operations and maintenance; procurement; and research, development, testing, and evaluation (RDT&E), which represents the bulk, 82 percent, of the classified spending. The large share of RDT&E spending comports with the broader Space Force budget, 64 percent of which is RDT&E, and reflects the reality that the Space Force is mostly focused on hardware given the nature of space operations.

Consolidation of Defense Space Activity

Prior to this budget submission, much of the defense space spending from the other military services had already transitioned to the Space Force's budget. This year's request transfers in two of the biggest remaining defense space efforts: SDA officially becoming part of the Space Force and military personnel transitioning from the Air Force. Collectively, these two transfers account for about 53 percent of the requested net increase for the Space Force from the enacted FY 2022 budget.

Transfer of SDA

The transfer of SDA to the Space Force was the single biggest contributor to the increase in the Space Force budget request. The impact was not simply that SDA's programs transferred to the Space Force but also that those programs grew significantly, increasing from $1.5 billion to $2.3 billion.[4]

The agency is planning to develop a proliferated low Earth orbit (LEO) satellite constellation that comprises several related "layers." Its priority is the transport layer, which seeks to create a satellite communications mesh network. The budget request specifies $816 million for the transport layer, which is planned to eventually total 300 to 500 satellites.[5]

The FY 2023 budget submission also includes an increase in funding for launch procurement for SDA (from $86 million to $314 million).[6] The request would fund three launches for the transport layer.[7] In addition to the amount in the budget submission, the agency requested $200 million in unfunded requirements for two launches for missile tracking.

Transfer of Military Personnel

Prior to the FY 2023 budget submission, the Space Force did not have any funding allotted for military personnel. Instead, the Space Force military personnel costs, which amounted to $954 million for FY 2022, came out of the Air Force military personnel appropriation.[8] The FY 2023 budget submission transitions this funding, which grew to $1.2 billion, to the Space Force military personnel appropriation. The budget request reflects a projected total of 8,600 Space Force personnel by the end of FY 2023, compared to the roughly 8,400 Space Force personnel expected at the end of FY 2022.

A New MW/MT Architecture

MW/MT saw a $1.6 billion increase, reaching a total of $4.7 billion in the FY 2023 request. This growth allows for a new approach to the mission. In 2021, the Space Force established SWAC to lead architecture design for the service. The center focused its first study on the MW/MT mission area, recommending a constellation of 135 LEO satellites and 16 medium Earth orbit (MEO) satellites working in concert through an integrated ground system. This effort seeks to achieve two major goals:

1. **Prepare for advanced missile threats.** A clear driver of DOD's proposed MW/MT plans is to better track complex missile systems that may not follow parabolic ballistic trajectories to predictable targets. As noted in the budget request: "The inclusion of missile tracking ensures the constellation can maintain custody of evolved dim and maneuvering threats through all phases of flight to provide required missile

warning attack characterization."[9] U.S. missile warning systems have historically focused on detecting the heat signature produced by the booster (rocket) of a missile to determine where an attack is headed and when it will impact. This approach does not, however, account for the maneuverability of a missile's payload—a feat that becomes more challenging for missiles that are flying low altitudes or producing small heat signatures. In a 2020 paper, we reported that, of a sample of 77 missile systems from China, Russia, North Korea, and Iran, most had the ability to maneuver after boost.[10] The justification book for the Space Force's RDT&E budget request says that the new architecture would be a "transition from a missile warning boost-phase focused constellation to a distributed, multi-orbit, constellation."[11]

2. **Defend the architecture from threats.** The proposals to MW/MT are not simply about making a more capable system but also a system that the Space Force can more easily defend. This plays into debates about space control—the idea that securing space assets, to potentially include targeting adversarial space systems, should be the priority for the domain. A distributed multi-orbit constellation may be better at tracking adversarial missiles, and it would also be harder to attack. "While Russia and China have threatened to destroy entire constellations of satellites in single orbits in a conflict," writes Christopher Stone of the Mitchell Institute, "it would be much more difficult for them to target all three orbital layers at the same time. This increased resiliency will enable satellite operators to quickly fill gaps in coverage using other surviving systems in the event attacks disable some number of LEO or MEO satellites."[12] The budget request frequently uses the word "resilient" in describing some of the programs for MW/MT, including in the budget lines. On the proposed changes to the MW/MT architecture, the request says: "This pivot also marks the transition to a more resilient architecture against kinetic and non-kinetic threats."[13]

The central debate about how to fulfill these dual goals is selecting which orbits DOD should exploit for the next generation of systems. In July 2022, Derek Tournear, the Director of SDA, said that SWAC found that "the department should move away from these larger satellites in highly elliptical orbits and the satellites at geosynchronous…and in the future go to a proliferated layer at LEO and a proliferated layer at MEO."[14] Tournear notes that because it is a "critical no-fail mission," there will be overlap in which DOD continues to deploy geosynchronous missile warning systems as the department builds the MEO and LEO satellites. Eventually, he says the mission will "go to all LEO and all MEO."

The FY 2023 budget, however, instead funds efforts across all orbits, with the bulk of the funding being in geosynchronous Earth orbit (GEO) and polar. The Next-Generation Overhead Persistent Infrared (Next-Gen OPIR) program accounts for 73 percent of this year's budget allotted to MW/MT. Next-Gen OPIR Block 0 will consist of five satellites, three GEO and two polar, and its related ground-based segment. After the major investment in FY 2023, however, the overall funds for Next-Gen OPIR are set to decrease each year through FY 2027.

The FY 2023 budget also continues the efforts in LEO, which began a few years ago. The predominant effort is SDA's tracking layer, which will provide global indications, warning, tracking, and targeting of advanced missile threats, including hypersonic missile systems.[15] Notably, last year's appropriations act added $550 million to what the president's budget submission had for SDA to demonstrate missile tracking satellites for the Indo-Pacific.[16] The increase was the single biggest congressional addition to the defense space budget. This program continues to grow throughout the future years defense program (FYDP).

The Missile Defense Agency (MDA) also has a LEO-based program, the Hypersonic and Ballistic Tracking Space Sensor (HBTSS). Prior budget requests attempted

to transfer this effort to SDA, and therefore into the Space Force this year, but Congress rejected those attempts, restoring the program with funding to MDA. Instead, MDA will develop its own sensor, which will have a medium field of view and higher sensitivity to ensure "fire-control data quality."[17] Despite its formal independence, MDA's budget documents emphasize collaboration among MDA, the Space Force, and the SDA to demonstrate "HBTSS as a potential element within the larger Unified OPIR Enterprise Architecture." MDA Director Vice Admiral Jon Hill says SDA's tracking layer satellites, with their wide field of view, may cue the MDA sensors.[18] Still, it is an exception to the consolidation within the Space Force.

The newest addition to the budget is a MEO layer. Space Systems Command would develop the MEO layer, which would comprise at least four MEO satellites by FY 2028. Much of the public rationale for the MEO constellation revolves around the "resiliency" offered by the capability, which could be due, in part, to its being in a different orbital regime than other missile warning assets.[19] Moreover, if the eventual constellation is to consist of purely LEO and MEO capabilities, the MEO systems would offer wider field of view and longer pass times over target areas than the LEO systems and add angular diversity to the broader architecture for tracking missile threats. Figure 2 shows the growth in funding levels, per program or project, for MW/MT from the FY 2022 appropriations to the FY 2023 budget request.

Transition to New MW/MT Architecture

This year's appropriations and authorization bills differ from one another in the funding levels they offer for the administration's MW/MT programs. These differences speak to questions about whether and how quickly DOD should transition from GEO and polar-orbiting systems to a LEO and MEO architecture.

In April, when discussing the department's plans for MW/MT, Space Force Chief General Jay Raymond said that the United States doesn't have "the luxury of going out to the world and saying we're going to turn off all of these capabilities and we'll come back in a few years with a bunch of new capabilities. You have to have a bridging strategy."[20] Different views on what this bridging strategy will look like can drive big differences in the budget.

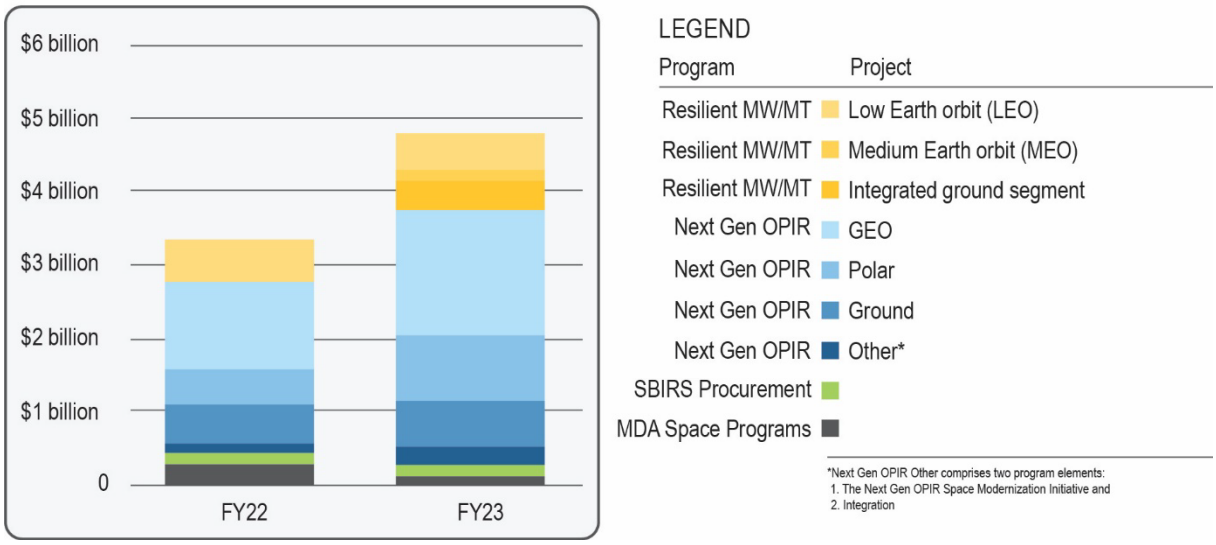


Figure 2: Growth in missile warning and tracking programs from FY 2022 appropriations to FY 2023 budget request.

The House appropriations bill and House and Senate authorization bills largely keep the administration's MW/MT approach intact, although each makes some minor modifications. All the bills, including the Senate appropriations bill, realign funding from the LEO/MEO ground system and split it between the LEO and MEO budget lines and the SDA budget line for launch. In addition to this realignment:

- The Senate authorizers added $200 million to the SDA launch budget line to "accelerate resilient missile warning/missile tracking."[21]
- The House authorizers looked favorably on MDA, more than doubling the funding for HBTSS and directing MDA to develop a sensor payload to be integrated into SDA's architecture.[22]
- The House appropriators made minor cuts to the Next-Gen OPIR modernization effort, the MEO ground architecture, and Space-Based Infrared System (SBIRS) procurement.[23]

These bills would begin funding the LEO and MEO architectures at modest levels while continuing to ramp up the next-generation higher orbit capabilities.

In contrast, the Senate appropriations bill pursues a more aggressive transition to lower orbits. The Senate bill would cut $674 million from Next-Gen OPIR, $612 million of which would come from the Next-Gen Polar project, slicing the polar program by 68 percent. Despite these cuts, the Senate appropriations bill contains the biggest overall cost for MW/MT because it would add $916 million to LEO and MEO, increasing the LEO and MEO effort by 89 percent. The bill language also offers a resounding critique of Next-Gen OPIR, at least in comparison to the proposed LEO and MEO architecture.

> The Committee understands that the NGEN OPIR program is schedule-driven with the constraining factor being the remaining life expectancy of the current Space Based Infrared Radar System. Given that ballistic missile defense is a no-fail mission, a capability gap cannot be tolerated. However, analysis of the MEO/LEO constellation programs during the fiscal year 2023 program and budget review indicate that they are scheduled to field prior to NGEN OPIR, deliver additional capability to track emerging threats, and provide a distributed transport layer, all within a more resilient architecture with a modernized acquisition approach for future capability upgrades. The Committee realizes that a change in architecture is required to compete in space, particularly in the transition from a benign environment to a warfighting domain.[24]

The cuts, plus the bill language, advocate for a more direct transition from current capabilities to LEO and MEO systems. Under this approach, it is unclear how much of a role Next-Gen OPIR, or the pieces of Next-Gen OPIR that are retained, would play. This is a question that concerns many stakeholders, including Strategic Command, which relies on missile warning assets.

Although the House appropriations bill mostly preserves the administration's MW/MT approach, it also warns that such an approach may not be sustainable. The bill contains a section titled, "Space Force Program Affordability and Executability," in which it criticizes the service's projections in the outyears to actually deliver these budgeting and planning: "The Space Force's ambitious plans for new architectures, programs, and mission areas…do not appear to be backed up with credible budget

capabilities." The bill adds, "The Committee cautions the Space Force against starting more programs than it can afford."[25] The terse warning could foreshadow upcoming fights, particularly for MW/MT, given that it makes up a large share of the Space Force budget.

Table 1 compares the FY 2023 request with the appropriations bills for MW/MT programs and projects.

Table 1: Comparison of FY 2023 Request to Appropriations Bills for Missile Warning and Tracking Programs (in millions)*

Project or Programs	Budget Request	House Appropriations	Senate Appropriations
Next Gen OPIR			
GEO	$1,714	— —	-$19
Polar	$899	— —	-$612
Ground	$613	— —	-$43
Other	$254	-$27	— —
Total Next Gen OPIR	$3,479	-$27	-$674
Resilient MW/MT			
LEO	$500	+$26	+$400
MEO	$139	+$124	+$300
SDA Launch (for MW/MT)	— —	+$200	+$432
Ground	$391	-$391	-$216
Total Resilient MW/MT	$1,030	-$41	+$916
Other			
SBIRS Procurement	$149	-$7	— —
MDA Space Programs	$130	— —	— —
Total Other	$279	-$7	— —
Total Missile Warning and Tracking	**$4,788**	**-$75**	**+$242**

Cut to plus up other program elements

*Sums may not add due to rounding.

Conclusion

The fiscal year 2023 budget request of $24.7 billion, a 36 percent increase ($6.5 billion) from the enacted fiscal year FY 2022 budget, highlights two important developments: further consolidation of defense space spending under the Space Force and targeted increases in MW/MT programs. The transfers of military personnel and the SDA into the Space Force account for 53 percent of this requested growth, and the net growth in MW/MT makes up 25 percent.

The budget also ushers in a new approach for MW/MT, which makes up nearly a fifth of the entire Space Force budget request. Although Congress seems supportive of moving to LEO and MEO, there seems to be a lack of consensus on how quickly, and in what manner, DOD should transition to this new architecture. The Senate appropriators seem to want to accelerate this transition, cutting some of the funding for next-generation GEO and polar-orbiting systems and nearly doubling the funding for LEO and MEO.

Over the next few years, MW/MT programs, given their size and the number of stakeholders reliant on them, will weigh heavily in debates about the future of U.S. space systems. The MW/MT approach may also be a harbinger for broader emphasis within the Pentagon to develop resilient and defendable architectures for other critical space missions. Such emphasis, if it materializes into more expensive and ambitious programs, could present significant budgetary pressures that DOD will need to balance, which could trigger additional scrutiny and concern from Congress.

Acknowledgments

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