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TESTIMONY

Potential Costs of a National Missile Defense System

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Chair Fischer, Ranking Member King, and Members of the Subcommittee, thank you for inviting me to testify about the potential costs of a national missile defense system. My submitted statement today reprises the Congressional Budget Office's May 2026 report *Potential Costs of a National Missile Defense System* (www.cbo.gov/publication/62379).

Unless otherwise indicated, all years referred to are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end. Numbers in the text and tables may not add up to totals because of rounding.

This report provides the Congressional Budget Office's estimate of the potential costs of a national missile defense (NMD) system. The analysis is based on the objectives laid out in the President's executive order titled "The Iron Dome for America."[1] The Department of Defense's (DoD's) implementation of that order—an initiative now called the Golden Dome for America (GDA)—is in the early stages. Although documents from DoD's budget request for the 2027 fiscal year provide five-year projections of funding plans for GDA, details about what and how many systems will be deployed—the "objective architecture"—have not been released, making it impossible to estimate the long-term cost of the GDA system being contemplated by DoD.[2] In the absence of specific plans for GDA's objective architecture, CBO has estimated the cost of a notional NMD architecture based on the defensive systems and capabilities that are called for in the executive order.

A national missile defense system possessing capabilities broadly consistent with those outlined in the executive order would cost about $1.2 trillion to develop, deploy, and operate for 20 years, CBO estimates. (All costs in this report are expressed in 2026 dollars.) CBO's notional NMD system is organized into four interceptor layers: a space-based layer, two wide-area surface layers (an upper layer and a lower layer), and a surface-based regional sector layer (see Figure 1). The NMD system also includes additional sensors, communication systems, and battle management systems to coordinate collective action among the layers. The layered structure of the overall system would provide the capacity to simultaneously engage multiple missiles launched by an adversary. Each layer would be able to operate independently if interaction with national command and control was disrupted.

Of the $1.2 trillion amount, acquisition costs for the notional NMD system would total just over $1 trillion. That amount includes costs for the system's major components—namely, the interceptor layers and a space-based missile warning and tracking system. It also includes costs for general, ongoing research and development and for improvements in the system's integration and performance (see Table 1). Annual operating costs would include the compensation of the additional personnel needed to run the system as well as the maintenance, repair, and periodic upgrades to the equipment. The most expensive component is the space-based interceptor layer, which accounts for about 70 percent of acquisition costs and 60 percent of total costs.

In accordance with the executive order, the notional NMD system that CBO analyzed would provide a layered defense against ballistic missiles, hypersonic missiles, cruise missiles, and other aerial threats (see Figure 1). The notional NMD system also would include both space-based and surface-based interceptors and would provide coverage of the entire United States, including Alaska and Hawaii. The system would have the capacity to fully engage an attack mounted by a regional adversary (that is, one with limited capabilities, such as North Korea) or a small-scale attack mounted by a peer or near-peer adversary (one with military capabilities similar to those of the United States, namely Russia or China). However, the system could be overwhelmed by a full-scale attack mounted by a peer or near-peer adversary. Furthermore, "fully engage" is not the same as "fully defeat" because no defense works perfectly every time. The probability of a successful engagement would depend on too many factors for CBO to analyze here.

CBO's estimate uses a building-block approach so that it can be scaled for smaller or larger systems. Costs would be lower for a less expansive system (for example, one that focused its defenses on a few critical locations instead of the entire country) or higher for a more robust system (for example, one that deployed more interceptors to defeat larger attacks). Regardless of the approach chosen, defensive capabilities would accrue as the architecture was fielded, and modifications would be possible (indeed likely) along the way if warranted by changes in the threat or breakthroughs in offensive or defensive technology.

In recent public statements, the director of the Office of Golden Dome for America has stated a cost of $185 billion for GDA's objective architecture to be deployed over the next decade.[3] That amount is generally consistent with 2027 budget request documents that call for the Golden Dome for America Fund to receive an average of about $15 billion per year for the next five years.

1. Executive Order 14186, "The Iron Dome for America," 90 Fed. Reg. 8767 (January 27, 2025), https://tinyurl.com/mryx7t37.

2. For details about 2027 funding plans for GDA, see Office of Management and Budget, *Budget of the U.S. Government: Fiscal Year 2027, Appendix*, p. 303, https://tinyurl.com/2sf3af9c.

3. Mikayla Easley, "Golden Dome Budget Plan Gets $10B Plus-Up to Accelerate Space Capabilities," *DefenseScoop* (March 17, 2026), https://tinyurl.com/4b8r4fse.

Figure 1.

Interceptor Layers in CBO's Notional National Missile Defense System and CBO's Assessment of Their Capability

Layer	Description	Primary interceptor	Threats: Intercontinental ballistic missile	Threats: Hypersonic glide vehicle	Threats: Cruise missile
Space	7,800-satellite constellation capable of engaging a raid of 10 ICBMs launched nearly simultaneously	Boost-phase SBI	+	±	–
Upper wide-area surface	2 new GMD sites (each with an LRDR and 60 interceptors) and the existing GMD site at Fort Greely, Alaska	GBI or NGI	+	–	–
Lower wide-area surface	4 Aegis Ashore sites in the continental United States (each with 48 interceptors)	SM-3 Block IIA	+	±	–
Regional sector	35 sectors (each with radars, interceptors, and command and control facilities capable of operating independently)	GPI	–	+	–
		SM-3 Block IB	±	–	–
		THAAD	±	±	–
		SM-6 Block IB	–	+	+
		Patriot MSE	–	±	+

+ Designed or likely capability ± Engagement might be possible – No capability

Data source: Congressional Budget Office.

GBI = Ground-Based Interceptor; GMD = Ground-Based Midcourse Defense; GPI = Glide-Phase Interceptor; ICBM = intercontinental ballistic missile; LRDR = Long-Range Discrimination Radar; MSE = Missile Segment Enhancement; NGI = Next-Generation Interceptor; SBI = space-based interceptor; SM = Standard Missile; THAAD = Terminal High Altitude Area Defense.

DoD's stated cost appears to cover a shorter time frame than CBO's analysis and may reflect a different scope of activities and budget categories. Even so, that stated cost is far lower than CBO's estimate for a notional NMD architecture consistent with the "Iron Dome" executive order. That difference suggests either that GDA's objective architecture is more limited than CBO's notional NMD system or that DoD expects significant funding from other accounts to contribute to GDA (or both). For example, procurement of interceptors might be funded directly through the services' missile procurement accounts instead of the GDA fund.

Table 1.

Major Cost Components of CBO's Notional National Missile Defense System

System components	Quantity	Cost (billions of 2026 dollars)		
		Acquisition	Average annual O&S	20-year total
Interceptor layers				
Space-based interceptor constellation	1	723[a]	1.0	743
Upper wide-area surface site	3[b]	30[c]	0.8[c]	46[c]
Lower wide-area surface site	4	16	0.7	29
Regional sector	35	93	4.7	187
Other components and activities				
Self-defense for four existing NMD sites	4	2	0.1	4
Space satellite constellation for tracking targets	1	69	1.0	90
Miscellaneous RDT&E (system integration, incremental improvements, new technologies)	n.a.	92	n.a.	92
Total cost for notional NMD system	**n.a.**	**1,025**	**8.3**	**1,191**

Data source: Congressional Budget Office. See www.cbo.gov/publication/62379#data.

NMD = national missile defense; O&S = operation and support; RDT&E = research, development, test, and evaluation; n.a. = not applicable.

a. Acquisition costs would be spread over 20 years because space-based interceptors have a 5-year life in orbit.

b. Consists of two new sites and the existing site at Fort Greely, Alaska.

c. Includes only the costs associated with the two new upper wide-area surface layer sites.

Although the notional NMD system analyzed by CBO would be far more capable than defenses the United States fields today, it would not be an impenetrable shield or be able to fully counter a large attack of the sort that Russia or China might be able to launch. As a result, the strategic consequences of deploying an NMD system with the capacity considered here are unclear because they hinge on an adversary's perception of the defense's capability and how that adversary chose to respond. Such a deployment could prompt regional adversaries to increase their inventories of long-range missiles (nuclear or conventional) or to pursue more effective countermeasures to improve their chances of penetrating the NMD system. Peer or near-peer adversaries could overwhelm CBO's notional NMD system with salvoes of many missiles in a large-scale attack with their current nuclear forces, although they still might choose to increase their arsenals of long-range missiles (both nuclear and conventional) to ensure they maintain that capability. (Faced with such increases, the United States might feel compelled to further expand its missile defenses or its long-range conventional and nuclear forces.) The notional NMD system might deter or defeat smaller raids launched by a peer adversary (possibly as part of a regional conventional conflict), but it could also prompt a peer adversary to increase the size of such raids.

Characteristics of an NMD System Consistent With "The Iron Dome for America" Executive Order

Because DoD has not provided details about its objective architecture for GDA, CBO used the language in the executive order as a guide to determine what components to include in its notional NMD system. That document called for a system with three fundamental characteristics:

- **Comprehensiveness.** The ability to counter many types of threats, including "ballistic, hypersonic, advanced cruise missiles, and other next-generation aerial attacks."
- **Capacity.** The ability to counter potentially large numbers of missiles that could be launched by "peer, near-peer, and rogue adversaries."
- **Coverage.** The ability to cover the United States, including "its citizens and critical infrastructure," with "capabilities postured to defeat a countervalue attack."[4]

4. "Countervalue attack" is a nuclear deterrence term for targeting an adversary's population centers. "Counterforce attack" refers to targeting an adversary's military capabilities, particularly its nuclear forces. A system postured to defeat a countervalue attack aims to defend a large percentage of the population.

Those fundamental characteristics largely determined what types and quantities of defensive systems to include in the notional NMD architecture and, consequently, the costs of the system.

The executive order also called for several specific elements that CBO included in its notional NMD architecture:

- Space-based interceptors (SBIs) capable of intercepting a missile during its boost phase, when the missile's rocket motor is still burning (the first three to five minutes after launch in the case of intercontinental ballistic missiles, or ICBMs);
- Deployment of the Hypersonic and Ballistic Tracking Space Sensor (HBTSS) satellite constellation, which is designed to track hypersonic weapons, including hypersonic glide vehicles (HGVs);[5] and
- Two layers of surface-based defenses—an "underlayer" and a "terminal layer"—which provide multiple opportunities to engage offensive missiles as they fly to their targets and thus increase the cumulative probability of defeating the threat.

CBO's estimate does not include the cost of several other efforts called for in the executive order. For example, it does not include the costs of "left-of-launch" capabilities—which enable the destruction of missiles before they are launched and which would probably be provided by general-purpose military forces—or directed energy weapons (such as lasers), which are unlikely to be fielded soon. Nor does CBO's estimate include the costs of ongoing missile defense activities such as deploying the Next-Generation Overhead Persistent Infrared (OPIR) satellites that provide early warning of a nuclear attack or expanding and operating the ground-based missile defense site in Alaska.

Detailed Composition and Costs of CBO's Notional NMD Architecture

CBO's notional NMD system is mainly composed of four interceptor layers and a space-based system of sensors for tracking missile targets. Not every type of threat missile can be engaged in every layer, but the system, taken as a whole, provides a defensive capability against each of the threats specified in the "Iron Dome" executive order.

5. Hypersonic glide vehicles are weapons that are boosted by a rocket to speeds greater than five times the speed of sound (Mach 5) and then glide in the upper atmosphere before diving to their target. They are distinguished from ballistic missiles by their ability to maneuver during the glide phase by using aerodynamic forces.

Space-Based Interceptor Layer

The SBI constellation included in CBO's notional architecture was sized to be able to engage a raid of 10 nearly simultaneously launched ICBMs during their boost phase. The ability to launch up to 10 ICBMs in rapid succession is considered representative of the capabilities of a regional adversary. (Each engagement would include two interceptor shots to improve the probability of successfully intercepting the target.) A long-range HGV might also be engaged by the SBI layer if the HGV's booster burned long enough on a sufficiently high trajectory.

CBO's notional constellation consists of 7,800 satellites in nearly polar low-Earth orbit (LEO). It would cost about $720 billion to develop, deploy, and maintain for 20 years and an additional $1 billion annually to operate.[6] The average cost per SBI satellite would be $22 million. That average is for the initial 7,800 SBIs as well as the nearly 1,600 SBIs that would be needed each year thereafter because of the satellites' short five-year service life. The need to periodically replace SBIs means that the acquisition costs would be spread over the life of the system.

The total is based on a cost of $500 per kilogram to launch the SBIs into orbit. Although that launch cost is lower than typical launch costs today, it is thought to be achievable using the new generation of heavy-lift rockets, such as the Space-X Starship, that are being developed. Even lower launch costs may be realized in the future, but that could have only a limited effect on total costs for the SBI layer because, even at $500 per kilogram, launch costs account for less than 5 percent of the total.

Both the very large number of SBIs needed to engage just 10 targets simultaneously and the SBIs' short service life are the result of how the satellites move in orbit. To

6. The SBI constellation and associated costs for CBO's notional architecture in this report are different from what CBO analyzed in its May 5, 2025, letter to Senators Deb Fischer and Angus King and are not directly comparable. That letter analyzed only the effect that today's lower launch costs could have on earlier estimates for much smaller constellations of boost-phase SBIs (1,000 to 2,000 SBIs to intercept an attack of only one or two ballistic missiles). In that letter, CBO estimated the effects of decreases in launch costs that have occurred over the past few years (to a current cost of about $2,500 per kilogram launched to LEO) but did not reestimate the costs of the SBIs themselves. See Congressional Budget Office, letter to the Honorable Deb Fischer and the Honorable Angus S. King Jr. about the effects of lower launch costs on previous estimates for space-based, boost-phase missile defense (May 5, 2025), www.cbo.gov/publication/61237. For this report, CBO analyzed a larger constellation, used lower launch costs to reflect those anticipated in the future, and updated its estimate of the cost of the SBIs.

be close enough to reach their targets within the three to five minutes available in the boost phase, SBIs must be in LEO at altitudes of roughly 300 to 500 kilometers.[7] However, the characteristics of satellite motion in LEO affect the size of constellations meant to provide continuous coverage over specific locations on Earth. (For boost-phase SBIs, "coverage" is relative to an ICBM's launch location, not the location of the ICBM's target.) The following are two such characteristics:

- **Absenteeism.** Satellites in LEO cannot be fixed over specific points on Earth; they orbit in a band centered on the equator and bounded equally north and south by their orbital inclination (usually measured in degrees of latitude). Therefore, constellations of many SBIs are needed to ensure that a sufficient number (20, for example, if two shots are needed against 10 ICBMs) are always close enough to potential launch locations to reach targets during the boost phase. The total number of satellites in a constellation depends mainly on the speed of the interceptors, how quickly they can be launched, the number of simultaneous targets the system needs to handle, and the latitudes to be covered.
- **Atmospheric drag.** Because atmospheric drag at the altitudes at which SBIs would orbit causes their orbits to decay over time, each satellite would need to be replaced roughly every 5 years. (By contrast, the service life of surface-based interceptors can be 20 years or more, and surface-based interceptors can be maintained and upgraded during that time.) For CBO's notional constellation, roughly 30,000 satellites would be needed to keep 7,800 in orbit for 20 years.

CBO's notional SBI constellation strikes a middle ground between a minimal constellation capable of engaging only a one- or two-missile attack by a regional adversary and a much larger (and more expensive) constellation that would be needed to fully engage a large attack by a peer adversary. It includes enough satellites to fully engage a regional-adversary-sized attack of 10 ICBMs launched nearly simultaneously, and it also includes coverage against attacks from high latitudes to provide some capability against peer adversaries (as is called for in the executive order). Although it would not be able to fully engage the large numbers of missiles that could be launched by a peer adversary, the layer could still help by deterring a smaller attack or, in the case of a large attack, by reducing the number of missiles that the surface-based layers would need to engage.

Upper Wide-Area Surface Layer

This layer in CBO's notional NMD system would include three fields of interceptor silos, including the existing field at Fort Greely, Alaska. The field in Alaska is equipped with Ground-Based Interceptors (GBIs). The two new fields would be armed with Next-Generation Interceptors (NGIs), which, like GBIs, are designed to defeat ICBMs in the midcourse part of their flight, when they are on a ballistic trajectory above the atmosphere.[8] Depending on the trajectory of the threat, each site could provide national or near national coverage.

Each site would cost about $15 billion to build and equip and roughly $410 million per year to operate. The new sites would be similar to the field in Alaska. Each would include 60 NGIs in underground silos, a command facility, and a Long-Range Discrimination Radar (LRDR) to detect and track targets (see Table 2).[9]

In addition to the sites' primary armament, CBO included a self-defense capability to protect against other missile and aerial threats, including unmanned aircraft. (GBIs and NGIs can only counter ICBMs.) That self-defense suite includes smaller radars and interceptors, as well as systems to counter small unmanned aircraft systems (sUASs) to make it more difficult for an adversary to suppress the ICBM defenses before or during an ICBM attack.

The new sites would probably be in the northeastern and southern United States.[10] Those locations are desirable because they would improve U.S. defenses against attacks by missiles on trajectories from the north, east,

7. Before an interceptor can be fired, the target must be detected and tracked, and the decision to engage must be made. Because those steps take time, the SBI will have less than the full boost time to reach its target.

8. A ballistic missile's flight is generally separated into three phases: the boost phase, when the missile's rocket is accelerating the warhead; the midcourse phase, when the warhead is coasting on a ballistic trajectory above the atmosphere; and the terminal phase, when the warhead reenters the atmosphere and falls to its target.

9. Twenty new silos are being added at Fort Greely, bringing the total to 60: 40 older GBIs and 20 NGIs. The cost of those silos and missiles is not included here.

10. For example, a National Academies study considered a site with GBIs in the northeastern United States. See National Research Council, *Making Sense of Ballistic Missile Defense: An Assessment of Concepts and Systems for U.S. Boost-Phase Missile Defense in Comparison to Other Alternatives* (National Academies Press, 2012), https://doi.org/10.17226/13189.

Table 2.

Composition and Cost of an Upper Wide-Area Surface Layer Site in CBO's Notional National Missile Defense System

	Quantity	Cost (millions of 2026 dollars)
Acquisition cost		
Sensors		
Long-Range Discrimination Radar	1	800
Lower-Tier Air and Missile Defense Sensor	1	130
Interceptors		
Next-Generation Interceptor	60	7,200
THAAD	8	107
Patriot MSE	24	103
Launchers		
GBI/NGI silo	60	4,644
THAAD (8-interceptor capacity)	1	16
Patriot (12-interceptor capacity)	2	32
Command and control systems		
GMD command center	1	1,858
Counter-sUAS systems		
RF signal detection and defeat system (facility defense)	1	13
Kinetic defeat system	1	5
Total acquisition cost	**n.a.**	**14,908**
Annual operation and support cost	n.a.	408

Data source: Congressional Budget Office. See www.cbo.gov/publication/62379#data.

The upper wide-area surface layer would consist of three sites armed with interceptors designed to defeat intercontinental ballistic missiles in the midcourse part of their flight, when they are on a ballistic trajectory above the atmosphere.

GBI = Ground-Based Interceptor; GMD = Ground-Based Midcourse Defense; MSE = Missile Segment Enhancement; NGI = Next-Generation Interceptor; RF = radio frequency; sUAS = small unmanned aircraft system; THAAD = Terminal High Altitude Area Defense; n.a. = not applicable.

and south. CBO did not evaluate specific sites. Also, the LRDR need not be colocated with the missile field. The LRDR in Alaska is at Clear Space Force Station, which is about 100 miles from the Fort Greely missile field. However, self-defense capability may be easier to provide if the radar and silos are colocated.

It is difficult to estimate how many ICBMs could be engaged by the upper wide-area surface layer. In principle, 60 interceptors would give each site a capacity of 30 two-shot engagements. However, engagements could consist of more shots or of only a single shot per target depending on the size of the attack and the tactics adopted by the defense. In addition, midcourse engagements are not as straightforward as boost-phase engagements because a single boost-phase target can turn into many midcourse targets by releasing multiple warheads and decoys. Further complicating the assignment of interceptors to targets, NGIs are expected to carry more than one kill vehicle.

Lower Wide-Area Surface Layer

This layer in CBO's notional NMD architecture would consist of four Aegis Ashore facilities similar to those the United States maintains in Romania and Poland. The primary armament would be Standard Missiles (SMs), specifically the SM-3 Block IIA, which has a demonstrated capability against ICBMs and shorter-range ballistic missiles. The sites would provide an additional opportunity to intercept ICBM warheads—in the late midcourse part of their trajectory—as well as the ability to engage shorter-range ballistic missiles that might be on trajectories too low to be engaged by the upper wide-area surface layer. In limited circumstances, engaging HGVs might also be possible.

Each site would cost nearly $4 billion to deploy and about $170 million per year to operate. The main components of the four lower wide-area surface layer sites would be an Aegis Ashore Deckhouse with a SPY-6 radar for detection,

Table 3.

Composition and Cost of a Lower Wide-Area Surface Layer Site in CBO's Notional National Missile Defense System

	Quantity	Cost (millions of 2026 dollars)
Acquisition cost		
Sensors		
Aegis Ashore deckhouse and radar (SPY-6)	1	650
Sentinel radar (MPQ-64A4)	4	56
Over-the-horizon radar	1	1,350
Interceptors		
SM-3 Block IIA	48	1,459
THAAD	8	107
Patriot MSE	24	103
Launchers		
Mark 41 VLS (8 cells)	6	154
THAAD (8-interceptor capacity)	1	16
Patriot (12-interceptor capacity)	2	32
Command and control systems		
Included in Aegis deckhouse	n.a.	0
Counter-sUAS systems		
RF detection and defeat system (facility defense)	1	13
Kinetic defeat system	1	5
Total acquisition cost	**n.a.**	**3,945**
Annual operation and support cost	n.a.	169

Data source: Congressional Budget Office. See www.cbo.gov/publication/62379#data.

The lower wide-area surface layer would consist of four sites armed with interceptors designed to defeat intercontinental ballistic missiles in the late midcourse part of their trajectory and shorter-range ballistic missiles that might be on trajectories too low to be engaged by the upper wide-area surface layer.

MSE = Missile Segment Enhancement; RF = radio frequency; SM = Standard Missile; sUAS = small unmanned aircraft system; THAAD = Terminal High Altitude Area Defense; VLS = vertical launch system; n.a. = not applicable.

tracking, and fire control and a Mark 41 vertical launch system with 48 cells armed with SM-3 Block IIA interceptors (see Table 3). As with the upper wide-area surface layer sites, CBO included a self-defense suite of radars, shorter-range interceptors, and counter-sUAS systems because SM-3 Block IIA interceptors can counter only missiles above the atmosphere, which leaves the systems vulnerable to cruise missiles and unmanned aircraft.

CBO did not determine specific locations for the four lower wide-area surface layer sites, but they would probably be roughly at the four corners of the contiguous 48 states. A site in the Pacific Northwest might provide coverage for Alaska. If not, the regional sector (described next) defending Alaska might be enhanced with additional interceptors. Similarly, interceptors could be added to Hawaii's regional sector or to the Aegis Ashore test facility on Kauai.[11] None of those measures are included in CBO's estimates.

Surface-Based Regional Sector Layer

The regional sectors in CBO's NMD architecture provide terminal defenses against ballistic and hypersonic missiles as well as defense against cruise missiles and other airborne threats. The structure of the regional sectors was inspired by the "Prioritized Area Defenses" (PADs) described in a 2022 report about cruise missile defense published by the Center for Strategic and

11. CBO did not analyze the coverage that its notional NMD system would provide for U.S. territories. The coverage provided by the space layer would be global, and the wide-area surface layers might provide coverage for the Caribbean territories. Guam is slated to receive an extensive system of integrated defenses independent of GDA, and other territories could receive a suite of regional sector defenses. The costs of such territorial defenses are not included in CBO's estimates.

International Studies.[12] For this analysis, CBO added capabilities to that structure to handle the full range of targets identified in the executive order. Each regional sector could defend approximately 270,000 square kilometers, or roughly 1/37 of the area of the United States. CBO's notional NMD system would have 35 regional sectors, enough to protect most of the U.S. population.

Each sector would cost $2.7 billion to deploy and $134 million per year to operate. A regional sector would include a command and control facility that would interface with national-level command authorities but that could also independently operate the sector's defenses if contact with higher command was disrupted. Regional sectors would be equipped with various radars and interceptors needed to counter the breadth of potential targets (see Table 4). Because the regional sectors are essentially terminal defenses, self-protection would be provided by the primary armament and by counter-sUAS systems located at the radar and launcher sites.

Although CBO's analysis is based on 35 identical regional sectors, the sectors could be varying sizes, or the layer could be made up of a smaller number of larger sectors. The actual sectors would probably be tailored to best protect the individual areas being covered. Differences in location, terrain, and the distribution of the population and critical infrastructure within a sector are factors that planners could use to customize the composition of specific sectors. For example, cruise missiles might be considered less of a threat far from the coasts, allowing for fewer interceptors in those areas or for a greater focus on ballistic missile interceptors. In addition, not all locations within a sector would have the same defensive coverage. Individual systems would need to be distributed to optimize the coverage provided.

Space-Based Tracking System

Space-based tracking systems enable missile defenses to start preparing a response to an attack before the attacking missiles come within range of surface-based radars. DoD is pursuing several space-based sensor programs, but their details are undefined or classified. Because the executive order called for deployment of a space-based sensor system—specifically, the infrared Hypersonic and Ballistic Tracking Space Sensor—CBO included a constellation of satellites with infrared sensors in its notional NMD architecture.

CBO's notional constellation would consist of 108 satellites in LEO and 27 satellites in medium-Earth orbit (MEO). The constellation is loosely based on the Tracking Layer of the Space Development Agency's Proliferated Warfighter Space Architecture, which is designed to detect missile launches and track hypersonic weapons. Like space-based interceptors, satellites would be replaced every five years. The notional constellation would cost about $69 billion to develop, deploy, and maintain for 20 years and an additional $1 billion annually to operate, CBO estimates.

It is unclear how the many ongoing space-based sensor programs at DoD will coalesce into an integrated NMD architecture. Space Force programs include the Resilient Missile Warning and Tracking system (with infrared satellites in low- and medium-Earth orbit) and a space-based air moving target indication (SB-AMTI) system of radar satellites. CBO's notional constellation may be similar to the former. In addition, the HBTSS program, a prototyping effort run by the Missile Defense Agency, will be transferred to the Space Force for operational deployment if the prototype satellites prove to be effective. It is possible that the capabilities offered by HBTSS will be incorporated into the Resilient Missile Warning and Tracking system.[13]

CBO did not include SB-AMTI in its notional NMD architecture because SB-AMTI is not explicitly called for in the executive order and because it is possible that DoD would pursue SB-AMTI regardless of the homeland missile defense deployed. The Air Force is planning to replace its airborne warning and control aircraft with space-based radar, and the ability to track aircraft anywhere on Earth would be useful to the intelligence community. Furthermore, in DoD's 2027 overview of mandatory funding, SB-AMTI is included with space superiority programs, not with homeland defense and Golden Dome for America programs. Depending on its performance, SB-AMTI could be effective at detecting (and possibly tracking) targets at both high and low altitudes, including cruise missiles, but it is unclear whether the tracking would be accurate enough to direct interceptors to those targets. If successfully fielded, SB-AMTI could replace the over-the-horizon radars included in CBO's lower wide-area surface layer.

12. Tom Karako and others, *North America Is a Region, Too: An Integrated, Phased, and Affordable Approach to Air and Missile Defense of the Homeland* (Center for Strategic and International Studies, July 2022), https://tinyurl.com/y4hrak42.

13. The Space Force has also proposed canceling two of the four satellites planned for the Next-Generation OPIR system, arguing that the mission of those satellites could be accomplished by the Resilient Missile Warning and Tracking System.

Table 4.

Composition and Cost of a Regional Sector in CBO's Notional National Missile Defense System

	Quantity	Cost (millions of 2026 dollars)
Acquisition cost		
Sensors		
Aegis-based radar	1	300
Sentinel radar (MPQ-64A4)	24	336
Radar tower	25	45
Interceptors		
GPI	8	292
SM-3 Block IB	4	64
SM-6 Block IB	20	222
THAAD	32	429
Patriot MSE	84	360
Launchers		
Mark 41 VLS (4 cells mounted on a trailer)	8	102
THAAD (8-interceptor capacity)	4	64
Patriot (12-interceptor capacity)	7	112
Command and control systems		
Regional control center	1	295
Counter-sUAS systems		
RF detection and defeat system (point defense)	40	40
Total acquisition cost	**n.a.**	**2,661**
Annual operation and support cost	n.a.	134

Data source: Congressional Budget Office. See www.cbo.gov/publication/62379#data.

In CBO's notional system, 35 regional sectors would provide terminal defenses against ballistic and hypersonic missiles as well as defense against cruise missiles and other airborne threats.

GPI = Glide-Phase Interceptor; MSE = Missile Segment Enhancement; RF = radio frequency; SM = Standard Missile; sUAS = small unmanned aircraft system; THAAD = Terminal High Altitude Area Defense; VLS = vertical launch system; n.a. = not applicable.

Costs Not Included in CBO's Notional NMD System

CBO did not include the costs of missile defense activities that were outside the direct scope of its notional NMD system. Among the excluded costs are those for the following elements:

- **Research, development, test, and evaluation for missile defense technologies not used in the notional architecture.** Funds to develop directed energy weapons, for example, were not included. CBO did, however, include funds for ongoing research and development to improve systems over time.
- **Communications systems to connect the NMD sites.** Each layer has its own command facility for communications and battle management, but CBO did not include the cost of national and global communication systems (such as the Space Data Network being developed by the Space Force or the Space Development Agency's Transport Layer). Such systems are likely to be fielded as part of broader military modernization. Although the demands of missile defense (such as very rapid transmission of data and system redundancy) might add to the systems' cost, such additional costs are not included in this estimate.
- **Efforts that involve substantial conventional forces.** CBO did not, for example, include the costs of having missile defense ships on patrol offshore or of increasing the number of fighters on alert at military airfields. Although such forces are expensive to keep at a level of readiness needed to defend against a surprise attack, they could be deployed in times of heightened tensions to augment the defenses in CBO's notional NMD system.

- **Space-based interceptors to engage targets in the midcourse or glide phases of their trajectory.** The Space Force and Golden Dome office are exploring such systems to provide an additional defense layer, but they are not explicitly called for in the executive order.
- **Systems to detect and destroy an adversary's missiles before they are launched.** CBO did not, for example, include funding for the Custody Layer of the Proliferated Warfighter Space Architecture. Even though such systems are called for in the executive order, they are not part of an active missile defense system.
- **Systems to counter small drones (other than those for self-defense of sites in the NMD system).** Because systems to detect and counter small drones operate over very short distances, they are better provided on a facility-by-facility basis than as part of a national missile defense.[14]
- **The acquisition of land for surface sites and for construction other than that directly related to the equipment.** For example, CBO did not include the cost of acquiring land for utilities and access roads. Many sites could probably be located on military or other federal land, but in some cases, land might need to be acquired.

Other Cost Considerations

Any estimate of the structure and cost of an effort with the scope and complexity of an NMD system will have considerable uncertainties. Two main areas of uncertainty in this analysis involve deployment timelines and potential cost growth.

Deployment Timelines. CBO's estimates do not include a specific timeline for deployment. Purchasing and fielding many of the system's components (such as surface-based interceptors) could begin immediately. Other components (such as space-based interceptors) will probably take at least several years to develop. The time to deploy nearly 8,000 SBIs would probably be measured in years as well. Additional factors that could affect the time it would take for DoD to deploy a full NMD system include the following:

- The ability of the industrial base to produce enough interceptors and radars, particularly of the types that have been consumed in large numbers or destroyed in the Iran war;
- The speed with which DoD could select deployment sites, build the necessary infrastructure, and establish and train the military units to operate the systems; and
- The annual funding available within DoD's budget, which might constrain the rate at which the system could be deployed.

Thus, for simplicity, CBO estimated the sum of the costs to acquire each component of the notional NMD system and operate it for 20 years. Operating costs are estimated over 20-year periods beginning with the deployment of each component, so total costs would be incurred over different calendar periods depending on when individual elements entered service. CBO is unable to project how long it would take to complete the system.

Potential for Cost Growth. DoD's programs have historically experienced cost growth during acquisition and operations. Reasons for such growth during acquisition have included these:

- Growth in program-specific costs (such as for rare raw materials or skilled labor) that outpaces general inflation;
- Changes in performance requirements, which can necessitate costly design modifications during development;
- Lower-than-anticipated annual funding, which can increase total costs by disrupting established plans and schedules and by extending programs (and their associated overhead costs) over longer periods; and
- Unanticipated technological challenges posed by new systems, including their integration with established systems.

Because of its breadth and complexity, an NMD system might be particularly prone to those kinds of unforeseen factors. That would be especially true for components that have never before been deployed, like space-based interceptors.

DoD's costs for operation and support (O&S) have regularly increased faster than inflation.[15] As a result, uncertainty in the deployment schedules for components of an NMD system could lead to uncertainty in estimates of future O&S costs. Rising O&S costs largely stem from

14. In a report coming out later this year, CBO explains how defenses against small UASs would work.

15. For a discussion of the trends in growth of O&S costs, see Congressional Budget Office, *Long-Term Implications of the 2025 Future Years Defense Program* (November 2024), www.cbo.gov/publication/60665.

increases in compensation costs (for salaries, health care, and other benefits) that exceed general inflation for military, federal civilian, and service contractor personnel. For example, the O&S cost in the first 20 years for a system deployed in 2035 (spanning 2036 to 2055) would be slightly higher than the cost in the first 20 years for a system deployed five years earlier, in 2030 (spanning 2031 to 2050), even after removing the effects of general inflation. Because of the substantial uncertainties about how quickly components of a national missile defense could be deployed, CBO's O&S costs are based on a 20-year period beginning in 2028 for surface-based systems and in 2030 for space-based systems. O&S costs are likely to be slightly higher if deployments occur later.

Building a Smaller or Larger NMD System

DoD could opt to build a national missile defense system that was smaller or larger than (or altogether different from) CBO's notional system. A larger system designed to handle a full-scale Russian ICBM attack, for example, could include more space-based interceptors or more NGIs at the three upper wide-area surface layer sites. It could also include more interceptors at lower levels. A smaller system, by contrast, might be able to engage fewer missiles or protect fewer areas. The total number of regional sectors in CBO's notional system is based on providing some terminal coverage to the entire country as suggested by the language in the "Iron Dome" executive order. The possibility of deploying fewer regional sectors is discussed below.

Estimating the costs of a smaller or larger system could be complicated. The building blocks for the upper and lower wide-area surface layers and the regional layer could be used to estimate the costs of deploying a different number of ground-based systems. But estimating the cost of smaller or larger layers of space-based systems would be less straightforward. That is because learning curve and production rate factors would alter the average cost per satellite as changes were made to the total number of satellites purchased. For example, increasing the number of SBIs by a factor of five to bolster capacity would push up the 20-year cost of the constellation by about a factor of four, to about $3 trillion. (Additional costs might be incurred to increase the capacity of other parts of the NMD system as well.) Decreasing the constellation by a factor of five (roughly the capacity to engage two ICBMs simultaneously) would reduce the 20-year cost by only about a third.

Comparison of CBO's Estimate With GDA Funding Plans in DoD's Budget Request for 2027

In recent public statements, the director of the Office of Golden Dome for America has estimated that the program's objective architecture would cost $185 billion to deploy over the next decade. The President's 2027 budget request documents call for the Golden Dome for America Fund to receive an average of about $15 billion per year for the next five years. Both of those amounts are much lower than CBO's estimate of the cost of a notional NMD architecture consistent with the "Iron Dome" executive order.

That difference in estimated costs raises the possibility that either GDA's objective architecture is more limited than CBO's notional NMD system or DoD expects funding from other accounts to contribute to GDA (or both). For example, procurement of interceptors might be funded directly through the services' missile procurement accounts instead of the GDA fund. The 2027 budget request includes significant increases in procurement of SM-3, SM-6, Terminal High Altitude Area Defense (THAAD), and Patriot Missile Segment Enhancement (MSE) interceptors, but those could be intended to replace expenditures in the Middle East and to increase inventories available to deployed military forces rather than for homeland defense. In addition to the GDA fund, the 2027 budget request includes $12.4 billion in research and development funds for the Missile Defense Agency that may cover some of the costs included in CBO's estimate.

Because of the limited information available about the Administration's planned NMD architecture, a direct comparison of DoD's and CBO's NMD systems and their costs is difficult. But it is possible to examine how costs might change if parts of CBO's notional NMD system were deleted.[16] For example, GDA's director has stated a focus on reducing GDA's cost per kill (that is, the cost per threat missile intercepted). If the space-based interceptors—which have a high cost per kill—were deleted from CBO's notional NMD system, the system's 20-year cost would drop to $448 billion, but the overall system would not align with the objectives outlined in the "Iron Dome" executive order, which specifically called for

16. A direct comparison would require such information as the exact composition of GDA's objective architecture, whether DoD's estimate includes operation costs, and whether the $185 billion reflects constant (inflation-adjusted) or nominal dollars.

space-based interceptors. If the number of regional sectors in CBO's notional NMD system was decreased to focus on defense of critical military sites or infrastructure, the system's costs would decline, but the population would have less protection. Many variations are possible.[17]

17. For example, see Todd Harrison, *Build Your Own Golden Dome: A Framework for Understanding Costs, Choices, and Tradeoffs*, AEI Foreign and Defense Policy Working Paper 2025-20 (American Enterprise Institute, September 2025), https://tinyurl.com/57e92eb3.

This testimony reprises the Congressional Budget Office's May 2026 report *Potential Costs of a National Missile Defense System*. In keeping with CBO's mandate to provide objective, impartial analysis, the testimony and report make no recommendations.

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