U.S. Military Electronic Warfare Program Funding: Background and Issues for Congress

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SUMMARY

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Congress, in the FY2019 National Defense Authorization Act, and the Department of Defense (DOD) has identified electronic warfare (EW) as a critical capability supporting military operations to fulfil the current National Defense Strategy. Collectively, DOD considers procurement appropriations and research, development, test and evaluation (RDT&E) appropriations as part of its investment accounts. Using programs identified by the EW Executive Commission (EW EXCOM), this report traces funding for three of the military services (Air Force, Army, and Navy) along with several defense agencies (Defense Advanced Research Projects Agency, Defense Information Systems Agency, the Joint Staff, Office of the Secretary of Defense Operational Test and Evaluation, and U.S. Special Operations Command).

This report compares DOD's funding requests for FY2019, FY2020, and FY2021 to assess if DOD seeks to increase the funding of the EW portfolio (by increasing funding), decrease its funding, or keep the portfolio relatively unchanged.

Insights into EW Program Funding

This report tracks DOD funding requests for approximately 65 research and develop program elements and 30 procurement line items across FY2019 and FY2021. Reviewing these three fiscal years request allows for comparisons across the EW portfolio and provides insights into how EW was prioritized relative to the overall DOD budget. In addition to tracking funding requests in each of the respective fiscal years and identifying what Congress appropriated in FY2019 and FY2020, this report looks at the future years defense program (FYDP) to identify potential trends in the EW portfolio.

This report looks at the combination of the procurement and RDT&E budget requests to provide a comprehensive, unclassified overview of the total EW program requests within DOD. DOD requested at least $10.1 billion in FY2019, $10.2 billion in FY2020, and $9.7 billion in FY2021 for EW, an amount analogous to the F-35 Joint Strike Fighter program ($10.7 billion in FY2019) or a Ford-class aircraft carrier ($12.5 billion in total ship-building procurement). Based on statements by several senior defense officials and the conclusions of the National Defense Strategy Commission, it could be expected that DOD is likely to substantially increase funding for EW programs. CRS assesses that DOD requested 11.5% more funding for EW RDT&E in FY2021 than what was projected in the FY2019 budget, but 1.7% less than what was projected in the FY2020 budget. Comparing the procurement budget, the FY2021 request seeks to increase funding by 2.2% compared to FY2019 projections, but decrease funding by 10.3% compared to what was projected in the FY2020 request. From a portfolio perspective, CRS assesses that the Administration projects $51.7 billion over the FY2021 Future Years Defense Program (FYDP), $259 million less than the FY2020 FYDP, but $4.5 billion more than the FY2019 FYDP. Overall, it appears the Administration is prioritizing research and development for EW programs, while decreasing procurement, which aligns with the overall FY2021 DOD budget request.

Potential Issues for Congress

Based on this analysis, this report identifies three potential issues for Congress

- Is DOD appropriately funding the EW portfolio?
- How does DOD use appropriated funds for EW programs? Is DOD potentially buying new capabilities with research and development funds, when it should use procurement funding?
- Does DOD understand what it is developing and procuring within the EW portfolio?

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Introduction

Congress has shown an interest in the Department of Defense's (DOD's) electronic warfare (EW) portfolio, requiring an independent assessment of EW plans and programs in the FY2019 National Defense Authorization Act (NDAA). This report addresses U.S. military EW funding across research, development, test, and evaluation (RDT&E) and procurement appropriations. Using the FY2019 through FY2021 budget request documents, this analysis compares funding profiles between fiscal years, as well as projected funding across the future years defense program (FYDP). Using unclassified sources, CRS estimates that DOD seeks to invest approximately $9.7 billion in FY2021 funding for EW programs. Discussion of specific EW-related programs, as well as an overview of electronic warfare, are outside the scope of this report.[1]

The following analysis looks at EW funding identified by the DOD's EW Executive Commission (EW EXCOM). The EW EXCOM identified a series of RDT&E program elements from three of the military services (Air Force, Army and Navy), as well as several defense agencies (Defense Advanced Research Projects Agency, Defense Information Systems Agency, the Joint Staff, Office of the Secretary of Defense Operational Test and Evaluation, and U.S. Special Operations Command). Using the program elements identified, this analysis extrapolates procurement funding to provide an overview of DOD investments in electronic warfare in FY2019 and FY2020 and requested investments in FY2021.

EW in Support of the National Defense Strategy

Over the past two decades, China and Russia have seen U.S. military command and control, intelligence surveillance, and reconnaissance (C2ISR) networks as a critical capability that they must develop capabilities against which to effectively compete.[2] Both countries, as a result, have invested heavily in EW-related systems.[3] According to one analyst, the Russian military views electronic warfare as a "type of armed struggle using electronic means against enemy C4ISR [command, control, communications, computers] to 'change the quality of information,' or using electronic means against various assets to change the condition of the operational environment."[4] Similarly, China has developed sophisticated EW capabilities to disrupt and deny adversary access to command and control systems—particularly space-based systems.[5] Not only has the Chinese military been developing new systems, but it routinely exercises with them. In its most

[1] For an overview of electronic warfare, see CRS In Focus IF11118, *Defense Primer: Electronic Warfare*, by John R. Hoehn. For a discussion of Airborne Electronic Attack Aircraft, see CRS Report R44572, *U.S. Airborne Electronic Attack Programs: Background and Issues for Congress*, by John R. Hoehn.

[2] Robert N. McDermott's report *Russia's Electronic Warfare Capabilities to 2025*, International Centre for Defence and Security, September 2017, accessed at https://icds.ee/wp-content/uploads/2018/ICDS_Report_Russias_Electronic_Warfare_to_2025.pdf.

[3] See Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2018*, p. 74, and Department of Defense, Defense Intelligence Agency, *Russia Military Power, Building a Military to Support Great Power Aspirations*, 2017, p. 12.

[4] See Department of Defense, Defense Intelligence Agency, *Russia Military Power, Building a Military to Support Great Power Aspirations*, 2017, p. 42, and Robert N. McDermott's *Russia's Electronic Warfare Capabilities to 2025*, p. 3. International Centre for Defence and Security, September 2017.

[5] Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2019*, Washington, DC, 2019.

recent annual report to Congress, DOD documented at least four major exercises the People's Liberation Army used to test and demonstrate their capabilities.[6]

The National Defense Strategy Commission, an independent Congressional commission charged with evaluating the DOD's National Defense Strategy, identified EW as a critical capability to achieve the goals of the National Defense Strategy. [7] Similarly, in its FY2019 through FY2021 Defense Budget Overview request documents,[8] DOD identified EW as a priority to improve platform and network survivability; provide advanced jamming techniques to disrupt radars, communications, and command and control systems; and provide measures to defend the space domain and maintain power projection forces.

Methodology

The Executive Branch and the Congress have placed a higher priority on EW programs in recent years. In 2015, the Deputy Secretary of Defense established the EW EXCOM—co-chaired by the Under Secretary of Defense for Acquisition and Sustainment (USD A&S) and Vice Chairman of the Joint Chiefs of Staff—to identify emerging EW technologies.[9] The FY2017 NDAA required the EW EXCOM to develop an EW Strategy. In its strategy, the EW EXCOM identified program elements and projects with EW facets in each of the services' and Defense-wide Research, Development, Test and Evaluation (RDT&E) appropriations. It did not, however, identify procurement lines due to complexity and classification issues.[10] Furthermore, some program elements the EXCOM identified might not clearly refer to EW capabilities, like DARPA's Electronics Technology. Other program elements that support EW operations, however, such as the Navy's E-2D Hawkeye, are not included in the EXCOM's program list.

With these methodological limitations, this report treats the EW EXCOM's list of 65 program elements and projects as encompassing DOD EW programs. The following analysis compares the FY2019 budget request for these programs with the FY2020 and FY2021 requests. The analysis includes funding for the Army, Navy, Air Force, DARPA, Defense Information Systems Agency (DISA), the Joint Staff, Office of the Secretary of Defense (OSD), Operational Test and

[6] Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2019*, p. 23, Washington, DC, 2019.

[7] National Defense Strategy Commission, *Providing the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission*, 2018, accessed on May 7, 2019 at https://www.usip.org/sites/default/files/2018-11/providing-for-the-common-defense.pdf.

[8] Department of Defense FY2019 Budget Overview Brief, accessed on May 7, 2019 at https://dod.defense.gov/Portals/1/Documents/pubs/FY2019-Budget-Request-Overview-Book.pdf, and Department of Defense FY2020 Budget Overview Brief, accessed on May 7, 2019 at https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/fy2020_Budget_Request_Overview_Book.pdf.

[9] Department of Defense Directive (DODD) 3222.04, *Electronic Warfare Policy*, March 26, 2014. Incorporating Change 2, August 31, 2018, accessed at https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/3222.04.pdf?ver=2018-10-11-075832-267. DODD 3222.04 identifies the Undersecretary of Defense for Acquisition, Technology, and Logistics (USD AT&L) as the co-chair of the EW EXCOM, however, the DOD was reorganized based on the FY2017 National Defense Authorization Act (P.L. 114-328), which recreated two new Undersecretary of Defense for Research and Engineering (USD R&E) and the Undersecretary of Defense for (Acquisition and Sustainment). Though DODD 3222.04 was updated after the organizational split, it still states that USD AT&L is the co-chair, based on the author's interpretation of the USD AT&L's responsibilities outlined it appears the USD A&S is the new co-chair of the organization since the instruction states that USD A&S is the office of primary responsibility.

[10] Sydney Freedberg, "Electronic Warfare Funding Up, But Short of DSB Marker," *Breaking Defense*, November 28, 2018, accessed at https://breakingdefense.com/2018/11/electronic-warfare-funding-up-still-short-of-dsb-recommendation/.

Evaluation (OT&E), and Special Operations Command (SOCOM), using program elements identified by EXCOM in its strategy document, which are aggregated at the department or agency level. The FY2021 request includes Space Force programs, which had been part of the Air Force request in prior years.

Though the EW EXCOM did not identify EW procurement programs, DOD procurement justification documents (P-40s) identify related research and development program elements. Using the Defense Technical Information Center investment budget search tool,[11] this analysis identified the associated EW procurement programs—28 in FY2019, 36 in FY2020, and 33 in FY2021. Some research and development efforts—such as the F/A-18 Hornet fighter jet and MQ-9 Reaper drone—did not differentiate funding for EW-specific procurement and therefore included procurement for aircraft. These procurements were excluded so as not to artificially inflate the funding profile. Based on the RDT&E profiles and program element searches, CRS did not identify DISA, Joint Staff, OSD, and DARPA programs with procurement appropriations.

DOD has stated that it has prioritized EW funding above other programs.[12] This report compares funding requests between the three fiscal years to assess if DOD seeks to increase funding of the EW portfolio (by increasing funding), decrease funding, or keep the portfolio relatively unchanged. To assess these changes, the percentage change from FY2019 to FY2020 is calculated for each appropriations category, and then compared to an overall DOD percentage change.

EW Research and Development Funding

FY2019 RDT&E Funding

Table 1. FY2019 Requested and Future Year Funding for DOD Electronic Warfare RDT&E

(in millions of dollars)

			Future Years				
Department/ Agency	**FY2019 Request**	**FY2019 Enacted**	**FY2020**	**FY2021**	**FY2022**	**FY2023**	**Requested FYDP Total**
Navy	2,443.0	2,393.5	2,345.7	2,090.4	1,611.9	1,417.0	9,908.1
Air Force	1,143.3	1,194.3	1,089.0	966.7	946.2	1,201.4	5,346.6
Army	859.7	945.5	621.0	581.1	576.3	528.5	3,166.6
DARPA	740.5	736.3	809.6	944.3	965.4	991.6	4,451.4
Other	341.0	520.6	312.7	311.4	313.8	351.7	1,630.6
Total	**5,527.5**	**5,790.2**	**5,178.0**	**4,894.0**	**4,413.6**	**4,490.1**	**24,503.3**

Source: Air Force FY2019-FY2020 Research, Development Test and Evaluation Budget Justification Volume 1-3b, Army FY2019-FY2020 Research, Development Test and Evaluation Budget Justification Volume 1-5, Navy FY2019-FY2020 Research, Development Test and Evaluation Budget Justification Volume 1-5, Defense-wide FY2019-FY2020 Research, Development Test and Evaluation Budget Justification Volume 5.

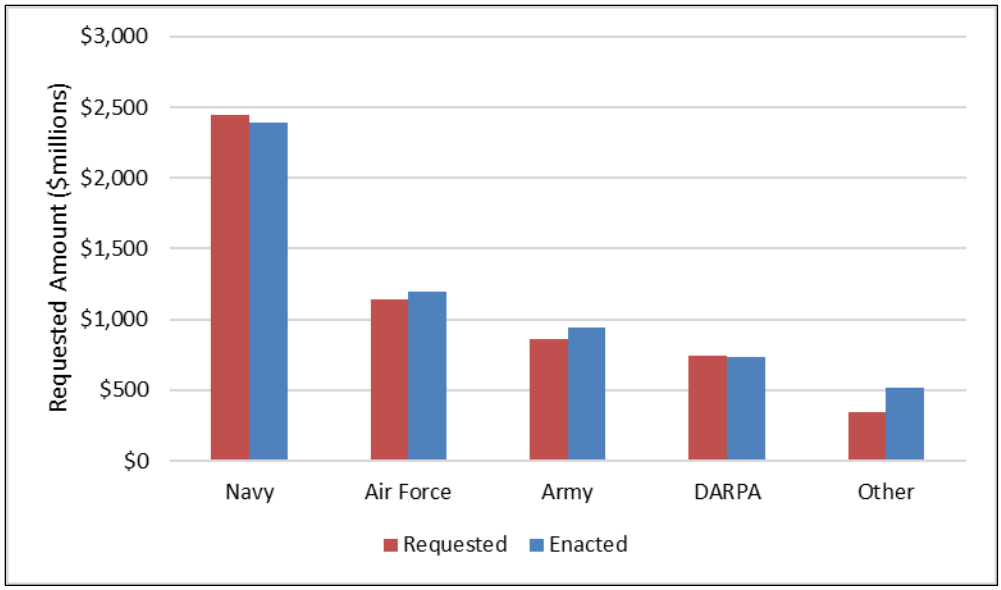
[11] Defense Technical Information Center, accessed at https://apps.dtic.mil/dodinvestment/#/.

[12] Department of Defense FY2020 Budget Overview Brief, accessed on May 7, 2019 at https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/fy2020_Budget_Request_Overview_Book.pdf.

Notes: The "Other" category combines funding from DISA, Joint Staff, OSD, OTE, and SOCOM. Data reported from the EW EXCOM and compiled by the Association of the Old Crows based on EW EXCOM designated Program Elements and Projects. The "FY2019 Enacted" column is derived from the FY2020 budget request.

Table 1, above, provides an overview of the FY2019 EW RDT&E funding request, FY2019-enacted funding, and projected funding for EW program elements in each of the departments and agencies. The FY2019 request serves as a baseline to compare how DOD changed its funding priorities for FY2020. Of note, DOD requested $5.53 billion in EW RDT&E for FY2019 and planned on spending approximately $24.5 billion across the FYDP. The Navy requested the most funding in FY2019 ($2.44 billion), followed by the Air Force ($1.14 billion), the Army ($859.7 million), DARPA ($740 million), and other organizations ($341 million). EW funding was anticipated to peak in FY2019 then curtail through FY2022, followed by a slight increase in FY2023.

Figure 1. FY2019 EW RDT&E Requested and Enacted Funding



Source: Air Force FY2019-FY2020 Research, Development Test and Evaluation Budget Justification Volume 1-3b, Army FY2019-FY2020 Research, Development Test and Evaluation Budget Justification Volume 1-5, Navy FY2019 Research, Development Test and Evaluation Budget Justification Volume 1-5, Defense-wide FY2019-FY2020 Research, Development Test and Evaluation Budget Justification Volume 5.

Note: Values presented are in nominal dollars.

Figure 1, above, shows the difference between the Administration's FY2019 DOD request and the enacted amount of EW RDT&E. DOD requested a total of approximately $5.5 billion in FY2019; Congress enacted approximately $5.8 billion, $263 million above the requested amount. Of particular note, OSD OT&E received additional funding for subsequent testing. The largest increases between the FY2019 request and enacted levels were for "Other" agencies—primarily Operational Test and Evaluation—and the Army. The Navy and DARPA saw slight decreases from their requested levels.

FY2020 RDT&E Funding

Table 2. FY2020 Requested and Projected Funding for DOD Electronic Warfare RDT&E

(in millions of dollars)

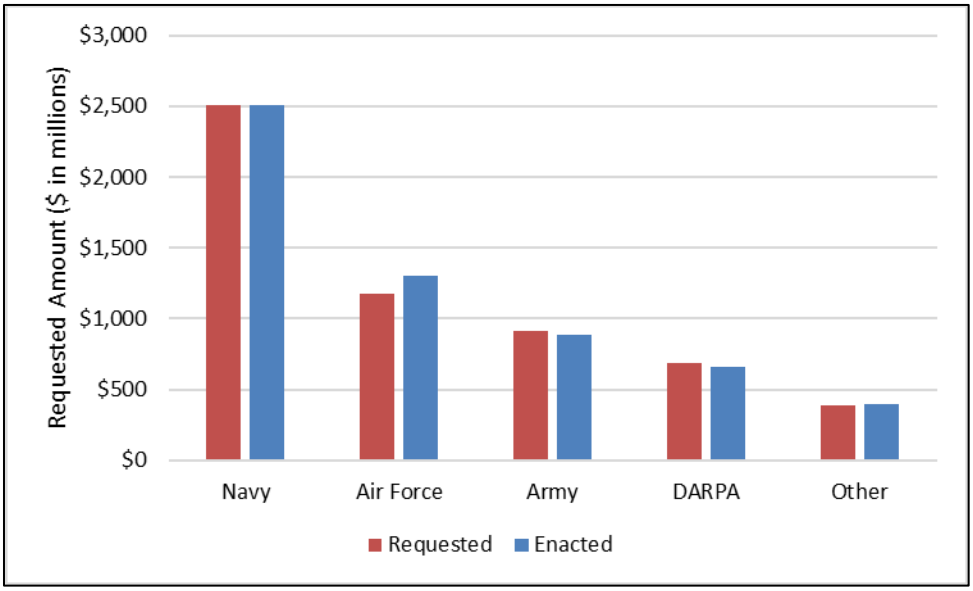
Department/ Agency	FY2020 Requested	FY2020 Enacted	Future Years				
			FY2021	FY2022	FY2023	FY2024	FYDP Total
Navy	2,507.6	2,507.0	2,402.0	1,920.3	1,566.6	1,554.7	9,951.2
Air Force	1,176.3	1,304.2	1,137.2	1,029.4	1,063.3	1,683.6	6,089.8
Army	915.6	889.5	861.7	635.4	589.2	536.2	3,538.2
DARPA	690.6	659.3	880.7	921.7	957.6	981.5	4,432.2
Other	391.5	397.3	361.6	362.6	357.3	344.1	1,817.1
Total	**5,681.5**	**5,757.3**	**5,643.2**	**4,869.5**	**4,534.0**	**5,100.2**	**25,828.5**

Source: Air Force FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-3b, Army FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Navy FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Defense-wide FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 5.

Notes: The "Other" category combines funding from DISA, Joint Staff, OSD, OTE, and SOCOM. Data analyzed by CRS. Values may not add due to rounding.

Table 2 provides the FY2020 request and projected future year funding levels for EW RDT&E appropriations in DOD's FY2020 budget request. Of particular note, the Administration's DOD budget requested $504 million in additional RDT&E funding for FY2020 compared with the FY2019 request. While it would follow a trend line similar to FY2019's projection, DOD's plan adds additional money to EW capabilities in each of the out-years of the FYDP. This increase can primarily be attributed to the Navy's start of the Next Generation Jammer-Low Band program, as well as the Army's renewed focus on EW capabilities.

Figure 2. FY2020 EW RDT&E Requested and Enacted Funding



Source: Air Force FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-3b, Army FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Navy FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Defense-wide FY2020-FY2021 Research, Development Test and Evaluation Budget Justification Volume 5.

Note: Values presented are in nominal dollars.

Figure 2 provides a comparison between requested and appropriated amounts by military department for FY2020. There was an overall increase in $140 million in EW research and development efforts. The Air Force received approximately $139 million in additional funding compared to the requested amount, with the largest increases for Advanced Aerospace Sensor Technologies and EW Quick Reaction Capabilities. The Navy received an additional $58 million for EW research and development efforts, including more funding for the F/A-18 Infrared Search and Track development and Shipboard Information Warfare Exploitation programs. These increases were partially offset by a $31 million reduction in DARPA funding for EW research and development and a $26 million reduction in Army funding for such efforts. DARPA programs all saw relatively small decreases in funding. Army funding decreases included reductions to assured Precision, Navigation and Timing equipment development.

FY2021 Request

The FY2021 RDT&E request includes approximately $5.7 billion across all military departments and agencies. The Navy requested the most, following a similar trend in FY2019 and FY2020. The Army requested the second most, replacing the Air Force in prior years. **Table 3** provides an overview of the FY2021 request.

Table 3. FY2021 Requested and Projected Funding for DOD Electronic Warfare RDT&E

(in millions of dollars)

Department / Agency	FY2021	Future Years				
		FY2022	FY2023	FY2024	FY2025	FYDP Total
Navy	2,379.1	1,964.8	1,676.0	1,612.5	1,567.4	**9,199.8**
Air Force	753.0	662.7	551.1	740.8	839.5	**3,547.1**
Army	1,167.7	937.7	743.2	586.4	578.9	**4,013.8**
DARPA	660.9	731.4	788.7	907.4	879.6	**3,968.0**
Space Force	209.4	233.8	469.7	851.2	679.3	**2,443.5**
Other	397.3	312.2	288.8	284.4	291.3	**1,462.7**
TOTAL	**5,757.3**	**5,482.2**	**4,819.3**	**4,513.2**	**4,989.6**	**4,830.6**

Source: Air Force FY2019-2021 Research, Development Test and Evaluation Budget Justification Volume 1-3b, Army FY2019-2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Navy FY2019-2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Defense-wide FY2019 Research, Development Test and Evaluation Budget Justification Volume 5, Space Force FY2021 Research, Development, Test and Evaluation Budget Justification.

Notes: The "Other" category combines funding from DISA, Joint Staff, OSD, OTE, and SOCOM. Data analyzed by CRS. Values may not add due to rounding.

The Army increased EW RDT&E funding by $305 million when comparing what was projected from the FY2020 request and what was requested in FY2021. The Air Force experienced the most changes, restructuring several program elements and transferring others to the Space Force. The top three programs that received increased funding include (1) the Army's Rapid Capability Development and Maturation program (increased by $247 million compared to the FY2020 projection for FY2021),[13] (2) the F/A-18 Infrared Search and Track (IRST) development (increased $168 million),[14] and (3) the Eagle Passive Active Warning System (increased by $146 million).[15] Programs that saw the largest reductions include the B-2 Defensive Management System (reduced by $164 million),[16] DARPA's Sensors and Processing Systems program

[13] This project funds development for directed energy, long-range precision fires, air and missile defense, cyber, artificial intelligence, counter-unmanned aircraft systems, among other highly demanded capabilities. For more information, see Department of the Army, *Research and Development Budget Request*, February 2020, pp. 438-440, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2021/Base%20Budget/rdte/RDTE_BA_5C_FY_2021_PB_RDTE_Vol%202_Budget_Activity_5C.pdf.

[14] The F/A-18 IRST is a sensor that uses heat signatures to detect and potentially target adversary aircraft.

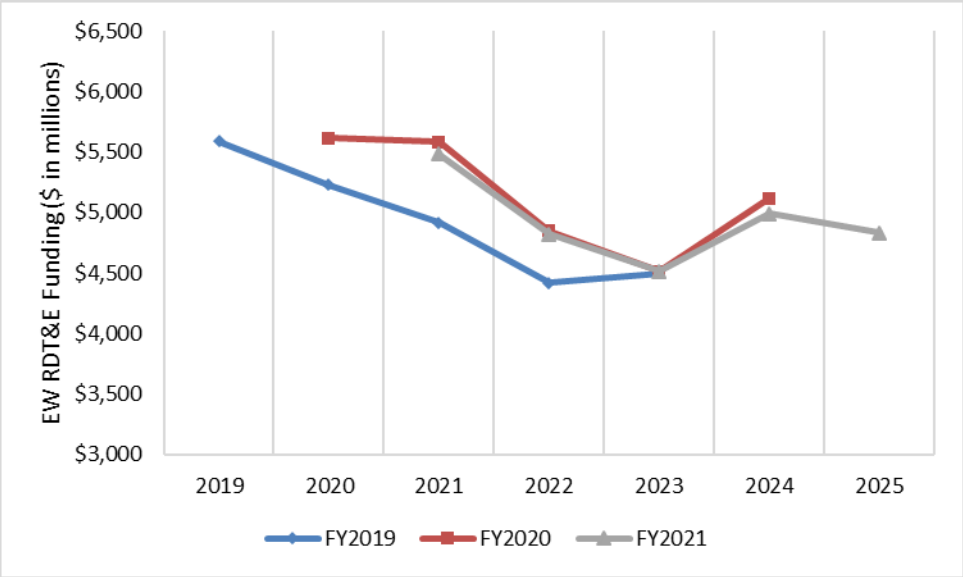
[15] The Eagle Passive Active Warning System is designed to alert F-15 pilots if they are targeted by enemy radar equipment.

[16] The Air Force announced that it was restructuring the B-2 Defensive Management System program to include only cockpit upgrades instead of a suite of technologies to reduce the risk of the B-2 flying in defended airspace. For more information, see Valerie Insinna, "The Air Force is massively scaling back a major upgrade for the B-2 stealth bomber," *Defense News*, February 12, 2020, at https://www.defensenews.com/smr/federal-budget/2020/02/12/the-air-force-is-massively-scaling-back-a-major-upgrade-for-the-b-2-stealth-bomber/.

(reduced by $142 million),[17] and the Space Force's Protected Tactical Satellite Communications (reduced $48 million).[18]

FY2019 Request Through FY2021 Request RDT&E Funding Comparison

Figure 3. Planned EW RDT&E Funding in the FY2019 and FY2020 DOD Budget Requests



Source: Air Force FY2019-2021 Research, Development Test and Evaluation Budget Justification Volume 1-3b, Army FY2019-2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Navy FY2019-2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Defense-wide FY2019 Research, Development Test and Evaluation Budget Justification Volume 5, Space Force FY2021 Research, Development, Test and Evaluation Budget Justification.

Note: Values presented are in nominal (or current) dollars.

CRS assesses that the FY2021 request includes 93 program elements associated with electronic warfare and 157 related projects. This represents a slight increase from previous years, partly as a result of the newly established Space Force, the Air Force restructuring research projects, and the Army's restructuring of programs. **Figure 3** depicts funding projections from the FY2019, FY2020, and FY2021 requests. The FY2021 request aligns closely with the FY2020 request, reducing funding by $104 million from projections in FY2020. The FY2021 request projects $25.6 billion over five years; FY2019 projected $24.6 billion over the FYDP, FY2020 similarly projected $25.6 billion.

[17] This DARPA project funds advanced sensors for intelligence, surveillance, and reconnaissance activities. Of particular note, this includes Dynamically Composed RF systems, new sensors to detect high-level targets, and the spatial temporal and orientation information for contested environments, among other activities. For more information, see Department of Defense, *Defense Advanced Research Projects Agency Budget Request*, Washington, DC, February 2020, pp. 232-235, https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2021/budget_justification/pdfs/03_RDT_and_E/RDTE_Vol1_DARPA_MasterJustificationBook_PB_2021.pdf.

[18] The Navy reported a $115 decrease in Innovative Naval Prototypes; however, this is a result of the program element being restructured due to the FY2017 National Defense Authorization Act (P.L. 114-328).

DOD has increased planned EW RDT&E funding from $4.9 billion in its FY2019 request to $5.6 billion in its FY2020 request, then down to $5.5 billion in the FY2021 request. The FY2021 request represents an 11.7% increase in funding when compared to FY2019 projections, but a 1.7% decrease from the projected funding from FY2020 request. The overall change from FY2019 to FY2021 (11.7%) is double the requested 4.9% increase in overall DOD funding from FY2019 to FY2020.

EW Procurement Funding

FY2019 Procurement Funding

Table 4. FY2019 Requested and Future Year Funding for DOD Electronic Warfare Procurement

(in millions of dollars)

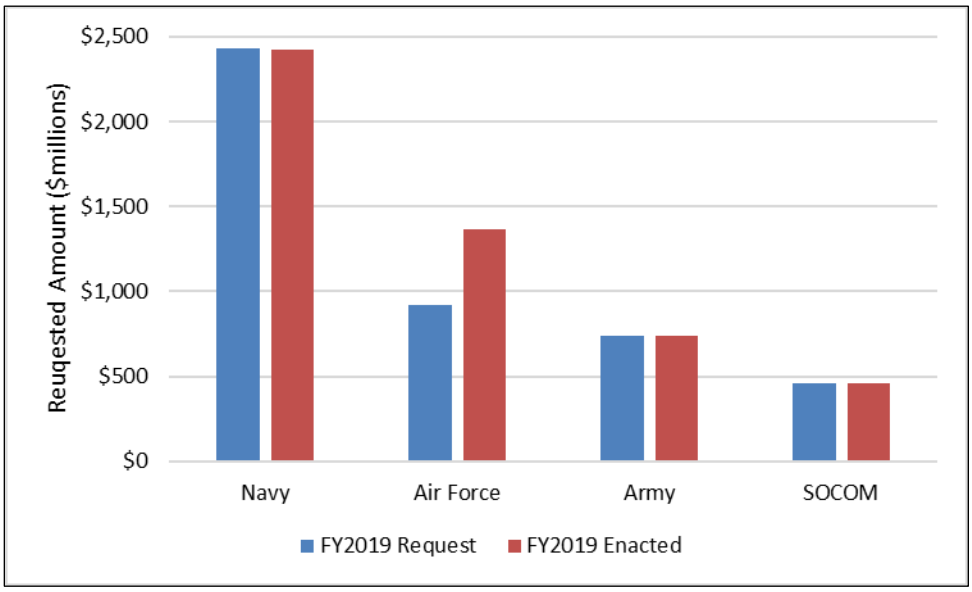
			Future Years				
Department/ Agency	FY2019 Request	FY2019 Enacted	FY2020	FY2021	FY2022	FY2023	Requested FYDP Total
Navy	2,431.7	2,420.4	2,714.3	2,778.0	3,059.4	3,539.0	14,522.5
Air Force	919.4	1,363.4	903.1	818.2	1,032.9	936.0	4,609.6
Army	742.8	742.5	350.4	270.1	224.8	232.3	1,820.3
SOCOM	459.7	458.5	293.6	304.3	282.5	295.4	1,635.5
TOTAL	**4,553.6**	**4,984.8**	**4,261.5**	**4,170.7**	**4,599.5**	**5,002.6**	**22,587.9**

Source: Air Force FY2019-FY2020 Aircraft, Other, and Space procurement budget justifications; Army FY2019-FY2020 Aircraft, Missile, and Other procurement budget justifications; Navy FY2019-FY2020 Aircraft, Ammunition, Marine Corps and Other procurement budget justifications; SOCOM FY2019-FY2020 procurement budget justification.

Table 4, above, provides an overview of the FY2019 EW procurement request along with enacted procurement appropriations. Overall, the Administration requested $4.55 billion for EW-related procurement activities. The Navy requested the most ($2.43 billion), followed by the Air Force ($919 million) and the Army ($743 million). Funding was projected to decline through FY2021 before increasing in FY2022 and FY2023, as a result of the first increment of the Next Generation Jammer (NGJ) entering production. The NGJ is a series of jamming pods designed to disrupt air defense radars and comminutions, replacing the Vietnam-era ALQ-99 jammers.

Figure 4. FY2019 Electronic Warfare Procurement Funding

FY2019 Requested and Enacted Funding



Source: Air Force FY2019-FY2020 Aircraft, Other, and Space procurement budget justifications; Army FY2019-FY2020 Aircraft, Missile, and Other procurement budget justifications; Navy FY2019-FY2020 Aircraft, Ammunition, Marine Corps and Other procurement budget justifications; SOCOM FY2019-FY2020 procurement budget justification.

Congress added $431 million in appropriations, representing a 9.5% increase over what the Administration requested. **Figure 4** provides the differences between what was requested versus enacted. Of note, the Air Force received an additional $444 million over the requested amount due to Congress funding an additional EC-37B aircraft—which is designed to jam air defense radars and command and control systems—as well as increases to combat training ranges and simulations and adjustments to the F-15 defensive systems. The Navy and SOCOM saw minor decreases in appropriations.

FY2020 Funding

Table 5. FY2020 Requested and Future Year Funding for DOD Electronic Warfare Procurement

(in millions of dollars)

			Future Years				
Department/ Agency	**FY2020 Request**	**FY2020 Enacted**	**FY2021**	**FY2022**	**FY2023**	**FY2024**	**Requested FYDP Total**
Navy	2,444.2	2,270.7	2,790.3	3,392.8	4,059.1	4,212.5	16,899.0
Air Force	1,209.6	1,073.5	1,087.7	1,271.1	1,187.6	1,158.0	5,914.1
Army	574.4	428.4	691.8	693.7	787.4	607.9	3,355.1
SOCOM	336.0	336.0	331.6	312.7	332.2	339.4	1,651.9
TOTAL	**4,564.2**	**4,114.2**	**4,901.4**	**5,670.3**	**6,366.3**	**6,317.8**	**27,820.1**

Source: Air Force FY2020-FY2021 Aircraft, Other, and Space procurement budget justifications; Army FY2020-FY2021 Aircraft, Missile, and Other procurement budget justifications; Navy FY2020-FY2021 Aircraft, Ammunition, Other, and Weapons procurement budget justifications; SOCOM FY2020-FY2021 procurement budget justification, Space Force FY2021 procurement budget justification.

The Administration requested $4.56 billion in EW procurement for FY2020, adding an additional $303 million compared to what was planned in FY2019. **Table 5** provides an overview of the overall FY2020 request. The Navy again requested the largest amount ($2.44 billion), followed by the Air Force ($1.21 billion) and the Army ($574 million). The Air Force's request increased the most (by $306 million) compared with what had been planned for FY2020 in the previous FY2019 request, followed by the Army (by $224 million).[19] This requested increase can be partially attributed to the Army starting a new program for Assured Positioning, Navigation and Timing and the Air Force's transition of the E-11 Battlefield Airborne Communications Node (BACN) to a program of record and increases to E-3 Airborne Warning and Control System (AWACS) modifications.

FY2021 Request

Procurement for EW equipment was $4.2 billion. The Navy and the Air Force requested the largest proportions of the request, following similar trends identified in FY2019 and FY2020. New to the FY2021 request was funding for the Space Force—the newest military service and authorized in the FY2020 National Defense Authorization Act (P.L. 116-92). **Table 6** provides an overview of the FY2021 procurement request. Procurement in FY2021 is the lowest of the three fiscal years tracked in this report, only slightly higher than funding levels projected from the FY2019 request.

Table 6. FY2021 Requested and Future Year Funding for DOD Electronic Warfare Procurement

(in millions of dollars)

Department/ Agency	FY2021	Future Years				
		FY2022	FY2023	FY2024	FY2025	FYDP
Navy	2,156.0	2,538.5	3,458.7	3,522.0	3,750.7	**15,425.9**
Air Force	1,005.6	1,292.6	1,302.2	1,191.9	1,326.7	**6,118.9**
Army	744.8	799.6	948.0	693.8	700.2	**3,886.3**
SOCOM	293.3	277.0	282.6	285.7	286.7	**1,425.3**
Space Force	65.5	65.6	66.8	62.8	2.0	**262.7**
TOTAL	**4,265.2**	**4,973.3**	**6,058.4**	**5,756.1**	**6,066.3**	**27,119.2**

Source: Air Force FY2021 Aircraft, Other, and Space procurement budget justifications; Army FY2021 Aircraft, Missile, and Other procurement budget justifications; Navy FY2021 Aircraft, Ammunition, Other, and Weapons procurement budget justifications; SOCOM FY2021 procurement budget justification, Space Force FY2021 procurement budget justification.

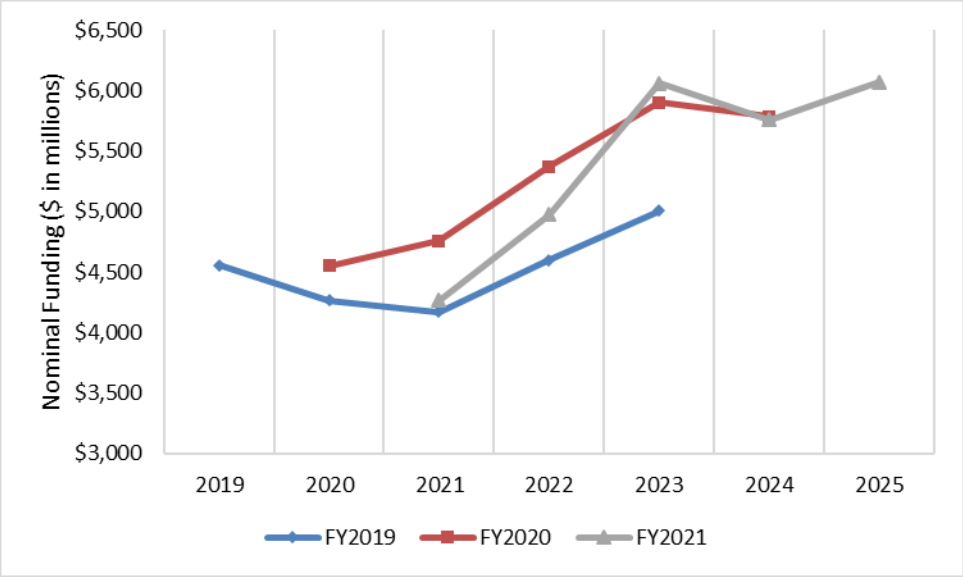
There are a few trends to highlight from the FY2021 request. First, Navy procurement saw the largest decreases. The primary programs with significant reductions include MQ-4 Triton procurement (reduced $543 million compared to projections for FY2021 from the FY2020

[19] The Air Force and Army requested amounts for FY2020 EW procurement are less than what was enacted in FY2019.

request),[20] MQ-4 Triton procurement (reduced $373 million),[21] and AN/ALQ-32s (reduced $159 million).[22] Procurement for Assured Precision Navigation, and Timing (PNT) equipment (increased $93 million), Patriot Modifications (increased $85 million), and the Integrated Fire Protection (IFPC) Family of Systems (increased $46 million) received the largest increases compared to the FY2020 request. The funding data suggest the Navy is reevaluating its EW programs, particularly for the surface fleet.

FY2019 Request through FY2021 Request Procurement Funding Comparison

Figure 5. Planned EW Procurement Funding in the FY2019-FY2021 DOD Budget Requests



Source: Air Force FY2019-FY2021 Aircraft, Other, and Space procurement budget justifications; Army FY2019-FY2021 Aircraft, Missile, and Other procurement budget justifications; Navy FY2019-FY2021 Aircraft, Ammunition, Marine Corps and Other procurement budget justifications; SOCOM FY2019-FY2021 procurement budget justification; Space Force FY2021 procurement justification.

The FY2021 request included approximately $3.7 billion to procure electronic warfare capabilities. This represents a 22.5% reduction in procurement funding compared to what was projected for FY2021 in the FY2020 request ($4.8 billion). The FY2021 FYDP projects $22.8 billion in funding over the next five years; this is compared to the FY2019 FYDP, which projected $22.5 billion, and the FY2020 FYDP, which projected $26.3 billion. **Figure 5** depicts each of the FYDPs as a comparison.

Figure 5 illustrates the differences between the Administration's plans for EW procurement from FY2019 to FY2021. The FY2020 request added an additional $5.23 billion across the FYDP compared with the FY2019 FYDP. FY2021 added $94 million compared to the FY2019 request, but reduced procurement by $491 million compared to projections from the FY2020 request. The

[20] The DDG Modernization line item funds modifications of MQ-4Cs, including intelligence sensors.

[21] This procurement line item funds modifications of MQ-4Cs, including intelligence sensors.

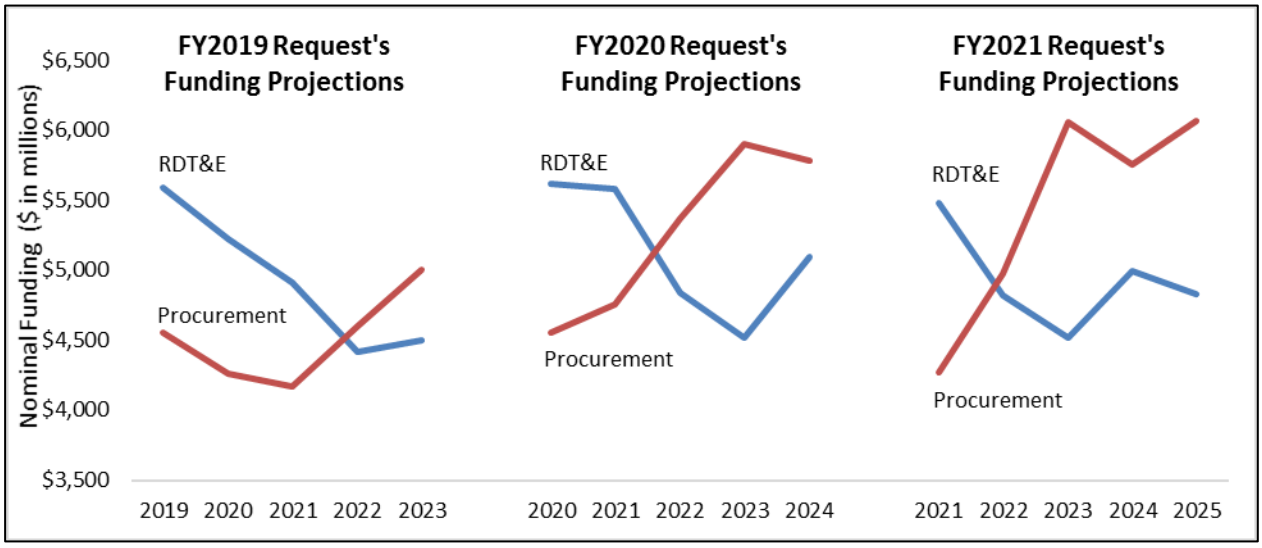
[22] The AN/SLQ-32 funds EW sensors for surface combatants. This includes the Surface Electronic Warfare Improvements Block 1, Small Ship Electronic Measures System, and High Gain Sensitivity, among other activities.

Navy observed the largest decrease in procurement funding, resulting in a reduction of $489 million. The Air Force saw a reduction of $81 million as well, primarily due to the introduction of the Space Force. The Army saw the largest increase, approximately $53 million.

It might be argued that DOD is making EW procurement a priority, which is aligned with the strategic direction in the National Defense Strategy and recommendations by the National Defense Strategy Commission. DOD requested an additional 4.9% increase in funding compared to what it projected in FY2019. EW procurement, however, increased by 7.1% from the FY2019 request compared to what was requested in FY2020—a 2.2% increase over the DOD request.

Comparison of RDT&E and Procurement Funding

Figure 6. Relationship between RDT&E and Procurement Funding



Source: Air Force FY2019-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-3b, Army FY2019-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Navy FY2019-FY2021 Research, Development Test and Evaluation Budget Justification Volume 1-5, Defense-wide FY2019-FY2021 Research, Development Test and Evaluation Budget Justification Volume 5, Air Force FY2019-FY2021 Aircraft, Other, and Space procurement budget justifications; Army FY2019-FY2021 Aircraft, Missile, and Other procurement budget justifications; Navy FY2019-FY2021 Aircraft, Ammunition, Marine Corps and Other procurement budget justifications; SOCOM FY2019-FY2021 procurement budget justification.

Figure 6, above, shows the relationship between RDT&E and procurement. Some might be concerned looking exclusively at the planned funding levels for RDT&E since this appropriation declines over the FYDP. However, several programs currently receiving RDT&E funding—such as the NGJ and the E-11 BACN—transition from being developmental programs to fielded systems. Also of note, it appears that the Administration may have changed its plans on fielding new programs. Based on funding projections the Administration plans on accelerating the Next Generation Jammer quicker than previously anticipated. In addition, it appears the Administration decided to accelerate the F-15 electronic warfare systems (F-15 EPAWS). The increase in planned procurement funding in FY2020 is particularly significant compared to the planned funding profile in FY2019.

Combining both appropriations, DOD requested an additional $662.5 million for EW in FY2021 compared to what it had initially projected in the FY2019 request; however, the FY2021 request is $591.3 million lower than had been projected from the FY2020 request. This represents a 7.3%

increase in the portfolio from FY2019 projections but a 5.7% decrease compared to projections from the FY2020 projections.

Potential Issues for Congress

EW Funding Levels

One potential issue for Congress is the overall funding level for EW programs. DOD requested approximately $9.7 billion dollars in FY2021 for the EW portfolio, based on unclassified budget request documents.[23] Historically, individual EW programs have not been generally seen as large enough for in-depth congressional scrutiny;[24] however, combined, these programs represent funding levels nearly as much as an aircraft carrier ($12.5 billion in total procurement for CVN-80)[25] or the F-35 Joint Strike Fighter procurement ($10.7 billion in FY2019).[26] Congress may ask whether $10.2 billion is sufficient for DOD to execute its missions, or, conversely, whether this funding level is too much. Second, Congress may ask whether each of the military services is funding unique programs, or whether there are overlapping programs that provide similar capabilities. To understand these questions, Congress may consider a historical perspective on how much the DOD allocated for EW to compare if current funding exceeds or under resources the portfolio. A second metric Congress may potentially consider using is the ratio of spending for procurement and RDT&E appropriations to understand where in the lifecycle EW programs currently are, and if the current portfolio is an anomaly.

Many EW programs are highly classified due to their close relationship with intelligence and command and control programs. As a result, there is potentially insufficient unclassified information to assess how much DOD is currently spending on EW. This limitation of data presents a potential oversight issue for Congress.[27]

Challenges with Appropriations Usage

Some have argued that DOD has not adequately prioritized EW over the past several years. The budget projections described above may support the argument that DOD is now prioritizing investment in EW funding.[28] Congress may consider whether DOD uses research and development funding to procure new electronic components. Congress might consider requiring DOD to report all EW-related funding for procurements, as well as ensuring that DOD is not procuring new or advanced electronics through other appropriations.

[23] This funding does not include classified programs or other research and development efforts or procurements that had distinctly EW facets.

[24] Some exceptions to this have included the Ec-130H Compass Call jamming aircraft and its replacement, the EC-37B Compass Call Rehost.

[25] CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke.

[26] CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by Jeremiah Gertler.

[27] For a more detailed discussion about Congressional oversight of classified programs see CRS Report R44463, *Air Force B-21 Raider Long-Range Strike Bomber*, by Jeremiah Gertler.

[28] For example, see Bryan Clark and Mark Gunzinger, *Winning the Airwaves: Regaining America's Dominance in the Electromagnetic Spectrum*, Center for Strategic and Budgetary Assessments, Washington, DC, 2017, https://csbaonline.org/uploads/documents/CSBA6292-EW_Reprint_WEB.pdf.

The EW EXCOM has stated that many procurement programs have EW-related spending, and it is difficult and complex to differentiate among them.[29] As a result, this report does not include all EW-related procurement programs, and therefore does not account for all EW funding. If Congress maintains interest in EW procurement, it may consider requiring DOD to report all EW-related procurement programs, as well as to break out specific EW-related initiatives within a larger procurement program.[30]

Assessing EW Plans and Programs

Congress has shown an interest in developing a comprehensive assessment of EW plans and programs across each of the DOD services and agencies. The FY2019 NDAA (P.L. 115-232) required DOD to contract with a scientific organization to perform an independent assessment of DOD-related EW plans and programs.[31] According to the legislation, this assessment identified U.S. programs, orders of battle and doctrine; analyze adversary programs, orders of battle and doctrine; and make recommendations for how the U.S. military might counteract adversary plans and programs.[32] The Center for Strategic and Budgetary Assessments delivered the NDAA mandated study in December 2019;[33] however, the FY2020 NDAA required a similar study to be performed.

In addition to requesting an independent assessment of EW programs and plans, the FY2019 NDAA required DOD to update its Electronic Warfare Strategy from 2017 and submit it to Congress.[34] Congress has expressed concern that DOD has not synchronized its efforts to ensure its dominance in the electromagnetic spectrum. For DOD to remain competitive, Congress directed the Secretary of Defense and a senior designated official to develop a process and procedure to integrate and enhance EW mission areas across DOD (i.e., to ensure each of the services cooperates and is integrated in the Joint force, as opposed to having service-specific solutions). This section of the NDAA requires DOD to develop a "defense-wide strategy, planning, and budgeting [process and procedures] with respect to conduct of such operations [electronic attack] by the Department, including activities conducted to counter and deter such operations by malign actors."[35] The strategy was delivered in 2019; however, much of the detail of this particular strategy is classified.

[29] Sydney Freedberg, "Electronic Warfare Funding Up, But Short of DSB Marker," *Breaking Defense*, November 28, 2018, accessed at https://breakingdefense.com/2018/11/electronic-warfare-funding-up-still-short-of-dsb-recommendation/.

[30] For example, the F/A-18 Hornet is currently upgrading its Infrared Search and Track (IRST) system to better enable the aircraft to operate in contested environments. There is currently RDT&E funding associated with this program; however, there is only a single procurement line item for the F/A-18 Hornet, which does not disclose what allocations of funds are used for procuring new airframes versus new avionics and components.

[31] P.L. 115-232, §255.

[32] P.L. 115-232, §255.

[33] Bryan Clark, Whitney M. McNamara, and Timothy A. Walton, *Winning the Invisible War: Gaining an Enduring U.S. Advantage in the Electromagnetic Spectrum*, Center for Strategic and Budgetary Assessments, Washington, DC, November 20, 2019, https://csbaonline.org/research/publications/winning-the-invisible-war-gaining-an-enduring-u.s-advantage-in-the-electromagnetic-spectrum.

[34] P.L. 115-232, §1053.

[35] P.L. 115-232, §1053.

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