Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Office of the Secretary Of Defense	Date: February 2020
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603662D8Z / *Networked Communications Capability*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	12.369	12.291	2.858	5.882	-	5.882	5.946	5.994	6.072	6.135	Continuing	Continuing
663: *Network Communications Analysis*	12.369	12.291	2.858	5.882	-	5.882	5.946	5.994	6.072	6.135	Continuing	Continuing

A. Mission Description and Budget Item Justification

Currently fielded satellite communications (SATCOM), terrestrial, and Tactical Data Links (TDLs) will be adversely affected during operations in contested Anti-Access/ Area-Denial (A2/AD) environments. The primary threat is from sophisticated electronic warfare capable of advanced jamming and signal collection techniques that are rapidly evolving to become more capable and agile. Department of Defense (DoD) advances in smart sensors and smart weapons have an urgent need for more resilient networks than the tactical data links of today. In FY 2016, the Network Communications Capability Program (NCCP) returned with a new focus on developing enabling technologies for Joint assured communications networks. The goals of this program are: to mitigate degradation across battlespace tiers and domains, and to provide agility that will support the mission needs of Joint Functional Component Commanders, Joint Force Commanders, and deployed forces.

The DoD's current TDLs platforms and capabilities are not sufficiently protected from emerging adversary threats and contain insufficient capacity for future needs. In order to enable the promise of net-centric operations for the warfighter, the next generation of airborne, surface, and ground tactical networks must provide greater affordability, higher network capacity, greater durability against electronic attack, better network connectivity, and faster response times to the changing demands from airborne, maritime, and ground users. Many line-of-sight (LOS), beyond LOS, and SATCOM waveforms have been integrated onto platforms for various missions. These waveforms necessarily exhibit tradeoffs in target performance attributes including capacity, latency, protection, and complexity. As a result, no single waveform capability will be able to satisfy all emerging mission needs emphasizing the need for interoperability and software-defined waveforms. The challenge is to understand the essential needs of the users, avoid needless redundancy, develop affordable capabilities, and integrate separate capabilities into a cohesive network. This research will develop transformative technologies to ensure performance in contested A2/AD environments by focusing on future communications networks that are a "leap ahead" of today's capabilities.

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B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	12.667	2.858	2.912	-	2.912
Current President's Budget	12.291	2.858	5.882	-	5.882
Total Adjustments	-0.376	0.000	2.970	-	2.970
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.374	-			
• Other Adjustments	-0.002	-	2.976	-	2.976
• Economic Assumption	-	-	-0.006	-	-0.006

Exhibit R-2A, RDT&E Project Justification: PB 2021 Office of the Secretary Of Defense			Date: February 2020
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603662D8Z / *Networked Communications Capability*	Project (Number/Name) 663 / *Network Communications Analysis*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
663: *Network Communications Analysis*	12.369	12.291	2.858	5.882	-	5.882	5.946	5.994	6.072	6.135	Continuing	Continuing

A. Mission Description and Budget Item Justification

In a contested environment, especially when conducting forward operations, platforms face a significant electronic warfare threat. The primary threat is from advanced jamming, signal collection, and geolocation techniques that are rapidly evolving to become more capable and agile. DoD advances in smart sensors and weapons demand robust tactical waveforms and networks with greater capacity but lower cost than communication links of today.

The Future Autonomous Battlespace Radio Frequency with Integrated Communications (FABRIC) program is developing next-generation communications-layer architecture for tactical networks for operations in anti-access/area denial (A2/AD) threat environments. This architecture will deliver capacity and affordability to enable future smart sensors and smart weapons. The network architecture is flexible enough to support Commander's Intent in any mission, environment, operating tactical platform, and weapon system under various threat conditions. FABRIC's efforts focus on developing advanced component technologies, such as Anti-Jam (AJ), Low Probability of Intercept (LPI), Low Probability of Detection (LPD) waveforms; adaptive antenna technologies (transmit/receive/nulling); cyber hardening; and advanced routing to ensure Quality of Service..

Based on the developed thresholds and objectives for the required network architecture, the specific advanced component technologies were prioritized and form the foundation of the FABRIC design. Through simulation and field experimentation, FABRIC is verifying the technology in operationally relevant environments against representative threats, and facilitates the migration and transition of these technologies to service platforms, radios, and other combat mission systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Future Autonomous Battlespace RF with Integrated Communications (FABRIC)	12.291	2.858	5.882
Description: The FABRIC program develops hardware (HW), software (SW), and algorithms to advance network technologies creating a robust tactical network to operate in contested A2/AD environments. The project investigates and develops flexible, high performance, and affordable technologies for the tactical network, supporting capability changes as a mission progresses from phase to phase. The project develops and matures technologies to support direct transition of the algorithms, prototype implementations, waveform improvements, and system design improvements to radio, waveform, and weapon systems programs managed by each military department. ***FY 2020 Plans:*** HW and SW Development - Complete design, fabrication, and test of initial FABRIC processor. - Design backboard that will integrate the processor with other FABRIC components - Fabricate/procure sufficient quantities of HW components required to implement 2021 system field test.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
- Complete unit testing and integration testing of baseline software. System Integration - Integrate and test sensor backboard assembly. - Integrate and test FABRIC brain assembly. - Integrate beamforming, modem, and networking SW onto FABRIC architecture. Scenarios and Transition Planning Prototyping, Lab, and Field Testing - Refine/update all component, subsystem, and system lab and field test plans. - Continue HW/SW unit testing and sub-system, and system integration testing and planning in preparation for system field test.			
FY 2021 Plans: HW and SW Development - Make necessary HW/SW modification to address any gaps arising from 2021 system field test. - Incorporate autonomous system control to enable manned-unmanned teaming (MUM-T). - Optimize support for AI/ML. System Integration - Integrate all HW components into FABRIC systems and integrate FABRIC systems onto platforms for system field test. Prototyping, Lab, and Field Testing - Complete lab/static testing of FABRIC systems on platforms prior to system field test. - Complete system field test. - Incorporate brigade and humanitarian assistance/disaster recovery (HADR) support utilizing many autonomous systems. Scenarios and Transition Planning - Perform scenario simulations to support transition planning to services and agencies.			
FY 2020 to FY 2021 Increase/Decrease Statement:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Delayed M&S until FY 2021 due to limited funding; delayed system integration and platform integration, until FY 2021, due to unavailability of packaged FABRIC processor until Summer FY 2020. Increased funding in FY 2021 supports increases in system testing and validation in operationally representative scenarios, as needed to achieve TRL6 and transition to the Warfighter.			
Accomplishments/Planned Programs Subtotals	12.291	2.858	5.882

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The FABRIC project will address capability gaps for Joint tactical data link networks by developing the technologies that the Military can incorporate in future platform and radio acquisitions. The proposed experimentation, with field demonstrations and modeling, will increase the Technology Readiness Level of critical technology components, suitable for transition to acquisition programs. This will also provide DoD leadership with the supporting technical and cost details to identify candidate "building blocks" for timely incremental improvements.