

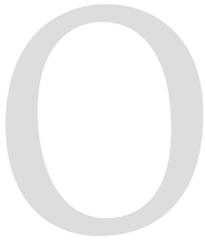
Trump's 2019 Missile Defense Budget: Choosing Capacity over Capability

By Thomas Karako and Wes Rumbaugh

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THE ISSUE

- President Trump's 2019 budget request includes \$12.9 billion for missile defense programs, including \$9.9 billion for the Missile Defense Agency and about \$3 billion in modernization in the military services, building upon the acceleration initiated in the \$323 million FY 2017 Above Threshold Reprogramming and the FY 2018 Budget Amendment of \$2.0 billion.
- The proposed budget continues the recent trend of procurement consuming a greater portion of overall missile defense spending, reflecting a choice for prioritizing near-term capacity over longer-term capability.
- With the exception of two new Pacific radars and a modest effort for tracking hypersonic threats, the request includes strikingly few changes to the program of record.
- The submission fails to address past shortfalls for more research and development of new missile defense technologies and capabilities, most significantly with its lack of real movement toward a space-based sensor layer for tracking and discrimination, as opposed to merely missile warning.
- Pursuit of more advanced capabilities will require substantial programmatic changes in the 2020 budget, or with a budget amendment later this year, if such capabilities are recommended by the forthcoming *Missile Defense Review*.



n February 12, the Department of Defense (DoD) released its budget request for FY 2019, which included a total of \$12.9 billion for missile defense-related activities. The proposed topline for the Missile Defense Agency comes in at \$9.9 billion, comprising \$2.4

billion for procurement, \$6.8 billion for research, development, test, and evaluation (RDT&E), \$500 million for operations and maintenance (O&M), and \$206 million for military construction (MILCON). The \$9.9 billion request is a 26 percent increase from the FY 2018 budget request of \$7.9 billion. Funding for ballistic missile defense within the services includes about \$3 billion, largely for the procurement of Patriot Advanced Capability-3 Missile Segment Enhancement (PAC-3 MSE) and Standard Missile-6 (SM-6) interceptors.

The two radars will cost approximately \$2.5 billion over the course of the Future Years Defense Program (FYDP).

Although these radars would be useful to close the near-term Pacific midcourse gap against limited ballistic missile threats to the homeland, such funds must be weighed against the opportunity cost for larger improvements in capability provided by a space-based sensor layer that could provide substantially more capable birth-to-death tracking and discrimination on a more global scale and against a wider diversity of threats. The choice for capacity over capability reflects a near-term time horizon, but further delay in more advanced technologies will carry costs at a later time.

In sum, the administration’s budget request for FY 2019 prioritizes near-term readiness against limited but growing ballistic missile threats from sources such as North Korea. This choice, however,

Table 1: 2019 Budget Request and Future Years Defense Program for MDA (in billions)

	2019	2020	2021	2022	2023
2018 \$	9.7	9.0	8.7	8.6	8.1
Then year \$	9.9	9.4	9.3	9.3	8.9

Overall, the budget reflects a near-term focus on capacity of existing programs, even at the expense of capability improvements. In its current form, the request boosts funding for all four families of interceptors. For homeland missile defense, this includes the continued improvements to the capacity and reliability of the Ground-based Midcourse Defense (GMD) system by continuing to deploy an additional 20 interceptors, several testing spares, and a new missile field at Fort Greely, Alaska. The request also deepens the magazines for Terminal High Altitude Area Defense (THAAD), Aegis, and Patriot interceptors, continuing a procurement-heavy trend from last year.¹ The focus on capacity does not answer the question, however, how missile defense efforts will be adapted to the new reality of great power competition described by the *National Security Strategy* and the *National Defense Strategy*.²

One of the few new muscle movements in the entire budget is the addition of two radars in the Pacific for discriminating long-range missile threats to the homeland. The idea of a discrimination radar for Hawaii had been publicly floated over the past two years, and had previously been part of the yet-unpassed appropriations marks from the House and Senate appropriations committees. The Hawaii radar is scheduled for a 2023 deployment, with an additional radar deployed by 2024 at a yet-undisclosed location.

falls short of connecting missile defense efforts to the reality of renewed great power competition as articulated in the *National Defense Strategy*. The inadequacy of the request lies not with the top line, but rather with the capabilities and strategy that the top line fails to prioritize. The 2019 request’s modesty of ambition is manifested by low funding for more advanced programs, such as boost-phase intercept, space-based sensors, and volume kill.

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Should the forthcoming *Missile Defense Review* address some of these issues and recommend programmatic changes, their implementation may have to wait until the 2020 budget, unless a budget amendment of some kind prioritizes them for the coming fiscal year.

THE 2019 TOP LINE IN CONTEXT

The FY 2019 request comes shortly after a congressional deal to raise Budget Control Act (BCA) caps on defense and nondefense spending negotiated as part of a continuing resolution (CR) on February 8.³ The congressional agreement both clears the way for a forthcoming FY 2018 appropriations bill that would hew closer to the higher numbers of the 2018 National Defense Authorization Act (NDAA) and Senate Appropriations Defense Subcommittee (SAC-D) markup, and provides relief from BCA caps for FY 2019.⁴

Under the terms of the current 2018 CR, MDA would receive \$10.5 billion, which would be MDA's highest appropriation since 2005 (in constant dollars). This level of funding for MDA came

about due to an additional \$2 billion approved in an emergency supplemental bill for missile defense and defeat programs passed in December 2017.⁵ Should pending Senate appropriations bills serve as the baseline, the final FY 2018 appropriation could grow to approximately \$11.3 billion.⁶

The 2019 request for the FYDP projects a gradual decline over the next few years. Admittedly, FYDP projections are often poor predictors of actual spending. Nevertheless, the content of the 2019 request would seem to project that the current spike in missile defense spending may be short-lived. A more constant FYDP projection could be necessary for the current emphasis on capacity building to be succeeded by an emphasis on capability building.

Figure 1: Missile Defense Agency Budget and FYDP Trends, FY 2002-2023

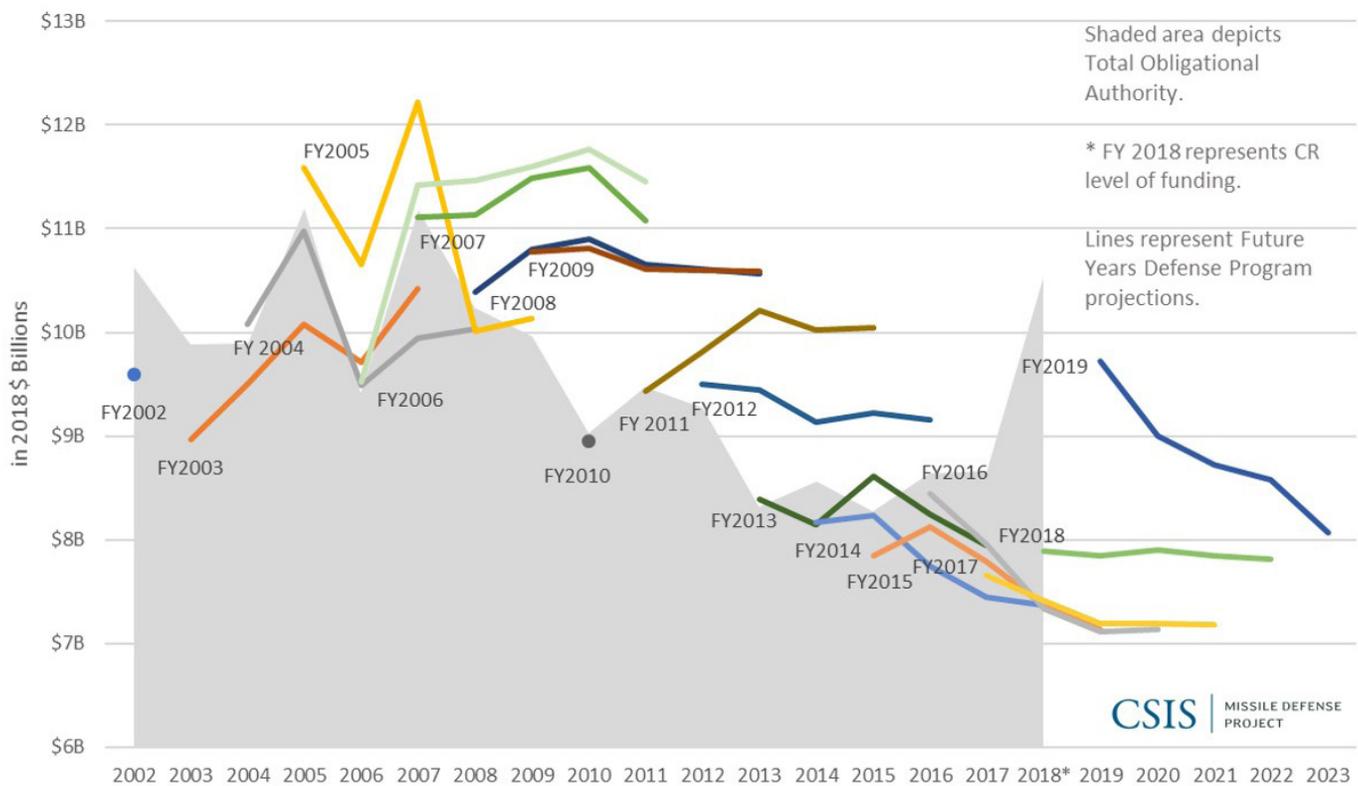


Table 2: MDA Budget Over Time—Constant and Then-Year Dollars (in billions)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
2018 \$	10.6	9.9	9.9	11.2	9.4	11.2	10.2	10.0	9.0	9.5	9.3	8.3	8.6	8.3	8.6	8.7	10.5
Then-year \$	7.8	7.4	7.6	8.8	7.7	9.4	8.8	8.6	7.9	8.4	8.4	7.7	8.0	7.9	8.3	8.5	10.5

* 2018 CR

CONTINUED PROCUREMENT GROWTH

One recent trend that continues into the 2019 request is the growth of MDA's procurement account, both in real terms and relative to the topline (see Figure 2). The 2018 emergency supplemental emphasized short-term operational needs, expanding the number of Ground-based Interceptors (GBIs) from 44 to 64, and procuring additional SM-3, THAAD, and PAC-3 MSE interceptors. Under the current CR for 2018, some 27.3 percent of MDA's topline goes to procurement. Part of the recent spike is due, however, to GMD dollars having only recently been included in the formal procurement account. Prior to 2017, not a single dollar for GMD had been colored as procurement, but instead as RDT&E.⁷

The request of \$2.4 billion for procurement would represent about a quarter of MDA's 2019 topline. Although the current FYDP suggests that the relative percent of procurement will decline, that downslope presupposes that no additional GMD procurement will occur after 2021, and that THAAD and Aegis procurement will slow down considerably, which may or may not hold up. As noted in a 2016 CSIS study, the growth of MDA procurement accounts has the potential to squeeze its RDT&E efforts as the accounts compete for funds within a limited top line.⁸ The 2019 request, for instance, includes

over \$1 billion less RDT&E funding than the FY18 SAC-D proposal. The falling topline in the FYDP are offset by the projected decline in procurement dollars, however, resulting in a steady rate of projected RDT&E spending for MDA over the next five years, between \$6.7 and \$6.9 billion in unadjusted dollars.

Because the new Memorandum of Understanding with Israel takes effect this year, this is the first presidential budget request to include the higher amount of \$500 million for Israel, rather than the typical sum of about \$150 million, which Congress would annually increase. Israeli programs continue the post-2012 trend to figure in the procurement as well as the RDT&E accounts for MDA. Indeed, Israeli programs represent three out of nine procurement lines for MDA (Arrow, David's Sling, and Iron Dome).

In short, the presidential request largely continues the current program of record at higher levels of spending, with a special emphasis on procuring additional interceptors. This emphasis on procurement for ballistic missile defense interceptors is not matched, however, by comparable emphasis on research and development of more advanced technologies.

Figure 2: MDA Procurement Appropriations

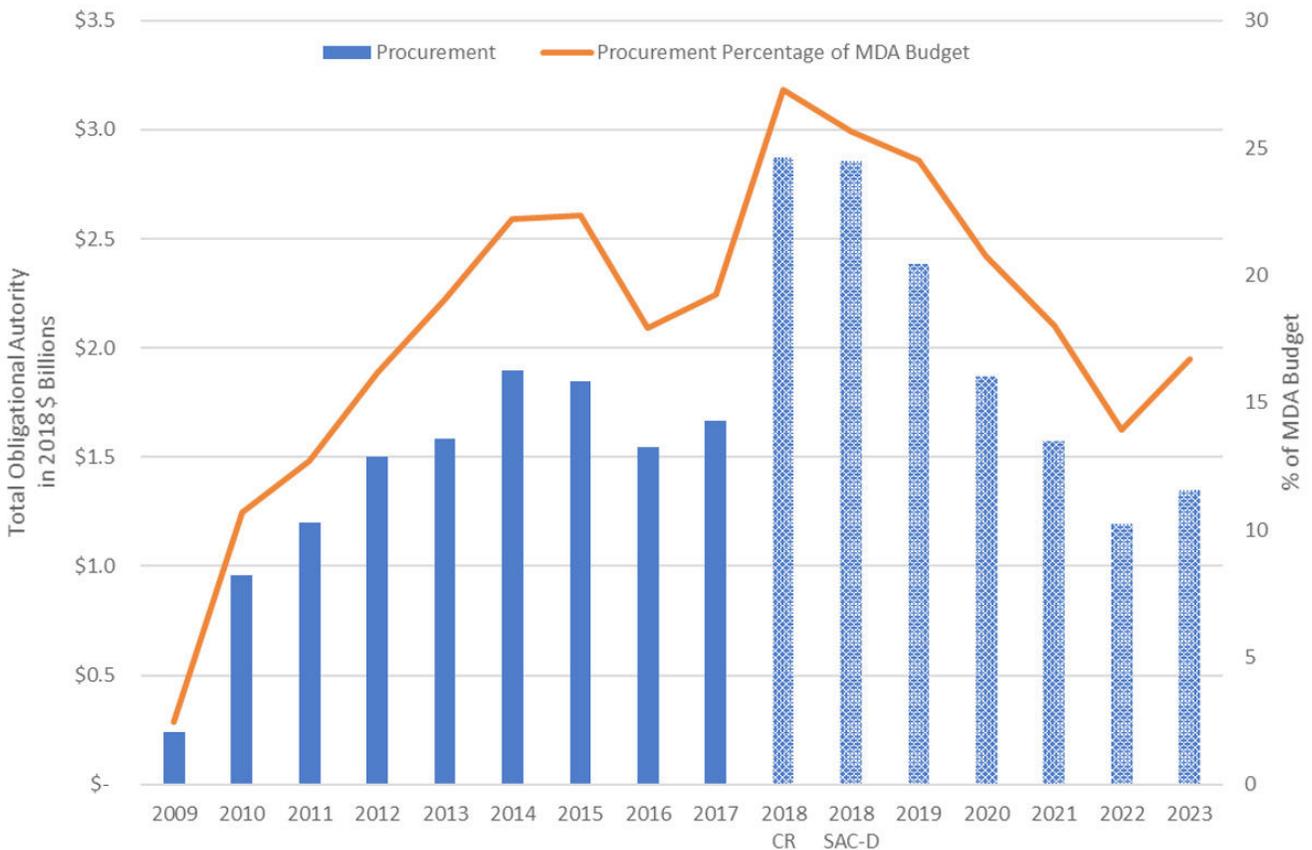
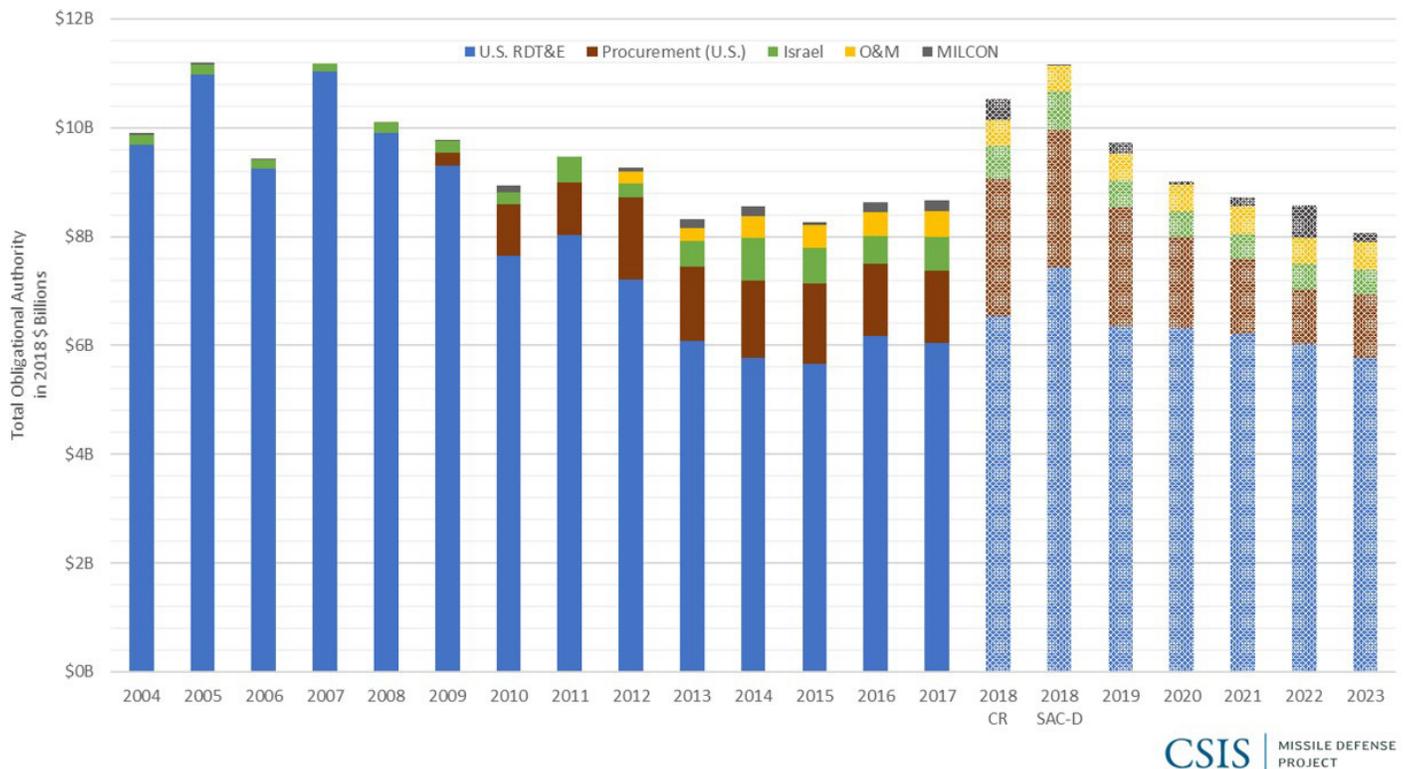


Figure 3: MDA Budget Categories, FY 2004–2023



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MAJOR PROGRAM MOVEMENTS

Because the *Missile Defense Review* has not yet been released, the 2019 budget request could be subject to revision either in the coming months or in subsequent years. Pentagon officials have previously indicated that the administration’s priorities will be more fully reflected in the 2020 submission.⁹

One of the stated objects of the review from presidential direction is to look at the relative balance between homeland and regional missile defense programs. Although the new submission shows a noticeable uptick in spending for homeland missile defense programs, regional missile defense has also grown significantly. THAAD and Aegis modernization funding, for instance, exceeds that for homeland missile defense funding, but the proportion levels out over the FYDP (see Figure 4). Another stated object of the forthcoming review, at congressional direction, is to explore the cruise missile threats to the homeland, hypersonic threats, and offense-defense integration to more comprehensively defeat rather than merely intercept missile threats. It remains to be seen how the forthcoming policy review will address the more complete spectrum of challenges.

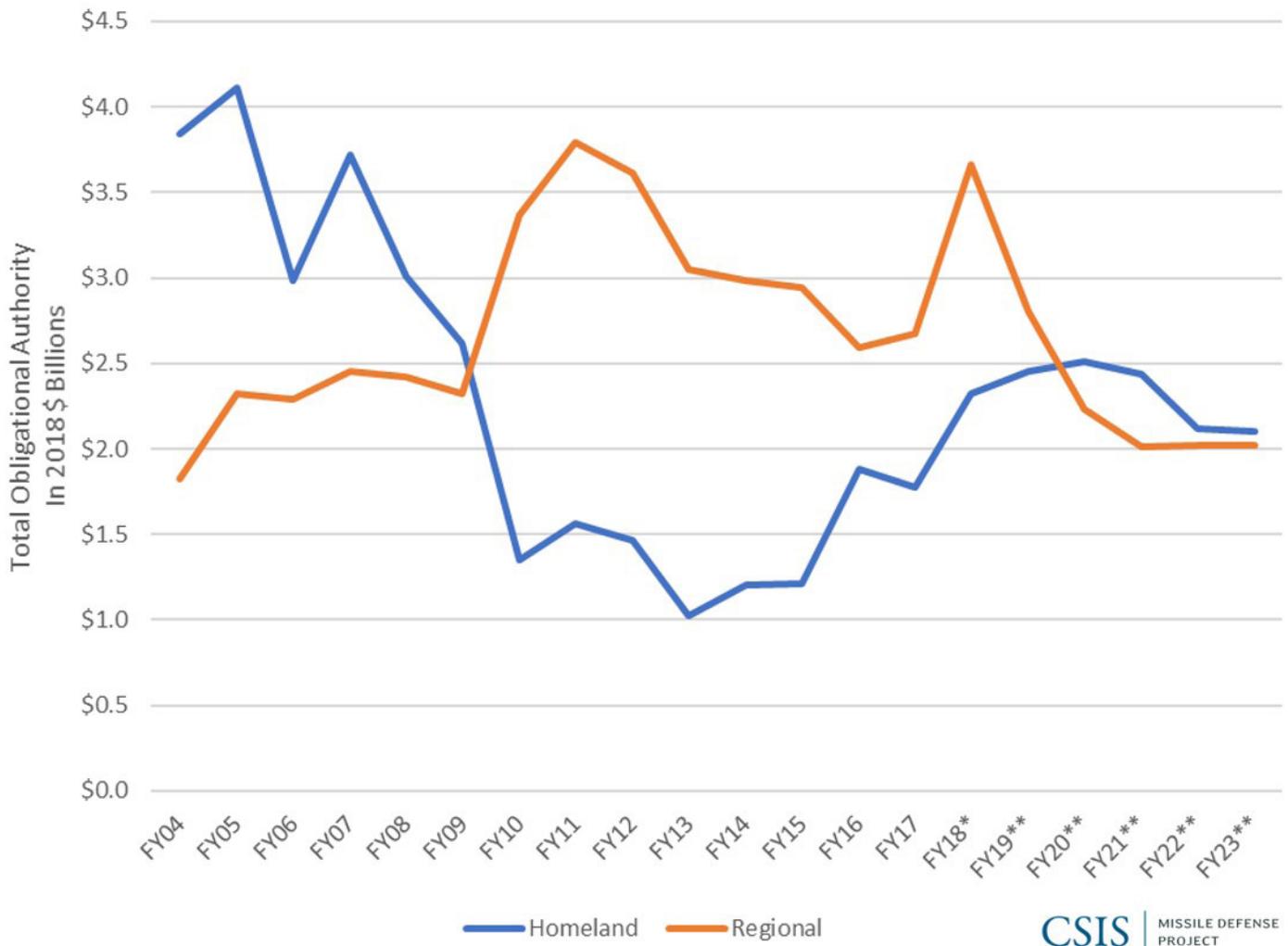
Many programmatic priorities remain roughly constant from 2018 for both homeland and regional missile defense programs. In terms of homeland defense, the 2019 request allocates \$524 million to continue the procurement of an additional 20 GBIs and

the construction of a new missile field, Missile Field 4, at Fort Greely. The base GMD account for RDT&E is \$926 million, which is \$108 million less than its 2017 appropriations level, but \$296 million more than the 2018 budget had projected for 2019.

Presumably reflecting the desire to recover some modest delays in the recent past, the request expands funding to develop the Redesigned Kill Vehicle (RKV) and a modified booster by some \$64 million relative to 2018’s projection for 2019. Funding for the Improved Homeland Defense Interceptors (which includes RKV) grows significantly in 2022–2023, suggesting this is when MDA plans to procure the new kill vehicles. The 2019 request also includes MILCON funding for two new silos in Fort Greely’s Missile Field 1. Due to safety restrictions during construction, the additional silos will create flexibility and simplify interceptor emplacement, thereby helping ensure that additional GBI emplacements do not result in fewer than 64 operational interceptors at any given time.¹⁰

The 2019 request for Aegis BMD falls just short of the projections from the 2018 budget, with \$593 million for procurement and \$768 million for its base RDT&E account, a reduction of \$39 million and \$38 million respectively. The most notable element for Aegis this cycle concerns the decision to procure six additional Standard Missile-3 Block IIA (SM-3 IIA) interceptors in FY 2019, in addition to the funding for 16 SM-3 IIA missiles from the FY 2018 emergency supplemental, despite a failure of the missile during a

Figure 4: MDA Homeland and Regional Modernization Budgets, FY 2004–2023



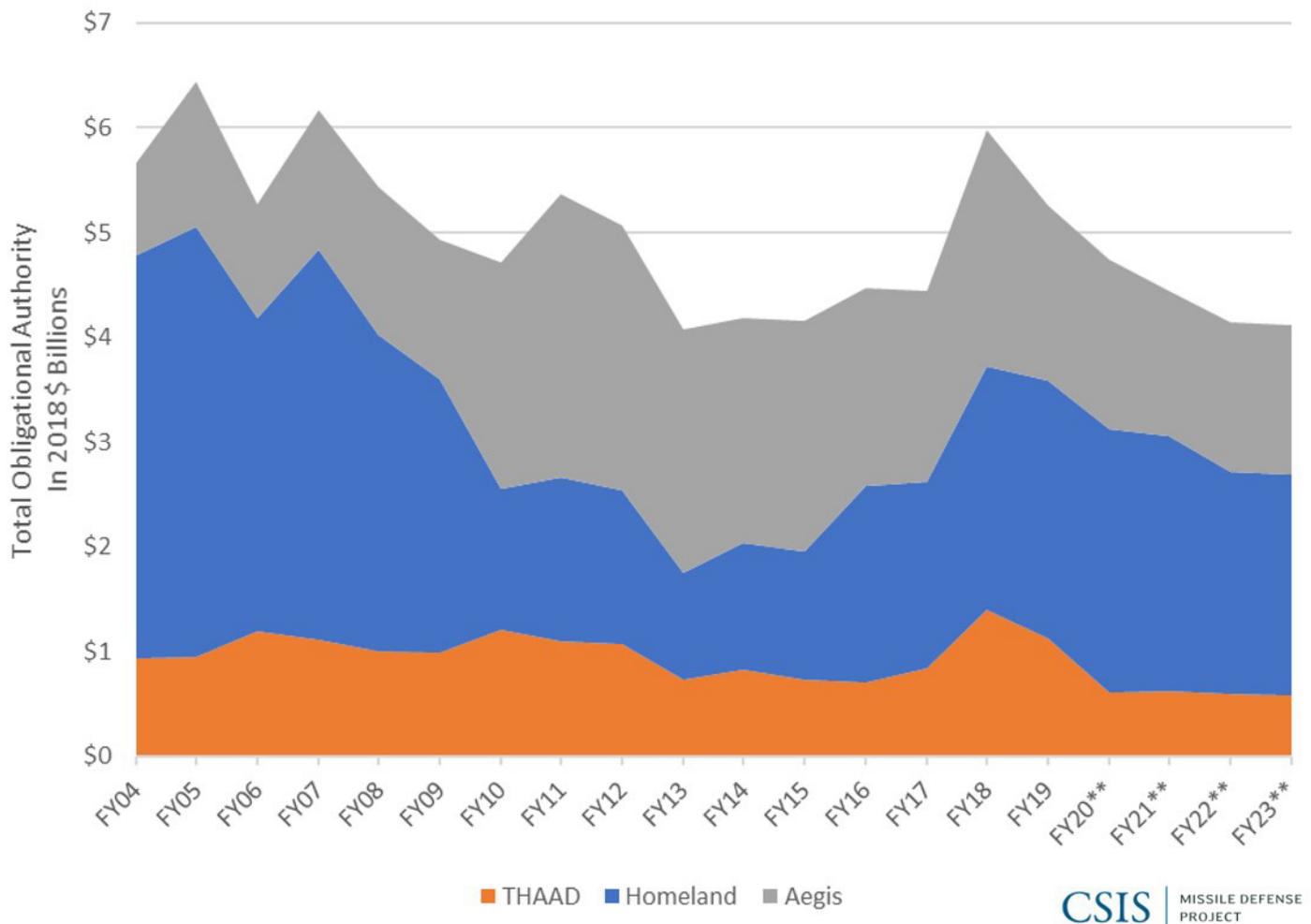
* 2018 CR ** 2019 PB Request
 Homeland category includes: GMD and associated programs.
 Regional category includes: THAAD, Aegis, and associated programs.
 "Modernization" here includes appropriations for procurement and RDT&E.

January 2018 test.¹⁰ The IIA missile is destined for U.S. Navy ships, the two NATO Aegis Ashore sites, and Japan’s own Aegis defenses, both afloat and ashore. In briefing the FY 2019 budget, MDA Director of Operations Gary Pennett noted that although the test failure is not expected to affect the overall SM-3 IIA timeline, MDA does not intend to procure those missiles until the cause of the failure is identified and remedied.¹²

THAAD receives a noticeable uptick in procurement spending for 2019, rising from \$441 million in the 2018 budget projection to \$874 million in this year’s request. The 2018 emergency supplemental had likewise added an additional \$509 million for THAAD atop the prior request. But while doubling down on more THAAD interceptors, the latest budget request drops previous plans for some kind of qualitative evolution with a THAAD follow-on program. Another notable element for the THAAD program is the plans under its testing budget to conduct an operational flight test with the intent to demonstrate its capability to interoperate

with both Aegis and Patriot.¹³ THAAD has previously demonstrated an ability to network with Aegis through the Command and Control, Battle Management, and Communications (C2BMC) network, but Patriot will be added into a 2019 test.¹⁴

Figure 5: MDA Selected Program Modernization Budgets, FY 2004–2023



* 2018 CR ** 2019 PB Request
 "Modernization" here includes appropriations for procurement and RDT&E.

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MODEST CAPABILITY AMBITIONS

The heavy emphasis on near-term procurement and terrestrial radars further underscores how the 2019 budget increase focuses on short-term urgent needs at the expense of longer-term research and development necessary to outpace the threat. MDA’s work on developing more advanced missile defense technologies apparently fails to inflect upwards in any meaningful way.

The most discussed of these programs is MDA’s attempt to deploy a boost-phase directed-energy weapon on a high-altitude unmanned aerial vehicle (UAV), an effort known as the Low Power Laser Demonstrator. This program will receive \$61 million of the \$148.8 million Technology Maturation Initiatives program, with an additional \$5 million going to the efforts to scale down the size of the laser to fit on the high-altitude UAV.¹⁵

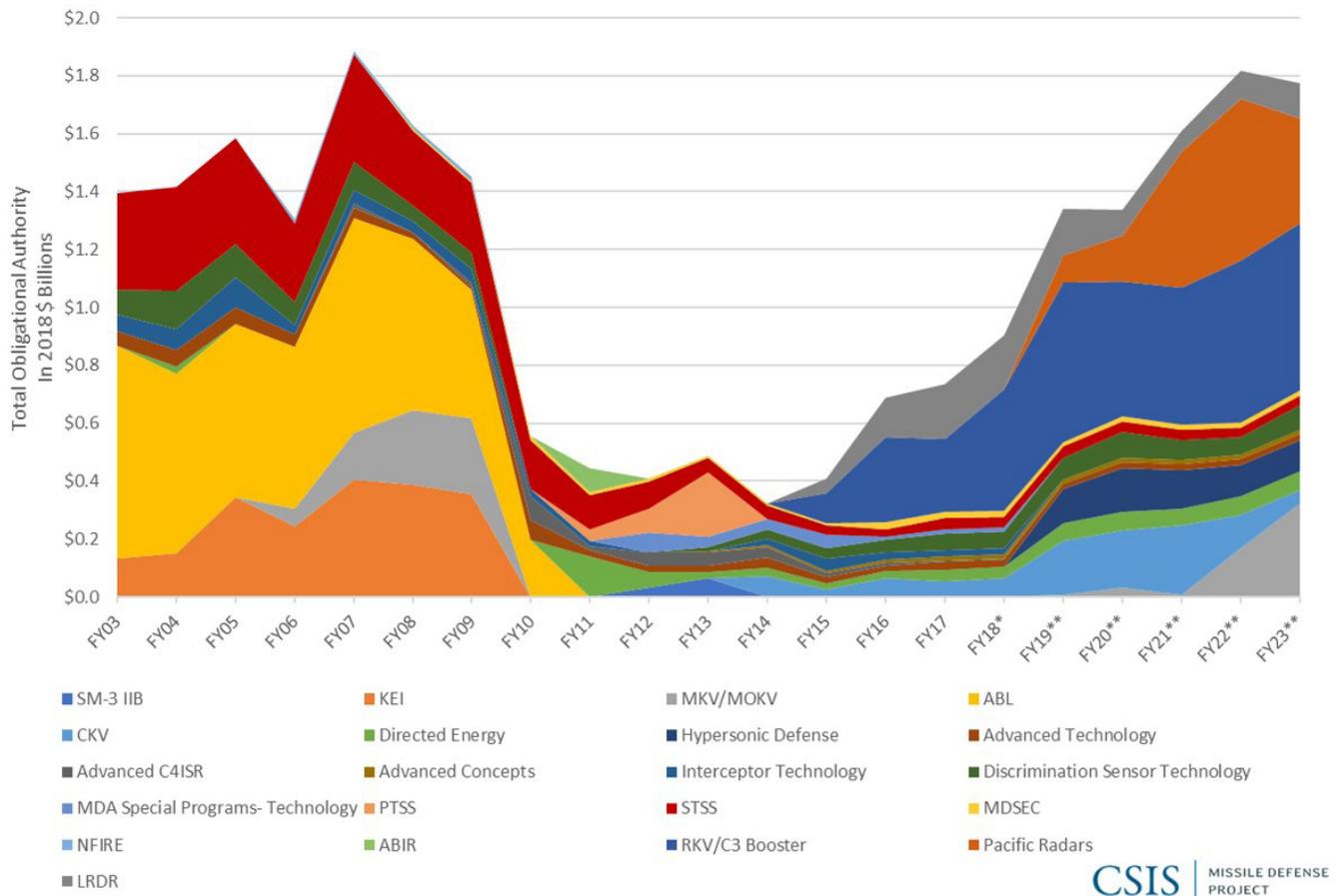
MDA also requested \$189.8 million for the Common Kill Vehicle (CKV) program as a precursor effort to develop a Multi Object Kill Vehicle (MOKV), although previous requests for the program have been trimmed by defense appropriations committees in

Congress. MDA currently projects the bulk of MOKV funding in FY 2022 and 2023, suggesting that is when it envisions the CKV technology to develop.

The current request does include some modest investments in new sensor technology, but the programs remain stuck in the study stage. In particular, MDA had previously requested funding to study sensors to detect and track hypersonic missile threats, but because it was a new program in the FY 2018 request, it has not yet been able to begin due to Congress’s continued reliance upon a CR rather than a full-year appropriation. Over this year’s FYDP, the Hypersonic Defense program is slated for \$657 million.

The 2019 PB adds a new program to build two new discriminating radars in the Pacific. These include a medium-range discrimination radar for Hawaii, scheduled for deployment in 2023, and an additional radar with similar features to be deployed the following year to a yet-undetermined site in the Pacific. Including MILCON, MDA projects to spend about \$2.5 billion building the radars over the course of the FYDP. MDA’s director of operations explained the need for such

Figure 6: Capability Improvements—Select MDA Programs, FY2003–2023



ABIR: Airborne Infrared
 ABL: Airborne Laser
 C4ISR: Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
 CKV: Common Kill Vehicle
 KEI: Kinetic Energy Interceptor
 LRDR: Long Range Discrimination Radar

NFIRE: Near Field Infrared Experiment
 PTSS: Precision Tracking Space System
 MDSEC: Missile Defense Space Experimentation Center
 MKV: Multiple Kill Vehicle
 MOKV: Multi Object Kill Vehicle
 SM-3 IIB: Standard Missile-3 Block IIB
 STSS: Space Tracking and Surveillance System

capability, saying, “one of the things that we need to do is maintain custody of the threat from birth to death and so with terrestrial based radars we have to put them in locations that we can maintain custody.”¹⁶ The location of the Pacific radar has not been identified, but one option might be in Hokkaido, Japan, or perhaps somewhere in southern Japan, with at least one face oriented to the east.

Pennett further stated during the budget rollout that these new radars would mirror the capabilities of the LRDR in Alaska, which would be sufficient to meet today’s threat but would fail to adequately address the emerging and evolving advanced threat, including quasi-ballistic boost glide vehicles. Here again we see a focus on near-term capacity over capability. Instead of replicating LRDR, these radars might be seen as an opportunity to leverage the evolving digital transformation of sensor technologies and potentially pave the way to subsequent space sensors.

FAILURE TO ADVANCE A SPACE SENSOR LAYER

As practically the only new activity in MDA’s budget, the addition of the Pacific radars currently serves to highlight the overall capability modesty of the current request. To be sure, terrestrial radars will remain essential for missile defense, but the 2019 budget request’s most striking shortfall is its failure to more substantially invest in a space-based sensor layer. In missile defense circles, the observation is frequently made that there are “only so many islands in the Pacific” upon which to put such radars, but even an archipelago of radars would remain limited by the curvature of the earth. Within the first few minutes of his budget briefing, Pennett himself had articulated why terrestrial radars are inadequate, noting that the hypersonic threat really “demands a globally present and persistent space sensor network to track it from birth to death.”¹⁷

Unfortunately, the 2019 budget does not do this. Each of the last five administrations have had on paper some sort of space-based sensor layer for tracking and discrimination—but each has failed to deploy an operational constellation. The 2019 budget request continues to kick the can on space sensors. Absent a course correction, the Trump administration may become the sixth successive administration committed to these paper satellites.

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Three lines within MDA's budget relate to a future space sensor layer, but none of them begin the development and deployment of such a capability. Within its Technology Maturation Initiatives program, MDA is working to integrate a multispectral targeting system sensor onto a UAV as part of a test bed that could, in principle, form the basis for a future space sensor layer.¹⁸ Other MDA space-related funding includes the two Space Tracking and Surveillance System (STSS) demonstrators, but this merely sustains the satellites as test assets. The proposed funding for the Space-based Kill Assessment (SKA) payload also remains constant, as the program has delayed its launch from 2017 to 2018.¹⁹ Although space sensor-related funding could in principle be hidden in MDA's classified Special Programs line, it seems unlikely that it would be more fully developed, let alone fielded, from within that line.

The failure to more aggressively pursue more advanced capabilities is consistent with the 2019 request's overall choice to prioritize near-term capacity, but nevertheless represents a major shortcoming.

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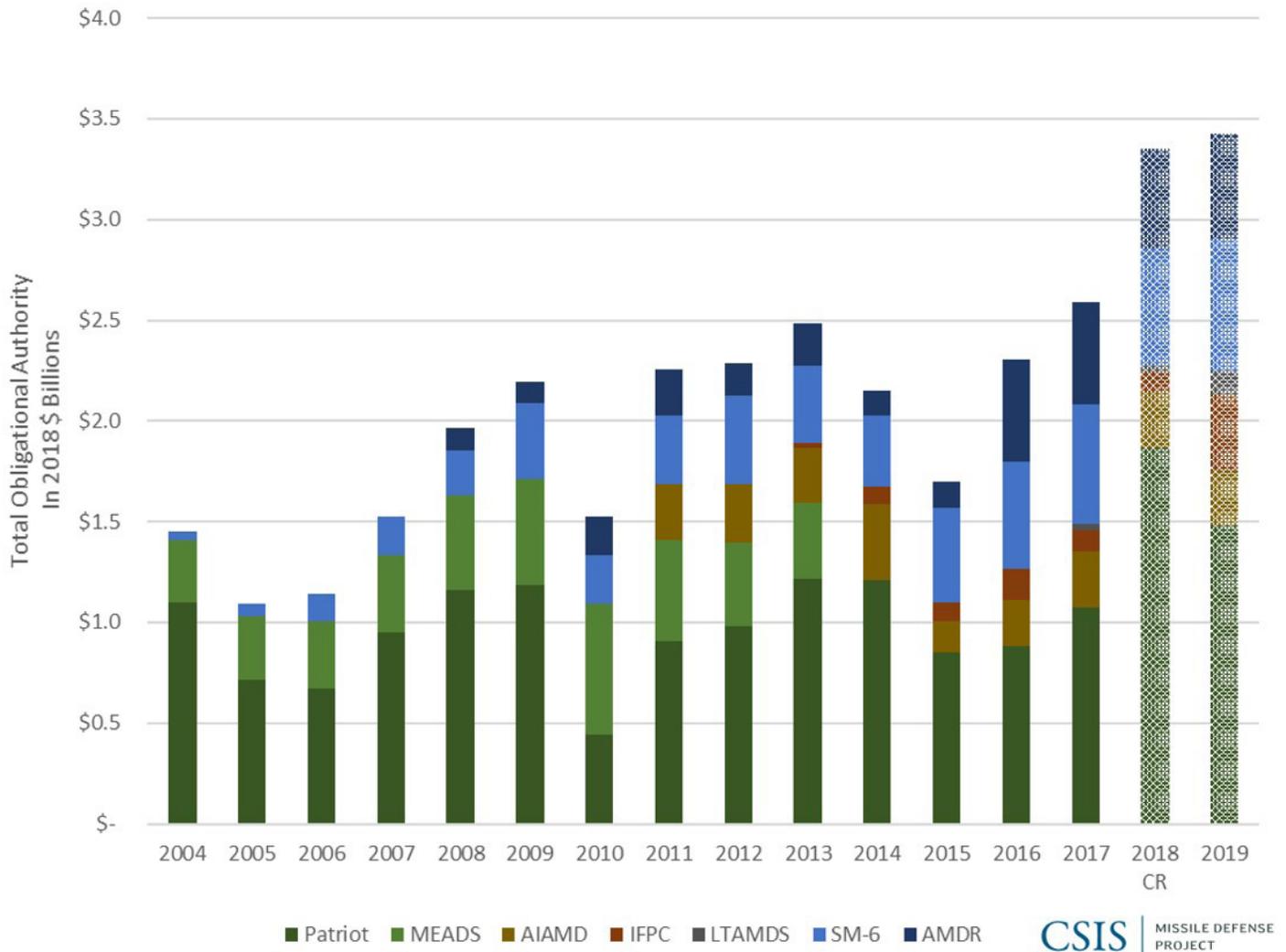
NON-MDA PROGRAMS

Outside of MDA, the Army's Patriot missile defense program received a particular boost from last year's emergency supplemental and continues to receive significant procurement funding in the 2019 request. Indeed, the growth for Patriot

and related interceptors constitutes the majority of growth in non-MDA missile defense accounts (Figure 7). The emergency supplemental included \$814 million for both procurement of additional PAC-3 MSE interceptors, as well as modifications to existing Patriot missiles and systems. The 2019 request for Patriot includes over \$1.5 billion requested for overall Patriot and interceptor modernization, but a full \$1.1 billion of this increase goes to MSE procurement.

Navy programs for procurement and RDT&E relating to the Standard Missile-6 (SM-6) and Air and Missile Defense Radar (AMDR) also see growth in the FY 2019 request. The U.S. Navy plans to procure 125 SM-6 missiles in 2019 and has also proposed a multiyear procurement plan to purchase 625 missiles between FY 2019–2023. The U.S. Navy also plans to buy three AMDRs for future Flight III *Arleigh Burke*-class destroyers within its modernization and shipbuilding plans. The first AMDR-equipped Flight III destroyer, the *USS Jack Lucas* (DDG-125), is scheduled to begin construction this year, with a projected delivery date of April 2023.²⁰

Figure 7: Select Non-MDA Missile Defense Modernization, FY 2004–2019



AIAMD: Army Integrated Air and Missile Defense
 AMDR: Air and Missile Defense Radar
 IFPC: Indirect Fire Protection Capability
 LTAMDS: Lower Tier Air and Missile Defense Sensor
 MEADS: Medium Extended Air Defense System
 SM-6: Standard Missile-6

INADEQUATE TO THE THREAT

The Trump administration’s 2019 budget request includes a high level of investment to increase the capacity of current missile defense programs, but the objects of those investments fall short of outpacing the threat for both ballistic and nonballistic missile attack. Despite recent congressional expressions of interest in more advanced capabilities, the only new start program in the 2019 request is the modest addition of two additional radars in the Pacific to help fill the midcourse discrimination gap against limited North Korean ballistic missile threats to the homeland.

Capacity building is necessary, but insufficient. Prioritizing short-term defensive needs for North Korea is understandable, but the budget’s proposed activities are inadequate for more advanced

threats and to the return of great power competition articulated in the recent *National Defense Strategy*. The 2019 request gives short shrift to longer-term investments in capabilities such as a space-based sensor layer, boost-phase intercept, directed energy, and multi-object kill vehicles.

It now falls to Congress and to decisions after the forthcoming *Missile Defense Review* to identify and prioritize capability enhancements as well, either with an amendment for this year or in the development of the 2020 budget. Failure to do so will constitute a missed opportunity.

Figure 8: FY 2019 Missile Defense Agency Budget Tracker

Fiscal Year 2019 Missile Defense Agency Budget Tracker								
Appropriations	Program	FY17 Final	FY18 Request	Continuing Resolution Funding	FY18 NDAA	FY18 SAC-D	FY18 Request for FY19	FY19 Request
Operations and Maintenance	AEGIS BMD	66.540	96.346	66.540	96.346		86.784	83.837
	THAAD	69.062	78.761	69.062	78.761		87.478	92.608
	TPY-2 Radars	192.873	191.055	192.873	191.055		178.661	176.143
	Midcourse	131.081	137.896	131.081	137.896		143.027	147.229
	Total O&M	459.556	504.058	459.556	504.058	475.000	495.950	499.817
Procurement	AEGIS Ashore Phase III	57.493	59.739	57.493	59.739	59.739	-	15.000
	AEGIS BMD	513.801	425.018	964.801	876.018	987.265	632.361	593.488
	Aegis BMD Advance Procurement	-	38.738	-	38.738	38.738	-	115.206
	AEGIS BMD Hardware and Software	63.098	160.330	63.098	160.330	160.330	97.999	97.057
	BMDs AN/TPY-2 Radars	5.503	0.947	16.503	11.947	11.947	13.572	13.185
	Iron Dome	62.000	42.000	62.000	92.000	92.000	-	70.000
	Arrow Upper Tier	120.000	-	120.000	120.000	120.000	-	-
	DAVID'S SLING	150.000	-	150.000	120.000	120.000	-	50.000
	THAAD	566.504	451.592	1,075.644	960.732	998.532	440.883	874.068
	Ground-based Midcourse Defense	47.000	-	227.000	180.000	180.000	-	409.000
	GMD Defense Advance Procurement	-	-	88.000	88.000	88.000	-	115.000
	RKV Long Lead Materials	50.000	-	50.000	-	-	-	-
	Israeli Programs	-	-	-	-	-	392.000	80.000
	Total Procurement	1,635.399	1,178.364	2,874.539	2,707.504	2,856.551	1,576.815	2,432.004
RDT&E	Cyber Security	0.945	0.986	0.945	0.986	0.986	0.997	0.985
	Advanced Concepts and Performance	14.534	12.996	14.534	12.996	12.996	13.741	13.017
	Weapons Technology	47.403	5.495	47.403	5.495	5.495	-	-
	Advanced Research	27.185	20.184	27.185	20.184	20.184	20.695	20.365
	Advanced C4ISR	3.489	-	3.489	-	-	-	-
	Special Program- MDA Technology	12.509	-	12.509	-	-	-	-
	Pacific Radar	-	-	-	-	109.000	-	95.765
	BMD Terminal Defense	197.171	230.162	259.271	292.262	570.762	194.328	214.173
	BMD Midcourse Defense	1,034.861	828.097	1,163.861	1,058.093	1,109.093	630.842	926.359
	BMD Sensors	252.665	247.345	283.465	305.207	322.107	247.643	220.876
	BMD Enabling Programs	435.203	449.442	451.403	472.784	524.584	466.760	540.926
	Special Programs	289.364	320.190	334.364	365.190	365.190	273.713	422.348
	BMD AEGIS	889.489	852.052	898.225	860.788	757.741	805.051	767.539
	STSS	37.809	34.907	37.809	34.907	34.907	39.453	36.955
	BMDs Space Program	20.910	16.994	34.910	44.494	30.994	13.348	16.484
	BMD C2BMC	465.433	430.115	490.180	454.862	487.862	461.275	475.168
	BMD Joint Warfighter	47.402	48.954	47.402	48.954	48.954	49.524	48.767
	MDIOC	53.483	53.265	53.483	53.265	53.265	54.505	54.925
	Regarding Trench	7.303	9.113	7.303	9.113	9.113	17.100	16.916
	Sea Based X-Band Radar	115.201	130.695	130.201	145.695	158.695	114.545	149.715
	Israeli Cooperative Programs	268.735	105.354	268.735	373.800	373.800	108.002	300.000
	BMD Test	294.441	305.791	304.843	316.193	341.593	295.042	365.681
	BMD Targets	521.784	410.425	571.484	460.125	517.246	373.203	517.852
	Hypersonic Defense	-	75.300	-	75.300	55.100	116.300	120.444
	Technology Maturation Initiatives	84.514	128.406	84.514	128.406	164.406	168.388	148.822
	Long Range Discrimination Radar (LRDR)	186.172	357.659	186.172	357.659	370.159	135.187	164.562
	Improved Homeland Defense Interceptors	247.362	465.530	418.262	636.430	864.630	496.414	561.220
	BMD Terminal Defense Segment Test	57.567	36.239	57.567	36.239	36.239	68.865	61.017
	AEGIS BMD Test	131.012	134.468	134.327	160.819	137.783	73.059	95.756
	BMD Sensor Test	81.376	84.239	98.976	101.839	101.839	65.886	81.001
	Land-Based SM-3	40.452	30.486	40.452	97.761	30.486	31.816	27.692
	Aegis SM-3 Blk IIA	102.272	9.739	102.272	9.739	9.739	-	-
	BMD Midcourse Segment Test	61.350	76.757	61.350	76.757	86.057	74.205	81.934
	Multi-Object Kill Vehicle	-	6.500	-	6.500	6.500	3.500	8.256
	Management Headquarters	30.693	29.947	30.693	29.947	29.947	28.024	28.626
	Small Business Innovation Research	86.742	-	86.742	-	-	-	-
	Assessments and Evaluations Cyber	-	-	-	-	-	-	3.400
	Common Kill Vehicle	54.395	252.879	54.395	252.879	56.879	321.175	189.753
	Total RDT&E	6,201.226	6,200.711	6,798.726	7,305.668	7,804.331	5,762.586	6,777.299
	MILCON	Unspecified Minor Construction	2.414	3.000	2.414	3.000	3.000	3.000
Fort Greely Missile Field 4		-	-	200.000	200.000	-	-	-
Fort Greely Missile Field 1 Expansion		-	-	-	-	-	-	8.000
Planning and Design		15.000	-	15.000	-	-	15.184	14.184
Long Range Discrimination Radar (LRDR)		155.000	-	155.000	-	-	150.000	174.000
Wake Island Facility		11.670	-	11.670	-	-	-	-
Missile Defense Complex Switchgear Facility	9.560	-	9.560	-	-	-	-	
Total MILCON	193.644	3.000	393.644	203.000	3.000	168.184	206.184	
Total MDA	8,489.825	7,886.133	10,526.465	10,720.230	11,138.882	8,003.535	9,915.304	

ABOUT THE AUTHORS

Thomas Karako is a senior fellow and director of the Missile Defense Project at the Center for Strategic and International Studies (CSIS) in Washington, D.C. Wes Rumbaugh is a research assistant with the CSIS Missile Defense Project.

ENDNOTES

1. Thomas Karako and Wes Rumbaugh, *Dissecting the Big Missile Defense Plus-up* (Washington DC: CSIS, December 2017), <https://missilethreat.csis.org/dissecting-big-missile-defense-plus/>.
2. Donald Trump, *National Security Strategy* (Washington, DC: White House, 2017), <https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf>; James Mattis, *National Defense Strategy* (Washington, DC: Department of Defense, 2018), <https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.
3. Thomas Kaplan, "Trump Signs Budget Deal to Raise Spending and Reopen Government," *New York Times*, February 8, 2018, <https://www.nytimes.com/2018/02/08/us/politics/congress-budget-deal-vote.html>.
4. Karako and Rumbaugh, *Dissecting the Big Missile Defense Plus-up*.
5. Marcus Weisgerber, "Congress Rushes Pentagon \$4B for Missile Defense Improvements," *Defense One*, December 22, 2017, <http://www.defenseone.com/business/2017/12/congress-rushes-pentagon-4b-missile-defense-improvements/144793/>.
6. This amount is computed by adding the SAC-D's \$11.1 billion of funding for MDA for 2018 to the \$200 million of emergency funding for military construction at Fort Greely that would be approved by a different appropriations subcommittee. See Karako and Rumbaugh, *Dissecting the Big Missile Defense Plus-up*.
7. Thomas Karako, Ian Williams, and Wes Rumbaugh, *Missile Defense 2020: Next Steps for Defending the Homeland* (Washington DC: CSIS, April 2017), 63, <https://www.csis.org/analysis/missile-defense-2020>.
8. Thomas Karako, Wes Rumbaugh, and Ian Williams, *The Missile Defense Agency and the Color of Money* (Washington, DC: CSIS, July 2016), https://csis-prod.s3.amazonaws.com/s3fs-public/publication/160721_Karako_MDA-ColorOfMoney_HiRes-compressed.pdf.
9. Aaron Mehta and Tara Copp, "Major US Defense Strategy Review Coming Jan. 19," *Defense News*, January 5, 2018, <https://www.defensenews.com/pentagon/2018/01/05/national-defense-strategy-coming-jan-19/>.
10. Missile Defense Agency, *Fiscal Year (FY) 2019 Budget Estimates: Overview*, <https://www.mda.mil/global/documents/pdf/budgetfy19.pdf>.
11. David B. Larter, "Another US Navy Ballistic Missile Intercept Reportedly Fails in Hawaii," *Defense News*, January 31, 2018, <https://www.defensenews.com/breaking-news/2018/01/31/second-navy-sm-3-block-ii-ballistic-missile-intercept-hawaii-report/>.
12. Gary Pennett, "Fiscal Year 2019 MDA Budget Briefing," Speech (Department of Defense, February 21, 2018).
13. MDA, "Fiscal Year (FY) 2019 Budget Estimates."
14. Andrea Shalal, "U.S. Completes Complex Test of Layered Missile Defense System," *Reuters*, November 1, 2015, <https://www.reuters.com/article/us-usa-missile-defense/u-s-completes-complex-test-of-layered-missile-defense-system-idUSKCNOSQ2GR20151102>.
15. Pennett, "Fiscal Year 2019 MDA Budget Briefing."
16. Ibid.
17. Ibid.
18. MDA, "Fiscal Year (FY) 2019 Budget Estimates."
19. Pennett, "Fiscal Year 2019 MDA Budget Briefing."
20. Kris Osborne, "Navy Will Start Construction in May on High-Tech Flight III DDG 51 Arleigh Burke-Class Destroyer," *National Interest*, January 28, 2018, <http://nationalinterest.org/blog/the-buzz/navy-will-start-construction-may-high-tech-flight-iii-ddg-51-24112>.

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