Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Defense Advanced Research Projects Agency	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	300.010	237.271	202.515	-	202.515	-	-	-	-	-	-
TT-03: *NAVAL WARFARE TECHNOLOGY*	-	49.652	14.890	11.059	-	11.059	-	-	-	-	-	-
TT-04: *ADVANCED LAND SYSTEMS TECHNOLOGY*	-	93.547	73.883	57.460	-	57.460	-	-	-	-	-	-
TT-07: *AERONAUTICS TECHNOLOGY*	-	59.434	56.119	47.607	-	47.607	-	-	-	-	-	-
TT-13: *INFORMATION ANALYTICS TECHNOLOGY*	-	97.377	92.379	86.389	-	86.389	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Tactical Technology Program Element is budgeted in the Applied Research Budget Activity because it supports the advancement of concepts and technologies to enhance the next generation of tactical systems. The Tactical Technology Program Element funds a number of projects in the areas of Naval Warfare, Advanced Land Systems, Aeronautics Technology and Information Analytics Technology.

The Naval Warfare Technology project develops advanced technologies for application to a broad range of naval requirements. Enabling and novel technologies include concepts for expanding the envelope of operational naval capabilities to include the entire sea column such as improved situational awareness over large maritime environments, ship self-defense techniques, novel underwater propulsion modalities, vessels for estuary and riverine operations, high speed underwater vessels, improved techniques for underwater object detection and discrimination, long endurance unmanned surface vehicles, methods and techniques for servicing assets throughout the sea column, and high bandwidth communications.

The Advanced Land Systems Technology project is developing technologies for enhancing U.S. military effectiveness and survivability in operations ranging from traditional threats to military operations against irregular forces that can employ disruptive or catastrophic capabilities, or disrupt stabilization operations. Programs seek to break the relative symmetry of land combat to give U.S. forces a decided advantage in the current and future ground battlefield. The emphasis is on developing affordable technologies that reduce reliance on consolidated forward-operating bases and required lines of communication, and provide small units and individual warfighters with hyper-mobility and hyper-lethality.

Aeronautics Technology efforts will address high payoff opportunities that dramatically reduce costs associated with advanced aeronautical and aerospace systems and/or provide revolutionary new system capabilities for satisfying current and projected military mission requirements. This includes advanced technology studies of revolutionary propulsion, vehicle, and launch concepts, sophisticated fabrication methods, and examination of novel materials and enabling technologies for aeronautic and aerospace system applications.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Defense Advanced Research Projects Agency	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*

The Information Analytics Technology project develops technology for analyzing data and information arising from: 1) intelligence networks; 2) open, media, and other external sources; 3) sensors and signal/image processors; and 4) collection platforms and weapon systems. Technical challenges include the need to: 1) process huge volumes of diverse, incomplete, and uncertain data in tactically-relevant timeframes and 2) counter the information operations of sophisticated adversaries who seek to deceive, degrade, deny, and disrupt the U.S. information enterprise. Benefits sought include deeper understanding of the evolving operational environment tailored to the needs of commanders at every echelon; an enhanced capability to plan, monitor, and control diverse military operations ranging from stabilization and information operations to combat engagements; and improvements to the efficiency of core military functions such as national and homeland security, warfighter health and readiness, and defense support of law enforcement and civil authorities.

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	313.002	233.271	199.803	-	199.803
Current President's Budget	300.010	237.271	202.515	-	202.515
Total Adjustments	-12.992	4.000	2.712	-	2.712
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	4.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	3.950	0.000			
• SBIR/STTR Transfer	-16.942	0.000			
• TotalOtherAdjustments	-	-	2.712	-	2.712

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: TT-04: *ADVANCED LAND SYSTEMS TECHNOLOGY*		
Congressional Add: *Counter Directed Energy Laser Eye Protection Research*	-	4.000
Congressional Add Subtotals for Project: TT-04	-	4.000
Congressional Add Totals for all Projects	-	4.000

Change Summary Explanation

FY 2020: Decrease reflects the SBIR/STTR transfer offset by reprogrammings.
FY 2021: Increase reflects congressional adjustments.
FY 2022: Increase reflects minor program repricing.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602702E / *TACTICAL TECHNOLOGY*	Project (Number/Name) TT-03 / *NAVAL WARFARE TECHNOLOGY*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
TT-03: *NAVAL WARFARE TECHNOLOGY*	-	49.652	14.890	11.059	-	11.059	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Naval Warfare Technology project develops advanced technologies for application to a broad range of naval requirements. Enabling and novel technologies include concepts for expanding the envelope of operational naval capabilities to include the entire sea column such as improved situational awareness over large maritime environments, ship self-defense techniques, novel underwater propulsion modalities, vessels for estuary and riverine operations, high speed underwater vessels, improved techniques for underwater object detection and discrimination, long endurance unmanned surface vehicles, methods and techniques for servicing assets throughout the sea column, and high bandwidth communications. This project will also examine methods and architectures for distributing maritime operations to enable a more agile, survivable, and cost-effective fleet.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Multi-Azimuth Defense Fast Intercept Round Engagement System (MAD-FIRES)	34.980	7.534	7.157

Description: The Multi-Azimuth Defense Fast Intercept Round Engagement (MAD-FIRES) program seeks to develop a point defense system against today's most stressing threats by developing a highly maneuverable, medium caliber, guided projectile, fire sequencing and control system capable of neutralizing large threat raids of high speed, highly maneuverable targets. Leveraging recent advancements in gun hardening, miniaturization of guided munition components, and long-range sensors, MAD-FIRES advances fire control technologies, medium caliber gun technologies, and guided projectile technologies enabling the multiple, simultaneous target, kinetic engagement mission at greatly reduced costs. MAD-FIRES seeks to achieve lethality overmatch through accuracy rather than size, thus expanding the role of smaller combat platforms into missions where they have been traditionally outgunned. MAD-FIRES, sized as a medium caliber system, enhances flexibility for installment as a new ship self-defense system. This phase of the project will end with testing against subsonic targets. The final phase of supersonic testing is funded in PE 0603766E, Project NET-02.

FY 2021 Plans:
- Verify fire control system ability to guide rounds to simulated target.
- Verify projectile compatibility with gun feed system.
- Verify fire control system ability to acquire and track surrogate threats.
- Perform end-to-end demonstration of gun launched guided flight.

FY 2022 Plans:
- Conduct end-to-end tests leading up to demonstrations against subsonic flying targets.

FY 2021 to FY 2022 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*	**Project (Number/Name)** TT-03 / *NAVAL WARFARE TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The FY 2022 decrease reflects minor program repricing.			
Title: Maritime Defense* ***Description:*** *Formerly Port Defense/Mine Counter Measures The Maritime Defense program will explore novel technologies and concepts of operations to mature capabilities to extend freedom of access and operations in all parts of the maritime domain, including waterways, arctic areas, and the seabed. The program will investigate and mature technologies necessary for unmanned underwater vehicle (UUV) concepts for defense against large volumes of low-cost expendable platforms, including compressing the detect-to-engage sequence by exploiting localized networked sensors to rapidly detect, identify, and neutralize threats. Enabling technologies for advanced undersea systems, including a revolutionary propulsion concept, and novel approaches for submarine self-defense will be investigated. Novel technologies and concepts required for arctic and seabed operations, such as distributed sensing, navigation, and communications architectures, as well as including new technologies to enable long duration UUV platforms, will also be investigated. ***FY 2021 Plans:*** - Begin developing advanced underwater propulsion subsystems. - Begin conceptual development of underwater networked sensors for artic environment. - Conduct a trade space analysis of advanced self-defense concepts, payloads, and employment Concept of Operations (CONOPS). - Begin conceptual design and component risk reduction to advance novel technologies for seabed operations. ***FY 2022 Plans:*** - Continue conceptual design and risk reduction activities to advance novel technologies and CONOPS. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects focus on design and risk reduction completion of conceptual design activities.	-	7.356	3.902
Title: Angler ***Description:*** The undersea domain has significant importance to national security and military operations. Yet it is a challenging domain in which to operate due to extreme water pressures, restricted communications, ever changing bottom environments, marine fouling and corrosion. The Angler program seeks to improve U.S. operations in this domain by enabling underwater robotic systems significantly ahead of the state of the art. These robotic systems would be able to search and manipulate objects autonomously, even in dark, turbulent, and semi-opaque sea conditions without the need for human control and without reliance on the Global Positioning System (GPS). Key Angler technical challenges include sensing techniques that provide high-resolution navigation without GPS, perception and manipulation strategies for objects with unknown parameters, long duration autonomy	14.672	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*	**Project (Number/Name)** TT-03 / *NAVAL WARFARE TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
approaches to support mission execution, and autonomy approaches that do not rely on human intervention. From FY 2021 onward, this program is funded in PE 0603766E, Project NET-02. The anticipated transition is to the Navy.			
Accomplishments/Planned Programs Subtotals	49.652	14.890	11.059

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602702E / *TACTICAL TECHNOLOGY*	Project (Number/Name) TT-04 / *ADVANCED LAND SYSTEMS TECHNOLOGY*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
TT-04: *ADVANCED LAND SYSTEMS TECHNOLOGY*	-	93.547	73.883	57.460	-	57.460	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Advanced Land Systems Technology project is developing technologies for enhancing U.S. military effectiveness and survivability in operations ranging from traditional threats to military operations against irregular forces that can employ disruptive or catastrophic capabilities, or disrupt stabilization operations, including competing in undergoverned spaces. Programs seek to break the relative symmetry of land combat to give U.S. forces a decided advantage in the current and future ground battlefield. The emphasis is on developing affordable technologies that reduce reliance on consolidated forward-operating bases and required lines of communication, and provide small units and individual warfighters with hyper-mobility and hyper-lethality. This project will develop methods and technologies to expand the maneuver trade space to include the vertical dimension, including subterranean environments, as well as undergoverned spaces. It will leverage advances in artificial intelligence to enable integrated manned-unmanned operations and decrease warfighter exposure through the use of autonomous agents.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Subterranean (SubT) Challenge	24.757	21.800	4.000
Description: The DARPA Subterranean (SubT) Challenge is developing novel integrated solutions capable of mapping, navigating, and searching complex and dynamic terrains (tunnel systems, urban underground and cave networks); sensors and computation for perception in austere conditions; distributed information sharing in degraded communications environments; and collaborative autonomy enabling extended operations with minimal human intervention. The core objective of the SubT Challenge is to discover the solution(s) which best outperforms current approaches for manually and laboriously mapping and searching subterranean environments. Newly developed capabilities will span across four technology focus areas in autonomy, perception, networking, and mobility technologies. The program will increase the diversity, versatility, and robustness of relevant system technologies, capable of addressing the multi-faceted needs of a wide range of environments. Innovations are being explored in the context of a public-facing, broadly inclusive DARPA Challenge.			
FY 2021 Plans: - Begin final competition efforts in the combined subdomains of tunnel systems, urban underground, and cave networks. - Continue development and refinement of the virtual test bed. - Host final event encompassing all three domains including tunnels, urban underground, and cave networks.			
FY 2022 Plans: - Facilitate deep tech commercialization and transfer opportunities. - Complete technology assessments, reference data collection, and prize award execution from the Final Event.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*	**Project (Number/Name)** TT-04 / *ADVANCED LAND SYSTEMS TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 decrease reflects completion of program with live capstone field demonstration.			
Title: Urban Reconnaissance through Supervised Autonomy (URSA)	20.000	19.000	8.000
Description: The Urban Reconnaissance through Supervised Autonomy (URSA) program is developing and demonstrating new autonomous agents and techniques that support a Blue Force Commander in managing the complexity and ambiguity of urban spaces by rapidly identifying and discriminating among potential threats during missions ranging from minutes to hours. The program uses perception-enabled autonomous vehicles to manage complexity and interactions with populations to drive down the ambiguity between peaceful civilians and threats. The program seeks to create a system of autonomous ground and air platforms operating in conjunction with U.S. ground forces that monitor an area overtly to detect hostile forces and establish Positive Identification (PID) before any U.S. troops come into contact. Military units follow strict rules of engagement (ROEs) that prescribe an escalation of force appropriate with the level of hostilities and confidence that an individual is engaged in nefarious behavior. This program will establish a Legal, Moral, Ethical (LME) working group comprising multiple individuals (technologists, military, university professors, ethicists, legal experts) to develop an understanding of how escalation and/or de-escalation of force can and should be appropriately applied in the context of supervised autonomous systems. URSA is exploring scenarios and probing behaviors that will enable identifying innocent civilians and individuals who pose a threat to U.S. Forces, allies, or non-combat civilians. This mission requires the integration and maturation of novel sensors, and unmanned ground and air vehicles which leverage current techniques in perspective and reactive autonomy to navigate cluttered urban environments. URSA is developing new search and engagement behaviors to disambiguate human actions and serve as evidence that a potential target is a threat. It is implementing new dimensions of evidence such as the human reactions to these engagements to improve confidence in its decisions, and building a novel framework for escalating and de-escalating nonlethal force. ***FY 2021 Plans:*** - Continue to develop and increase the fidelity of the URSA Integrated Testbed (UIT) for iterative evaluation of expanding URSA system capability. - Develop test infrastructure for live URSA field demonstrations. - Begin evaluating system performance with incremental field demonstrations in increasingly complex and varying urban environments. ***FY 2022 Plans:*** - Conduct the final system end-to-end performance evaluation in a live environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY 2022 decrease reflects completion of program with live capstone field demonstration.			
Title: Robotic Autonomy in Complex Environments with Resiliency (RACER)*	7.500	11.000	35.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*	**Project (Number/Name)** TT-04 / *ADVANCED LAND SYSTEMS TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022

Description: *Formerly Sustained Combat Operations in Undefined Terrain (SCOUT)

Multi-domain operations (MDO) environments present complex and challenging environments to ground combat platforms. Ground combat platforms must operate in a more distributed manner in these environments to gain a sustained tactical advantage and enhance Warfighter survivability. The Army intends to deploy autonomous robotic combat vehicles and optionally manned fighting vehicles to accomplish this objective. In order to meet the demands of an MDO environment, significant advances in perception, planning, and control algorithms are required to autonomously maneuver faster and more resiliently in complex and novel off-road environments. Maneuver environments are characterized by three-dimensional surfaces of highly compliant soils and vegetation, hundreds of positive and negative obstacle classes, no defined road networks or driving rules, and where use of terrain for survivability is critical. In order to achieve operationally relevant speeds and resilience to novel situations on the future battlefield, while simultaneously reducing the Soldier cognitive and communications burden and increasing battle space awareness, RACER will demonstrate game-changing autonomous ground combat vehicle mobility using a combination of simulation and advanced platforms. RACER will deliver autonomy algorithms using the latest in Artificial Intelligence (AI) and machine-learning techniques, a code repository, an off-road simulation environment tailored for military off-road autonomy development, tactical route planning methods and field-demonstrated off-road autonomous capabilities. The culmination of the RACER program will be to demonstrate fully autonomous maneuver on a military Unmanned Ground Vehicle (UGV) in a variety of militarily relevant environments.

FY 2021 Plans:
- Complete assessment of sensors and detection techniques, size weight and power for demonstration vehicles.
- Initiate assessments of off-road autonomy simulation technologies.
- Initiate testing of off-road autonomy algorithms using subscale vehicles.
- Conduct testing of autonomy algorithms on surrogate vehicles.
- Initiate code repository of AI-based autonomy algorithms.

FY 2022 Plans:
- Initiate Government-hosted field experiments.
- Initiate large-scale combat vehicle platform preparations.
- Demonstrate off-road autonomy simulation technologies.
- Demonstrate off-road speeds and interventions comparable to best human driver capability.
- Increase the complexity of capability demonstrations.

FY 2021 to FY 2022 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*	**Project (Number/Name)** TT-04 / *ADVANCED LAND SYSTEMS TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The FY 2022 increase reflects the initiation of field demonstrations and large-scale platform preparations.			
Title: Proportional Weapons	-	2.000	-
Description: The Proportional Weapons program will pursue a real-time capability to analyze and apply proportional effects for families of weapons that suppress or breach any external structure to neutralize threats, clear spaces at range, keep them intact, and minimize collateral damage. Novel approaches are needed that are effective from the air or ground against several scales of threats while not being catastrophically destructive. Current approaches to identifying, engaging, and assessing effects against evasive ground targets requires significant human oversight combined with human semantic reasoning tied to rules of execution, resulting in slow and methodical engagements. Proportional weapons will study systems that provide extended range and tunable effects. Proposed technical approaches will be scalable for application to dismounted warfighters, vehicle-borne (air and ground) systems, or as human-in-the-loop payloads for future autonomous platforms. ***FY 2021 Plans:*** - Conduct performance trade studies of air and ground systems and conduct effects analysis that support concepts development leading to a future platform. - Translate performance trade studies of air and ground systems and effects analysis into prototype concepts development leading to a future platform. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects completion of program studies.			
Title: Competing in Undergoverned Spaces	-	-	10.460
Description: A vast majority of U.S. technology is focused on gaining competitive advantage against near peer adversaries in kinetic engagements where there are known rules and players, concrete timelines and clear winners and losers. While these finite games are important, many critical engagements are actually infinite contests, where activities occur over long periods, often involving third parties with an ultimate goal of resetting the regional power and influence equilibrium. Competing in these contests is critical for successful stabilization and Humanitarian Assistance Disaster Relief (HADR) missions, as well as operations in undergoverned spaces, where local governance is sufficiently weak such that internal or external parties can compete for influence over the local population (e.g., Syria). This program will develop technologies that are focused on successfully competing in infinite contests by developing tools for constant acting, assessing and adapting (i.e., iterative Hypothesis A/B testing). Specific areas of interest include information, influence or economic tools that rapidly adapt to the environment to yield specific, effects that can be sensed. This includes developing new options to engage friendly/non-friendly local populations while minimizing the social impact of stabilization. Other areas of interest include sensing tools designed to update pre-existing models to support decision making, and decision tools designed to adapt to changing population or adversary actions.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*	**Project (Number/Name)** TT-04 / *ADVANCED LAND SYSTEMS TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 Plans: - Initiate efforts to develop techniques for measuring and characterizing changes to structure and operation of an exemplar global system (e.g., food) at multiple time scales. - Identify potential approaches for bridging the gap between static risk analysis and real time monitoring for an exemplar global system (e.g., food). - Develop initial requirements for economic, social, informational, and controlled force concepts that positively engage local populations while providing security for U.S. forces amidst regional conflicts. - Explore decision tools (e.g., wargames) that are specifically tuned to infinite contests in undergoverned spaces. - Leverage commercial cloud computing systems and petabyte-scale computer networks to extend advanced anomaly detection mathematics and algorithms to analyze an exemplar, previously computationally intractable global system (e.g., food). - Employ novel multiscale anomaly detection algorithms to detect non-linear, divergent regions for an exemplar global system (e.g., food). - Initiate development of automated red team analytics with "what-if" analysis to enable the continuous discovery, testing and challenging of risks and resilience in critical global systems. - Explore approaches to link diverse spectroscopy techniques to quantifiable local activity (e.g., economic, social). - Initiate the development of models to anticipate community dynamics through studies of how terrain, social structure, environment, etc. shape activity. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase is due to program initiation.			
Title: Mobile Force Protection (MFP)	12.050	4.320	-
Description: The goal of the Mobile Force Protection (MFP) program is to develop and demonstrate an integrated system capable of defeating a raid of self-guided small unmanned aircraft systems (sUAS) attacking a high value convoy on the move. By focusing on protecting mobile assets, the program is emphasizing low footprint solutions, in terms of size, weight, power (SWaP), and manning, which will benefit other counter-UAS missions and result in more affordable systems. Defending in a variety of operating environments against these sUAS threats and associated concept of operations requires several breakthroughs in affordable technology to sense, decide and act on a compressed timeline while mitigating collateral damage. The program is developing solutions applicable to the defense of mobile ground and naval forces that can also potentially defeat more conventional threats. The solution will be scalable and modular such that it can be deployed in multiple defense applications and does not become obsolete with evolving threat capability. ***FY 2021 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Conduct additional open-air demonstrations that include realistic threats, performance models, signatures, networks, and environmental factors. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects program completion.			
Title: Underminer ***Description:*** The Underminer effort, an outgrowth of the Subterranean Challenge program, is exploring the development and integration of technologies that drill/bore and build the underground environment for tactical operations. Underminer is exploring creation and utilization of tunneling, drilling, and boring capabilities for systems at multiple scales. The program is examining multiple concepts of operation and considering creation and use of both temporary tunnels as well as rapid creation of tunnel networks. ***FY 2021 Plans:*** - Finalize concept of operation, system architecture, and demonstration test plans. - Integrate enabling technologies and test system performance. - Verify technologies meet required speed and accuracy threshold. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects program completion.	9.000	8.763	-
Title: Squad X ***Description:*** The U.S. military achieves overmatch against its adversaries in certain regimes; however, this level of overmatch is not realized at the squad to individual dismounted warfighter level. The goal of the Squad X program was to leverage advances in real-time situational awareness and mission command; organic three-dimensional dismount mobility; extended range tracking, targeting, and response; and unmanned mobility and perception in order to create a squad with substantial combat overmatch. The concept of overmatch at the squad level included increased human stand-off, a smaller force density, and adaptive sensing to allow for responses at multiple scales. Squad X explored advanced wearable force protection, advanced organic squad level direct and indirect trajectory precision weaponry, and non-kinetic precision capabilities. The end result of the Squad X program was an individual dismount unit outfitted with sensors, weaponry, and supporting technology to achieve unit level overmatch as well as the overall integration of unmanned assets alongside the dismounts to create an advanced, dismounted small unit. ***FY 2021 Plans:*** - Demonstrate artificial intelligence decision aids and autonomous behaviors to augment small unit tactics with significant increase in situational awareness and tactical advantage.	16.240	3.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Conduct system-level experimentation in operational deployments to evaluate with transition partners. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects program completion.			
Title: Rapunzel ***Description:*** Urban combat demands that riflemen also serve as combat engineers manipulating their local environment to gain tactical advantage. The urban environment creates unique challenges in providing solutions for mobility, counter-mobility, survivability, and concealment. Every pound that a warfighter wears or carries reduces their mobility and mission effectiveness, and, particularly in urban combat, reduced mobility paradoxically reduces their survivability. The Rapunzel program sought to enable warfighters to manipulate the urban environment through the application of novel materials research. Rapunzel envisioned soldier-borne or vehicle-borne utility-belt style packaged containers, reels, and spools of material that can perform urban engineering tasks such as create bridges between building rooftops, pull down enemy barriers, or provide false targets and concealment. The program identified those mass-manufactured materials, such as extremely high-tensile strength monofilament that can both provide novel mobility between buildings but also provide novel counter-mobility to enemy vehicles due to their electrical conductance properties. The Rapunzel program leveraged extensive existing research into early developmental materials and invest in the task-based development and packing to provide these materials at appropriate length and size scales for immediate tactical use.	4.000	-	-
Accomplishments/Planned Programs Subtotals	93.547	69.883	57.460

	FY 2020	FY 2021
Congressional Add: Counter Directed Energy Laser Eye Protection Research	-	4.000
FY 2021 Plans: - Conduct research in Counter Directed Energy Laser Eye Protection.		
Congressional Adds Subtotals	-	4.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602702E / *TACTICAL TECHNOLOGY*	Project (Number/Name) TT-07 / *AERONAUTICS TECHNOLOGY*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
TT-07: *AERONAUTICS TECHNOLOGY*	-	59.434	56.119	47.607	-	47.607	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Aeronautics Technology efforts will address high payoff opportunities that dramatically reduce costs associated with advanced aeronautical and aerospace systems and/or provide revolutionary new system capabilities for satisfying current and projected military mission requirements. This includes advanced technology studies of revolutionary propulsion, vehicle, and launch concepts, sophisticated fabrication methods, and examination of novel materials and enabling technologies for aeronautic and aerospace system applications. Studies that also fundamentally change the calculus of battle including consideration of a mix of assets, potentially disposable or with limited lifespans, with increased levels of autonomy are included.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Control of Revolutionary Aircraft with Novel Effectors (CRANE)	23.573	26.000	31.607

Description: The Control of Revolutionary Aircraft with Novel Effectors (CRANE) program is demonstrating revolutionary improvements in aircraft controls technology. The program will design, build, and flight test an aircraft that is able to fly and maneuver at altitude relying on state of the art Active Flow Control (AFC) technology. AFC is a broad term that encompasses a range of technology approaches; it includes a number of control mechanism which alter the aerodynamic flow field thru ejection or suction of fluid via an orifice on a lifting body. An emphasis of the program will be on assessing AFC component technologies, risk reduction and experimentation, integrated testing, fabrication and demonstration of a relevant scale novel and innovative aircraft. Technologies, design tools and models developed and demonstrated under this program will be made available to all Services as well as the civilian aerospace sector for application to future air systems development.

FY 2021 Plans:
- Complete development of conceptual design tools for AFC enabled aircraft.
- Continue experimentation and test of AFC technologies.
- Conduct design and analysis activities resulting in conceptual design review.

FY 2022 Plans:
- Complete analysis and test activities resulting in preliminary design review.
- Conduct system critical design review.
- Conduct detailed design, flight software and control law development.
- Begin subsystems integration leading to the fabrication of a demonstration aircraft.
- Initiate airworthiness and ground/flight test approvals supporting testing of the X-Plane.

FY 2021 to FY 2022 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602702E / *TACTICAL TECHNOLOGY*	**Project (Number/Name)** TT-07 / *AERONAUTICS TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The FY 2022 increase reflects program focus on detailed design and component testing.			
Title: Gremlins	12.361	14.119	12.500
Description: The goal of the Gremlins program is to develop platform technologies that enable a new class of distributed warfare. The Gremlins concept envisions small air-launched unmanned systems that can be responsively dispatched in volley quantity from commodity platforms, fly into contested airspace, conduct a moderate duration mission, and ultimately be recovered. Key enabling technologies for the concept include smaller developmental payloads that benefit from multiple collaborating host platforms. The Gremlins program will conduct risk reduction and development of the host platform launch and recovery capability and develop and demonstrate a recoverable Unmanned Air Vehicle (UAV) platform concept. Enabling platform technologies will include precision relative navigation, advanced computational modeling, small form factor payloads, compact propulsion systems, and high speed digital flight control. The program will leverage these technologies, perform analytic trade studies, conduct incremental development, and ultimately demonstrate the potential for an integrated air-launched Gremlins unmanned platform capable of conducting distributed air operations. ***FY 2021 Plans:*** - Conduct final flight test demonstrating full recovery capability. - Conduct flight analysis and reporting of airborne launch and recovery. - Perform design work for Intelligence Surveillance and Reconnaissance (ISR) payload integration. - Integrate autonomy architecture into Gremlins system. ***FY 2022 Plans:*** - Integrate ISR payload into Gremlins system. - Conduct preliminary flight test demonstrating autonomy capability. - Demonstrate ISR Gremlins capability. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects completion of full recovery demonstrations and shift to final ISR demonstrations.			
Title: Advanced Aeronautics Technologies	4.000	3.000	3.500
Description: The Advanced Aeronautics Technologies program is examining and evaluating aeronautical technologies and concepts through applied research. These may include the feasibility studies of novel or emergent materials, devices and tactics for both fixed and rotary wing air vehicle applications, launch vehicles, as well as manufacturing and implementation approaches. The areas of interest range from propulsion and power to control techniques to solutions for aerospace mission requirements. The result of these studies may lead to the development of new programs, components or subsystems to enhance future aerospace platforms, or improvement of existing systems. ***FY 2021 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Initiate conceptual design studies. - Demonstrate emerging technologies to support maturation plans and risk reduction strategies. - Perform modeling and simulation that support future concepts and novel architectures. ***FY 2022 Plans:*** - Continue conceptual design studies and demonstrate emerging technologies. - Perform modeling and simulation that support future concepts and novel architectures. - Identify and demonstrate feasible technologies for air platform defense. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY 2022 increase reflects minor program repricing.			
Title: OFFensive Swarm-Enabled Tactics (OFFSET) ***Description:*** The OFFensive Swarm-Enabled Tactics (OFFSET) program is designing, developing, and demonstrating a swarm system architecture to advance the innovation, interaction, and integration of novel swarm tactics. The program will examine enabling technologies for collaborative autonomy for large teams of unmanned systems, including unmanned ground and air capabilities through the use of both virtual, game-based and physical, live-fly testbeds. Key research thrusts include the development of advanced swarm tactics-centered autonomy and development of human-swarm teaming interface technologies. These combined enhancements will facilitate insights and enable employment of these collective systems to address current needs and defeat future threats. The program will consider technologies supporting U.S. ground and air operations, extensible to other operating environments, requiring organic and/or tactical swarm capabilities, and leveraging low-cost, rapidly deploy-able, autonomous system technologies. ***FY 2021 Plans:*** - Integrate advanced swarm tactics and physical testbed enhanced for capability-based field experimentation. - Perform capability-based demonstration at scaled missions of relevance. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects program completion.	14.500	8.000	-
Title: CounterSwarmAI ***Description:*** The objective of the CounterSwarmAI program is to develop systems for anticipating and defeating autonomous systems threats of the future. These adversary systems will likely employ advanced artificial intelligence (AI) and machine learning techniques which will inevitably lead to increased complexity and unpredictability of these advanced threats. CounterSwarmAI envisions the development of disruptive technologies across the engagement kill chain, themselves AI-empowered, which directly combat these challenges. CounterSwarmAI decision software will directly interface with future and legacy defensive systems (kinetic and non-kinetic) to rapidly assess, optimally exploit, and efficiently defeat enemy autonomous	5.000	5.000	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
systems threats. Innovative solutions will enable (a) autonomous systems which provide understanding and vulnerability exploitation through machine learning, (b) an integrated AI-equipped open architecture for multi-faceted swarm defense, and (c) integration and experimentation with live surrogate swarm threats against current fielded defensive systems. ***FY 2021 Plans:*** - Develop understanding of swarm behaviors, techniques and vulnerabilities to underpin possible mechanisms for disruption of swarm behaviors or goals. - Collect and curate operationally relevant swarm data sets captured at field experiment events that highlight swarm threat behaviors. - Document possible swarm defeat or mitigation approaches to inform future program approaches. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects program completion.			
Accomplishments/Planned Programs Subtotals	59.434	56.119	47.607

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency			Date: May 2021
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COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
TT-13: *INFORMATION ANALYTICS TECHNOLOGY*	-	97.377	92.379	86.389	-	86.389	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Information Analytics Technology project develops technology for analyzing data and information arising from: 1) intelligence networks; 2) open sources, social and broadcast media, and other external sources; 3) sensors and signal/image processors; and 4) collection platforms and weapon systems. Technical challenges include processing huge volumes of diverse, incomplete, and uncertain data in tactically-relevant timeframes, and countering the information operations of sophisticated adversaries who seek to deceive, degrade, deny, and disrupt the U.S. information enterprise. Benefits sought include a deeper understanding of the evolving operational environment tailored to the needs of commanders at every echelon; an enhanced capability to plan, monitor, and control diverse military operations ranging from stabilization and information operations to combat engagements; and increased efficiency of core military functions such as national and homeland security, warfighter health and readiness, and defense support of law enforcement and civil authorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Semantic Forensics (SemaFor)	10.450	19.700	23.421
Description: The Semantic Forensics (SemaFor) program is developing technologies to defend against the falsification of multimedia and disinformation campaigns. Statistical detection techniques have been successful, but media generation and manipulation technology is advancing rapidly, including imagery, voice, video, text, and other modalities. Purely statistical detection methods are now insufficient to detect these manipulations, especially when multiple modalities are involved. Existing media generation and manipulation algorithms are data driven and are prone to making semantic errors that provide defenders an opportunity for asymmetric advantage. SemaFor is developing semantic and statistical analysis algorithms that determine if media is generated or manipulated, attribution algorithms that infer if media originates from a particular organization or individual, and characterization algorithms that reason about whether media was falsified (generated or manipulated) for malicious purposes. SemaFor aims to create technologies to identify, deter, and understand adversary media falsification. ***FY 2021 Plans:*** - Create techniques for using multi-source semantic information to detect, attribute, and characterize inconsistent and potentially falsified media, such as news articles or social media posts, and to develop mechanisms for explaining algorithmically-generated semantic inferences on multimedia. - Develop an initial semantic forensics system prototype, and evaluate performance on existing and purpose-built text, image, video, and audio datasets.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Develop challenge problems that emphasize threat scenarios in collaboration with DoD and Intelligence Community (IC) partners. ***FY 2022 Plans:*** - Implement algorithmic approaches for analyzing inconsistencies across complex, multi-modal social media posts and technical information. - Develop machine learning and other artificial intelligence techniques to attribute falsified media to particular adversarial elements. - Enhance the semantic forensics prototype with the capability to reason about inconsistencies across multiple media instances, such as news articles, to detect falsification, and to explain its reasoning. - Collaborate with DoD and IC partners to assess prototype semantic forensics capabilities on challenge problems informed by threat scenarios, and identify areas for additional research effort based on the assessment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase is due to ramping up of development of semantic techniques for reasoning about inconsistencies in multimedia, and initiation of prototyping and evaluation work.			
Title: Adapting Cross-domain Kill-Webs (ACK)	15.000	14.400	11.700
Description: The Adapting Cross-domain Kill-Webs (ACK) program is assisting military decision makers with rapidly identifying and selecting options for tasking and re-tasking assets within and across organizational boundaries. Based on technologies developed in the Resilient Synchronized Planning and Assessment for the Contest Environment (RSPACE) program (budgeted in PE 0603766E, Project NET-01), ACK will assist users with selecting sensors, effectors, and support elements across military domains (space, air, land, surface, subsurface, and cyber) to form and adapt kill chains to deliver desired effects on targets. Today's Command and Control (C2) organizations and processes cannot support multi-domain warfighting concepts, especially during joint operations. ACK will address this challenge by utilizing a decentralized approach to allocating resources to tasks and assigning mission orders to assets, motivated by ideas developed in online commerce, sourcing, and supply chain management, such as bid requests and offers. The impact of ACK will be to accelerate asset re-allocation and assignment decision timelines to be on the order of minutes, and the output of ACK will be automated tools and decision aids to support the selection of the elements of a kill-chain and assignment of roles and responsibilities to each of the elements. Technology developed under this program will be transitioned to the Services. ***FY 2021 Plans:*** - Complete development of evaluation test-bed. - Assess the ability of virtual liaisons to quickly adapt mission plans in the test bed environment. - Assess the ability of C2 node software to adjudicate offers and support rapid user assessment in visual interfaces.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Identify Service partners and develop plans for demonstration of cross-domain mission adaptation. ***FY 2022 Plans:*** - Execute evaluation scenario to exercise algorithm cross-domain reasoning capabilities. - Evaluate cross-domain solution recommendations and user interface presentation. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease is due to a transition from software development to integration and software deployment and testing.			
Title: Data-Driven Discovery of Models (D3M) ***Description:*** The Data-Driven Discovery of Models (D3M) program is developing automated model discovery techniques and tools that enable non-expert users to create empirical models of real, complex processes and phenomena. The ability to understand the battlespace is driven increasingly by expert analysis of sensor and open source data. The DoD and the Intelligence Community (IC) are fundamentally limited by a shortage of domain-focused subject matter expert data scientists to construct empirical models that predict behaviors and anticipate contingencies during tactical and strategic planning. D3M is addressing this need by creating technologies that automate the construction of complex empirical models. D3M technologies include a library of data modeling primitives that are automatically selectable, automated approaches for composition of complex models from modeling primitives, and intuitive mechanisms for human-model interaction that enable curation of models by non-experts. D3M is focused on the types of empirical modeling problems commonly encountered by the DoD and IC. ***FY 2021 Plans:*** - Enhance the library of modeling primitives with support for unsupervised and semi-supervised machine learning, and extend automated data collection to support discovery and augmentation of datasets with limited or no human-in-the-loop. - Develop scalable techniques to extract information from contractual databases to enable situational awareness and vulnerability analysis of markets and supply chains. - Refine modeling tools with respect to interoperability to enable transition and deployment of end-to-end empirical modeling software systems. ***FY 2022 Plans:*** - Demonstrate automated surveillance algorithms that respond in real-time to high-speed, coordinated attacks against global supply chains and markets to enable early warning, damage mitigation, and active protection measures. - Harden software modeling tools and systems, and transition to operational users. ***FY 2021 to FY 2022 Increase/Decrease Statement:***	16.000	12.650	11.700

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The FY 2022 decrease is the result of development work ramping down and the focus shifting to hardening of modeling tools for transition.			
Title: Warfighter Analytics using Smartphones for Health (WASH) ***Description:*** The Warfighter Analytics using Smartphones for Health (WASH) program is developing analytic techniques for continuous and real-time assessment of warfighter physiological health and cognitive state based on the multiple sensor data streams generated by modern smartphones. Recent research in the area of smartphone biometrics has shown the feasibility of measuring user physiological and behavioral parameters for purposes of user authentication. WASH will extend these smartphone biometrics to reliably measure additional user physiological and behavioral parameters relevant to health assessment and the diagnosis of disease. WASH aims to enable the remote assessment of warfighter health and mission readiness. ***FY 2021 Plans:*** - Continue to enhance periodic audits of the security and privacy controls of the cloud-based data ingest and storage infrastructure, and perform upgrades as appropriate. - Evaluate privacy-preserving contact tracing techniques as an adjunct to digital biomarkers as a means for predicting physiological disease. - Demonstrate technology suitable for a privacy-preserving military mobile app, and scale cloud-based back-end infrastructure for a large study with a military service partner. ***FY 2022 Plans:*** - Evaluate algorithms to associate digital biomarkers with physiological and cognitive state across a diverse set of relevant ambient contexts. - Conduct demonstrations of the capability to track and predict service member physiological health status in collaboration with DoD stakeholders, and harden technology for transition. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease is due to ramping down of work to develop and integrate techniques to analyze user smartphone data, and focus shifting to demonstration and evaluation of the performance of techniques to assess user physiological health and cognitive state.	17.000	15.500	7.000
Title: Causal Exploration of Complex Operational Environments ***Description:*** The Causal Exploration of Complex Operational Environments program is developing advanced modeling, analysis, simulation, and visualization tools to enable command staffs to rapidly and effectively design, plan, and manage missions in complex operational environments. The U.S. military increasingly operates in remote and unstable parts of the world where mission success depends heavily on cooperation with a wide variety of stakeholder groups on civil, economic, and military	20.500	13.400	5.468

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
matters. These groups typically include host nation government organizations, local civilian groups, and non-governmental organizations, each of which has priorities, sensitivities, and concerns that may differ significantly. Current mission design and planning technologies do not adequately model the range of options or the inherent uncertainties. This program is developing tools to create causal, computational models that represent the most significant relationships, dynamics, interactions, and uncertainties of the operational environment including political, military, economic, and social factors. These tools will enable command staffs to design and quantitatively assess potential courses of action in complex operational environments. ***FY 2021 Plans:*** - Develop war gaming and red teaming capabilities to account for adversary activities, and assess effectiveness of countermeasures. - Fully integrate and transition system into the School of Advanced Military Studies (SAMS) curriculum, tailor system to meet key functional and performance needs of transition partners, and conduct operational evaluation to measure military utility of the system. - Harden system and transition new operational design capability to operational users. ***FY 2022 Plans:*** - Explore the utility of the technology for the planning and conduct of multi-domain operations and related joint force concepts for countering and defeating a near-peer adversary, with emphasis on non-kinetic domains and phases of conflict. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease is due to ramping down of work to develop, evaluate, and refine causal modeling technologies, and focus shifting to exploration of technical utility and transition to military users.			
Title: Modeling Adversarial Activity (MAA) ***Description:*** The Modeling Adversarial Activity (MAA) program is developing technologies for generating high-confidence indications and warnings for weapons of mass terror (WMT) activities. WMT pathways consist of networks or links among individuals, groups, organizations, and other entities that act to promote or enable the development, procurement, possession, transportation, or proliferation of WMTs and related capabilities. Monitoring and controlling WMT pathways is essential to denying access to WMT technology, knowledge, materials, expertise, and weapons. MAA will create template graph models reflecting prototypical WMT pathways, develop methods for creating merged activity graphs by aligning entities across multiple intelligence modalities, develop algorithms to match large-scale empirical activity graphs with pathway models, and create synthetic data sets at scale to support development and testing of WMT activity detection techniques. MAA technology development is being coordinated with operational partners. ***FY 2021 Plans:***	14.000	10.729	5.100

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Evaluate the scalability of techniques for construction of large, semantically-rich graphs and for approximate matching of activity graphs with rich semantics on real world data. - Extend real-time graph alignment capabilities to environments with frequent information updates and explore methods to tune the end-to-end system to maximize detection and graph matching performance. - Collaborate with transition partners to implement techniques in their environments and to optimize techniques for efficient and timely execution on their computational infrastructure. ***FY 2022 Plans:*** - Harden graph analysis techniques and transition software capabilities to operational partners. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects ramping down of work to develop and evaluate techniques and software for WMT pathway discovery, and the focus shifting to hardening of software capabilities and transition.			
Title: Influence Campaign Awareness and Sensemaking (INCAS)	-	6.000	14.500
Description: The Influence Campaign Awareness and Sensemaking (INCAS) program, building upon research conducted in the Causal Exploration of Complex Operational Environments program in this PE/Project, will develop techniques, tools, and platforms for the DoD to detect and understand information operations in a rigorous, quantitative manner. Increasingly, competitors and adversaries are using information operations to project soft power. Competitor and adversary influence campaigns can be overt in the form of anti-U.S. messaging, or they can be disguised in the form of complex narratives that seek to advance agendas harmful to U.S. interests. The USG and DoD need the capability to rapidly detect and understand competitor and adversary messaging campaigns and narratives within the context of the populations and groups for whom they are intended. To accomplish this, the program will develop and operationalize natural language processing, semantic analysis, social network analysis, psychographics, and behavioral science-based technologies, and integrate these into a unified information operations modeling framework and sensemaking platform. INCAS aims to produce a suite of largely automated digital tools to enable analysts to better understand how information is being used by competitors and adversaries, and to quantitatively assess in real time and at scale the effects of influence campaigns and of countermeasures. ***FY 2021 Plans:*** - Formulate influence indicators that can be used to detect competitor and adversary influence campaigns from messages and narratives. - Explore the potential for natural language processing and semantic analysis techniques to extract an agenda from influence indicators and context, and for psychographic and behavioral science-based techniques to measure the receptivity of populations and groups to influence messages and narratives. ***FY 2022 Plans:***			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Implement influence indicators in scalable algorithms and conduct initial assessments of their effectiveness in detecting competitor and adversary influence campaigns from messages and narratives. - Develop and implement natural language processing and semantic analysis techniques to extract an agenda from influence indicators and context, and for psychographic and behavioral science-based techniques to measure the receptivity of populations and groups to influence messages and narratives, and initiate efforts to quantify the contribution of these capabilities to analyst sensemaking. - Develop, refine, and extend a modeling framework and sensemaking platform in response to operator assessments of its contribution to their ability to understand and anticipate the likely reaction of populations and groups to influence campaigns. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase is due to ramping up of work to develop natural language processing and semantic analysis techniques, to extract an agenda, to measure the receptivity of populations and groups, and to implement a modeling framework and sensemaking platform.			
Title: Culturally-aware IO Defense (CLAID) ***Description:*** The Culturally-aware IO Defense (CLAID) program aims to create human language technology capabilities to enable machines to understand cultural background and social and emotional context in order to deepen situational awareness of emergent incidents. Speakers produce and consume language within a social and cultural context that influences cognition, beliefs, and intents through shared values, and social norms. Therefore, for a natural language processing (NLP) system to fully understand a language and its speakers, it must understand culture and social context. Specific sociocultural NLP capabilities to be developed in CLAID include understanding localized references to entities, assessing emotion and urgency, and interpreting the cultural significance of narratives and events. CLAID will develop technologies to enable local commanders to better understand rapidly changing tactical environments, and to more effectively plan and conduct stabilization operations in all phases of conflict. ***FY 2022 Plans:*** - Introduce a modeling framework for social and cultural context that includes shared values, social norms, and variations in cross-cultural affective expressions. - Formulate approaches for new NLP capabilities such as interpreting localized references to entities, emotion, and urgency, and the cultural significance of narratives and events. - Create culturally-specialized capabilities for understanding the types of emergent incidents typically encountered during the conduct of stabilization operations. ***FY 2021 to FY 2022 Increase/Decrease Statement:***	-	-	7.500

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The FY 2022 increase reflects program initiation.			
Title: Media Forensics (MediFor) ***Description:*** The Media Forensics (MediFor) program created technologies for analyzing media content to determine trustworthiness for military and intelligence purposes. Prior to MediFor, approaches to media forensics were labor intensive, requiring analysts and investigators to undertake painstaking analyses to establish context and provenance. The program developed, integrated, and extended image and video analytics to provide forensic information that can be used by analysts and automated systems to quickly determine the integrity of open source and captured images and video. Technologies were transitioned to operational commands, the Intelligence Community (IC), and Law Enforcement.	4.427	-	-
Accomplishments/Planned Programs Subtotals	97.377	92.379	86.389

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A