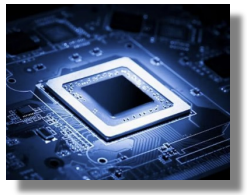
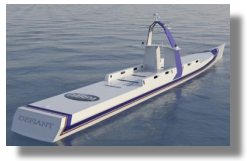
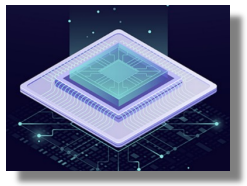






DARPA FY24

Key Priorities, Funding Outlook, Implications For Industry

May 2023

Fairmont Consulting Group LLC – Boston, MA & Washington, DC
Info@FairmontCG.com – www.FairmontCG.com

FAIRMONT
CONSULTING GROUP

DARPA & National Defense: Fairmont Perspectives

- DARPA's investment priorities include technical areas where the private sector is dedicating vast sums to the development of commercially viable products, services and solutions – notably artificial intelligence and semiconductors

DARPA and the defense and national security sector more broadly should accelerate efforts to tap private sector capabilities and ensure that (1) best in class technology is understood and incorporated, (2) avoid unnecessary duplication of effort, and (3) thereby permit allocation of funding to defense / national security-specific areas of interest

- DARPA's contracting over the past five years shows a pattern consistent with defense and Federal spending more broadly, with heavy concentration among a few key players (Top Ten defense primes receiving ~40% of funding)

DARPA should accelerate efforts to reach non-traditional technology players who can bring capabilities to bear in the national interest; contract mechanisms and processes should be modified as necessary to reduce barriers to non-traditional participation in DARPA / USG technology efforts

🤖 **AI craze hits new level with big Builder.ai and Anthropic rounds**

Investors poured $700 million into two AI startups — Builder.ai and Anthropic — seemingly marking another level of the AI craze that has dominated the private markets since late last year. ChatGPT rival Anthropic raised $450 million in Series C funding, while software development platform Builder.ai raised more than $250 million in its Series D.

Applied Materials to Build $4 Billion Chip Research Facility in Silicon Valley

Aim is to speed development of advanced semiconductors

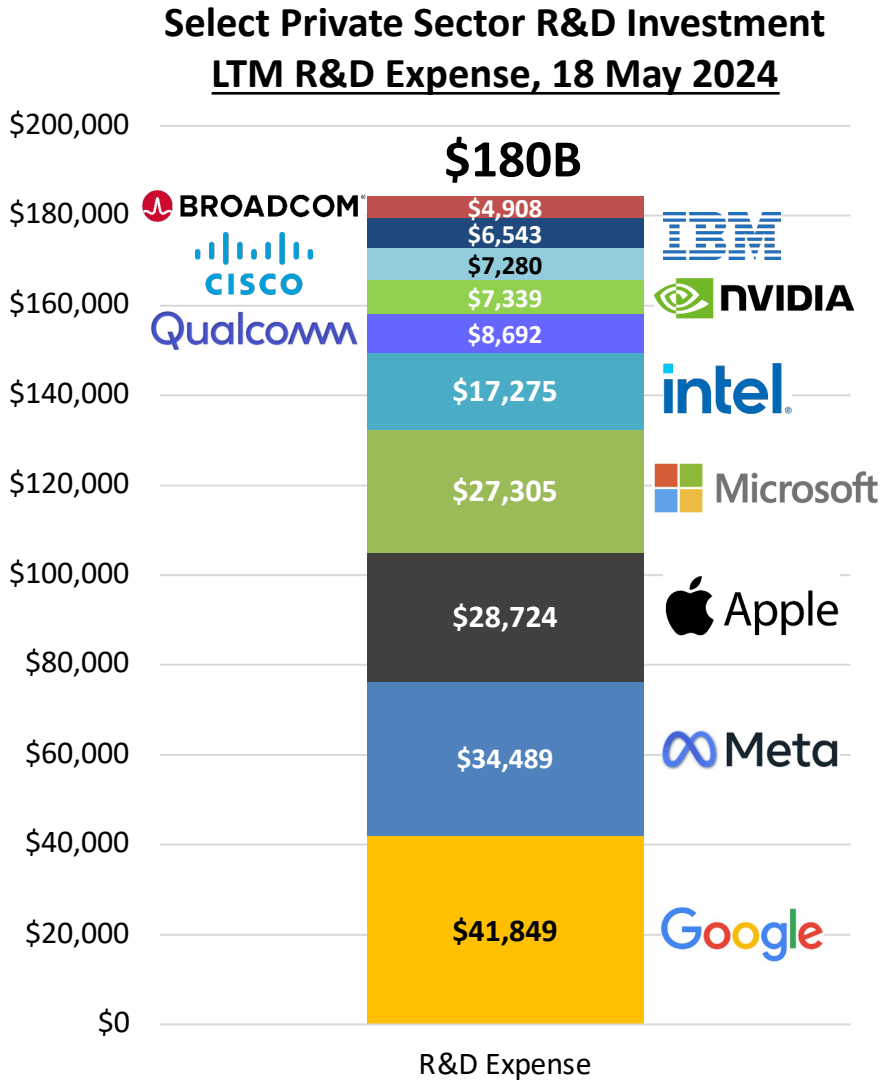
💰 **Why Bessemer is betting $1B on AI**

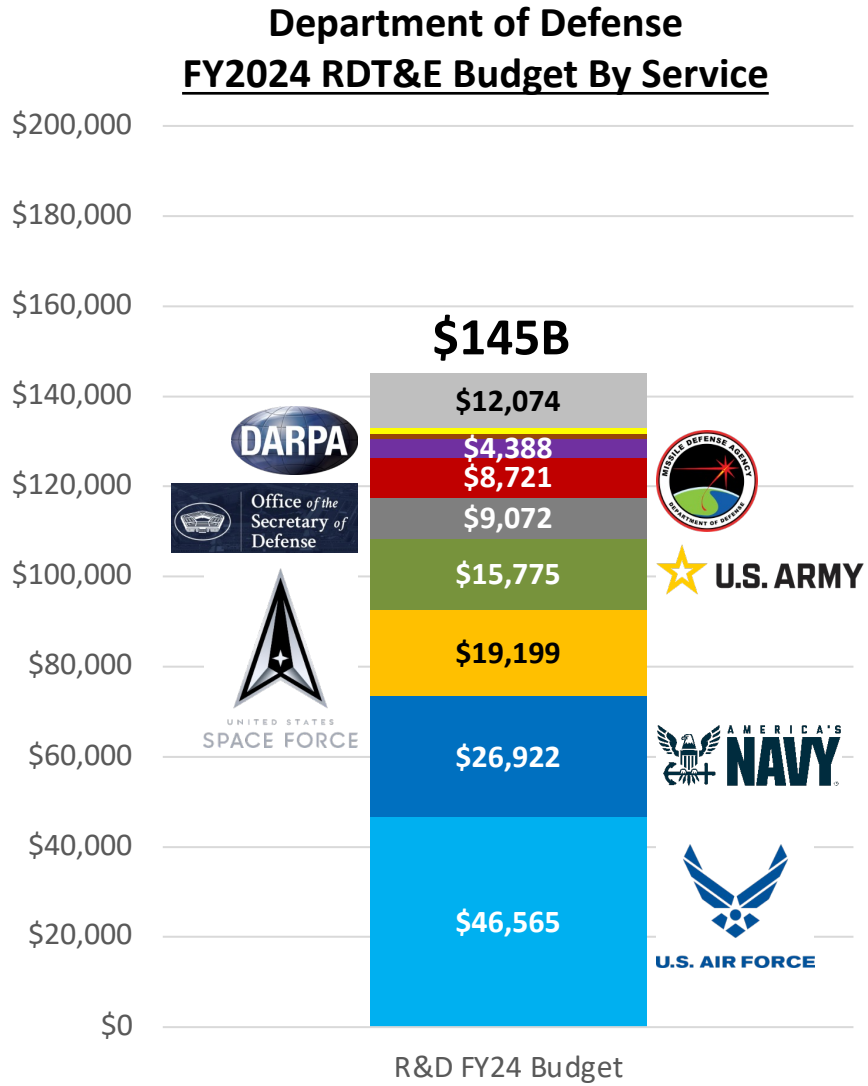
Bessemer Venture Partners' massive bet on the future potential for AI reflects its belief that the technology is a seismic shift that will fundamentally change the way billions of people work. See what else Bessemer partner Sameer Dholakia has to say.

Microsoft Plans to Build OpenAI, ChatGPT Features Into All Products

Offering for businesses and end users to be transformed by incorporating tools like ChatGPT, CEO Satya Nadella says

Comparing Private Sector Investment With DoD RDT&E – Imperative That DoD Leverage Private Sector Investment In Areas Of Shared Interest



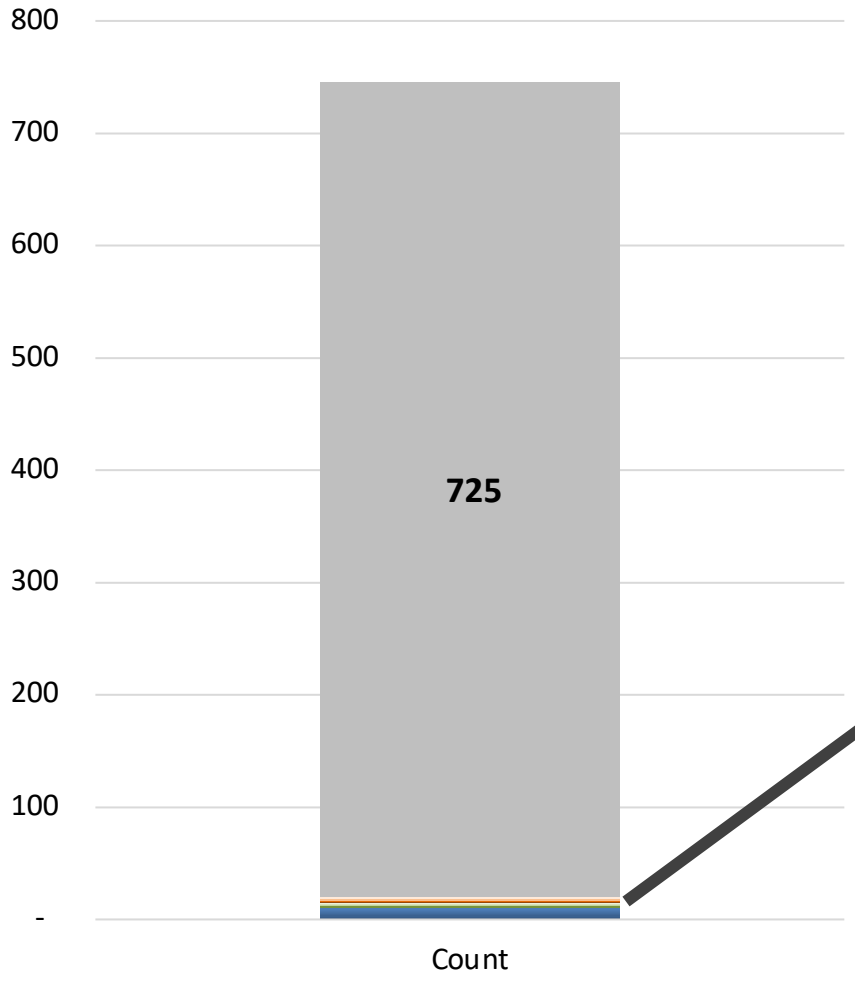


- To put things in perspective, the trailing twelve-month internal R&D expenses for ten well-known U.S. high-tech private sector companies are shown in the chart at far left – totaling $180B in R&D spending
- Total DoD RDT&E budget per the unclassified FY2024 FYDP is $145B
- **DARPA's budget for FY24 is $4.4B**
- **By comparison – Google, Facebook (Meta), Apple, Microsoft, and Intel spent $150B on R&D over just the past twelve months**

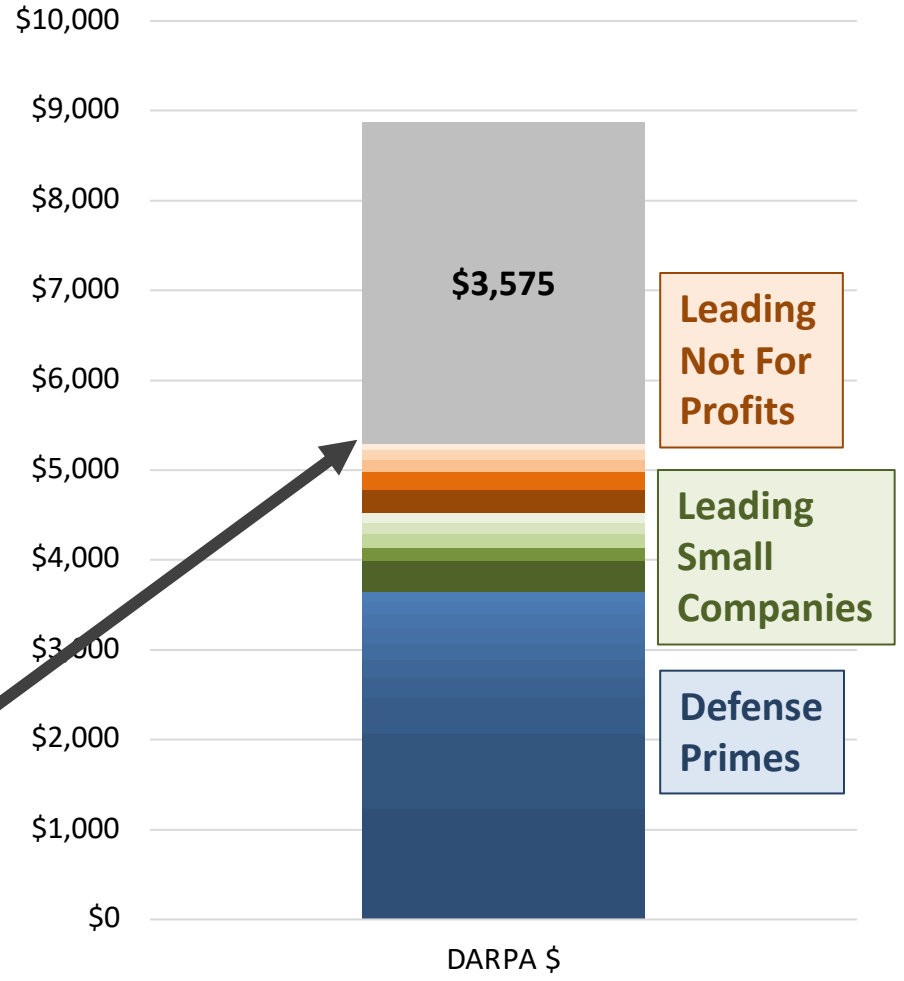
It is imperative that DoD leverage private sector investment in areas of shared interest – notably AI/ML and semiconductors among others

As With Most Federal Spending, DARPA Contract Awards Have Been Heavily Concentrated In Relatively Small Set Of Recipients Over Past Five Years

DARPA Contract Recipients By Count
Number Of Recipients – FY17-FY21



DARPA Contract Recipients By Value
Prime Contract Value, $M – FY17-FY21



- Between FY17-FY21 DARPA awarded $8.9B in contracts
- Twenty companies and organizations received 60% of that contract value
- Top Ten defense primes (shown in blue) received ~40%
- Five notable small companies received ~10% of spending
- Five not-for-profit organizations received ~10%
- Remaining 40% of spending ($3.6B) was divided among 745 contractors; each receiving on average ~$1M per year (albeit with same concentration pattern repeating down the spending curve)

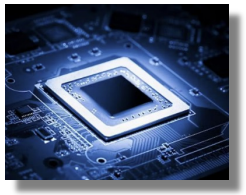
DARPA – Role & Mission

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

For sixty years, DARPA has held to a singular and enduring mission: to make pivotal investments in breakthrough technologies for national security.

- The genesis of that mission and of DARPA itself dates to the launch of Sputnik in 1957, and a commitment by the United States that, from that time forward, it would be the initiator and not the victim of strategic technological surprises.
- Working with innovators inside and outside of government, DARPA has repeatedly delivered on that mission, transforming revolutionary concepts and even seeming impossibilities into practical capabilities.
- The ultimate results have included not only game-changing military capabilities such as precision weapons and stealth technology, but also such icons of modern civilian society such as the Internet, automated voice recognition and language translation, and Global Positioning System receivers small enough to embed in myriad consumer devices.
- DARPA explicitly reaches for transformational change instead of incremental advances. But it does not perform its engineering alchemy in isolation. It works within an innovation ecosystem that includes academic, corporate and governmental partners, with a constant focus on the Nation's military Services, which work with DARPA to create new strategic opportunities and novel tactical options.
- DARPA benefits greatly from special statutory hiring authorities and alternative contracting vehicles that allow the Agency to take quick advantage of opportunities to advance its mission. These legislated capabilities have helped DARPA continue to execute its mission effectively.

DARPA - Key Themes For FY2024



MICRO ELECTRONICS

- DARPA is pursuing electronics performance advancements that exploit new concepts in circuit specialization and three-dimensional heterogeneous integration
- Will significantly increase the ease with which DoD can design, deliver, and eventually upgrade critical, customized microelectronics, particularly for operation in extreme environments

NETCENTRIC WARFARE

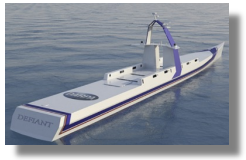
- It is imperative for the future of the U.S. forces to operate flawlessly with each other, regardless of which services and systems are involved in any particular mission.
- The overarching goal of this PE is to enable technologies at all levels, regardless of service component, to operate as one system.

ADVANCED AERO

- Advanced Aero is focused on exploiting high pay-off opportunities to provide revolutionary new system capabilities in order to achieve undeterrable air presence at dramatically reduced costs.
- New architectural concepts that employ a mix of weapon technologies that achieve lethality through a combination of overwhelming performance and overwhelming numbers

QUANTUM & AI

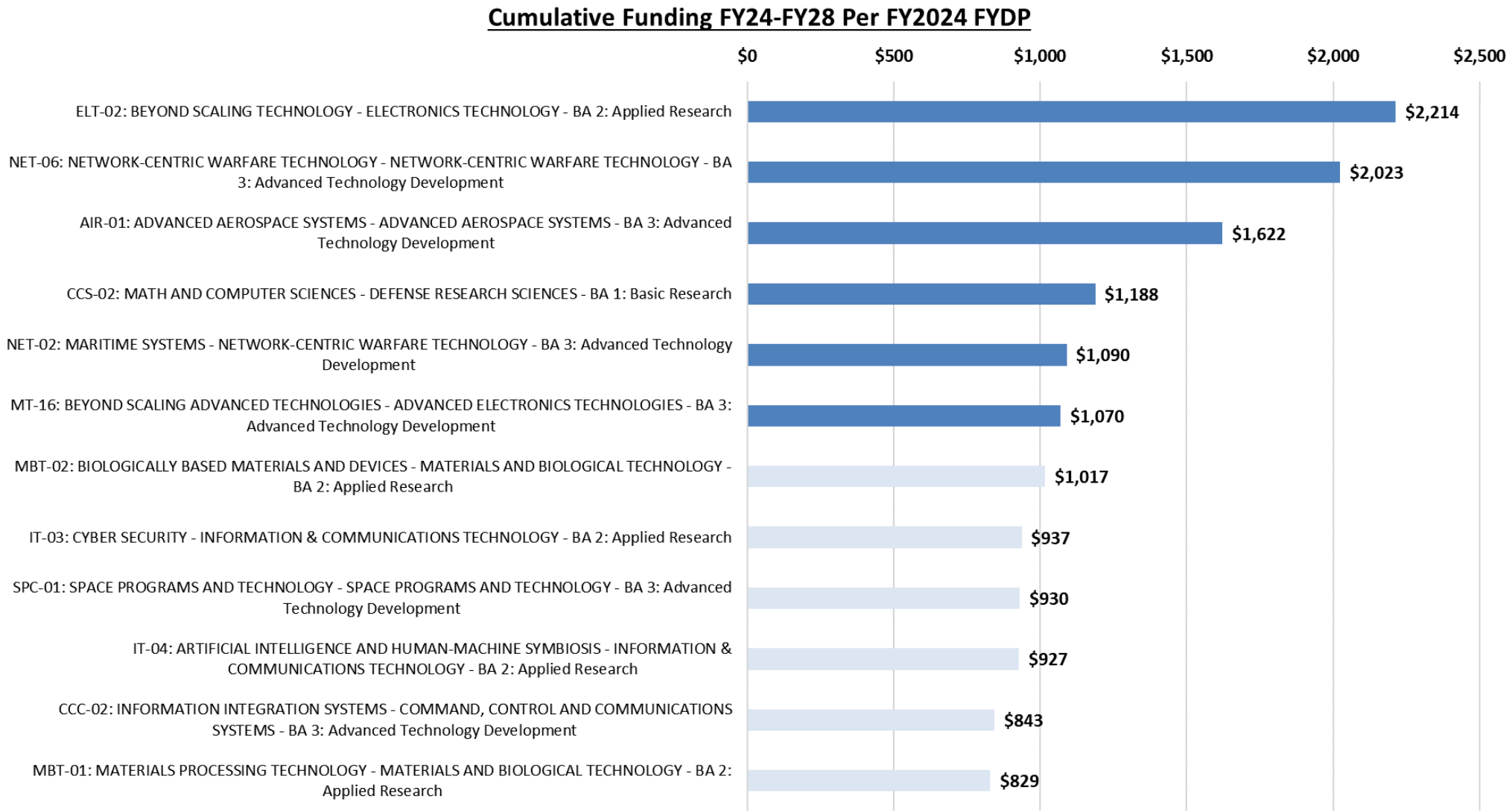
- Math & Computer Sciences efforts will magnify opportunities and mitigate threats by leveraging emerging mathematical and computational capabilities including artificial intelligence (AI), computational social science, machine learning and reasoning, data science, quantum science, complex systems modeling and simulation, and theories of computation and programming



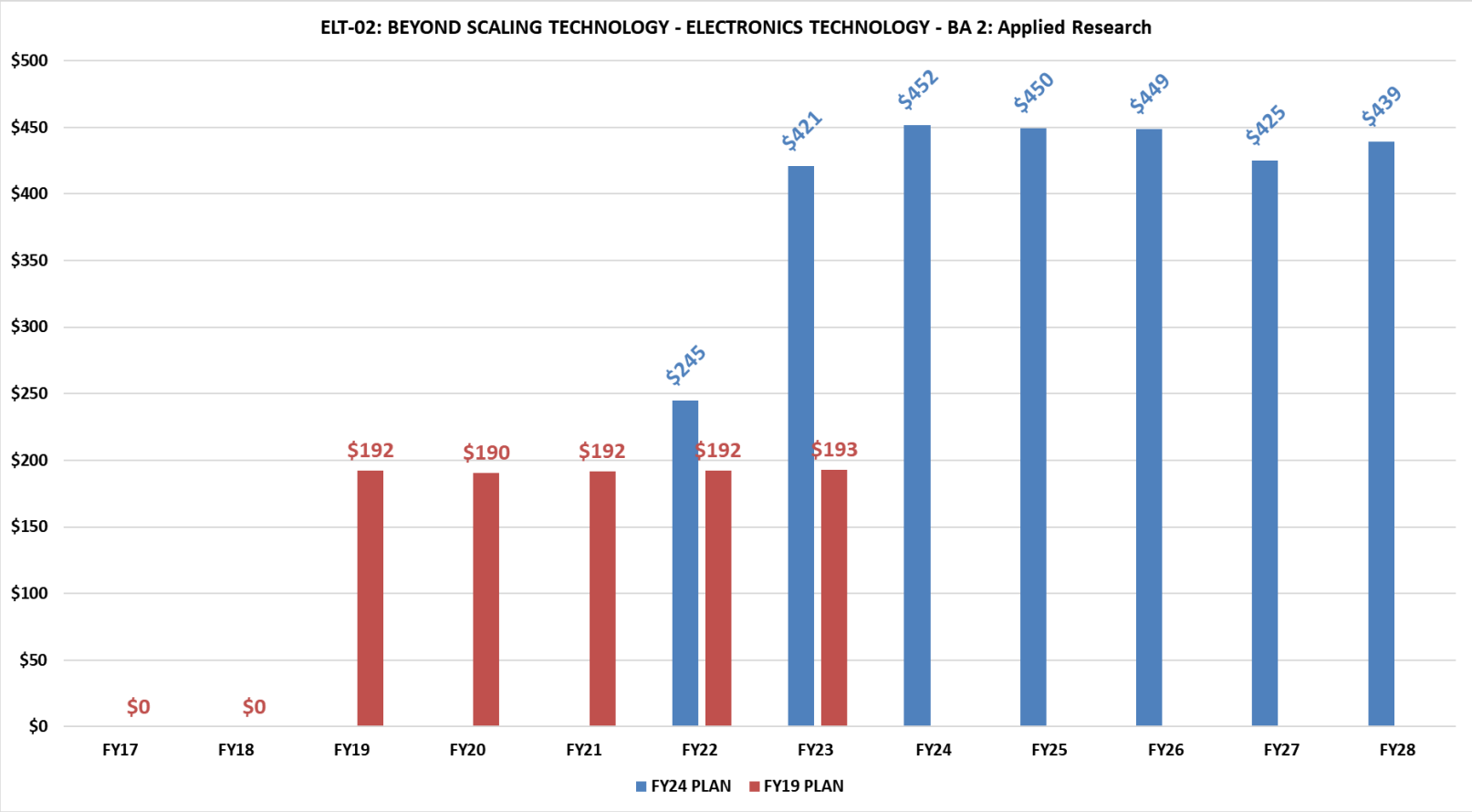
ADVANCED MARITIME

- Naval forces will play an ever-increasing role in network-centric warfare because of their forward deployed nature, their unique capability to operate simultaneously in the air, on the sea and under the sea, and their versatile ability to provide both rapid strike and project sustained force.

Top Twelve DARPA Budget Line-Items, FY2024



ELT-02: BEYOND SCALING TECHNOLOGY - ELECTRONICS TECHNOLOGY - BA 2: Applied Research

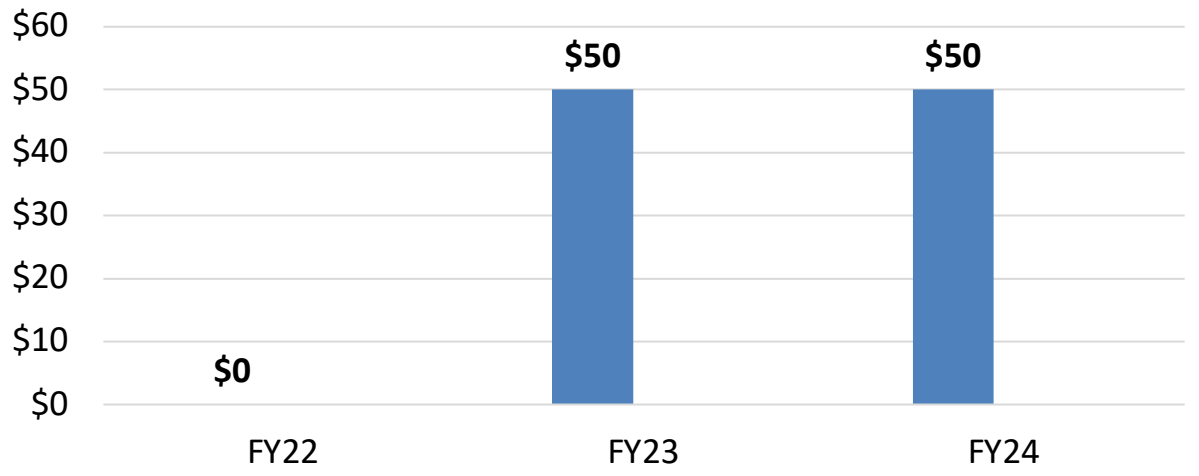


- The Beyond Scaling Technology project recognizes that, within the next decade, the continuous pace of improvements in electronics performance will face the fundamental limits of silicon technology.
- This project pursues electronics performance advancements that exploit new concepts in circuit specialization and three-dimensional heterogeneous integration (3DHI) by the optimization of materials, devices, architectures, and designs to achieve specific circuit function at high performance.
- Because electronics advancements must simultaneously make progress in performance and secure the foundation on which our microelectronics infrastructure relies, this specialization will require incorporation of security safeguards and advancing manufacturing tools and process automation.
- Programs within the Beyond Scaling Technology project will reduce barriers to making specialized circuits in today's silicon hardware and 3DHI by improving producibility.
- This will significantly increase the ease with which DoD can design, deliver, and eventually upgrade critical, customized microelectronics, particularly for operation in extreme environments.

Examples: Advanced Manufacturing Tools and Next-Gen Manufacturing For Extreme Environment Electronics

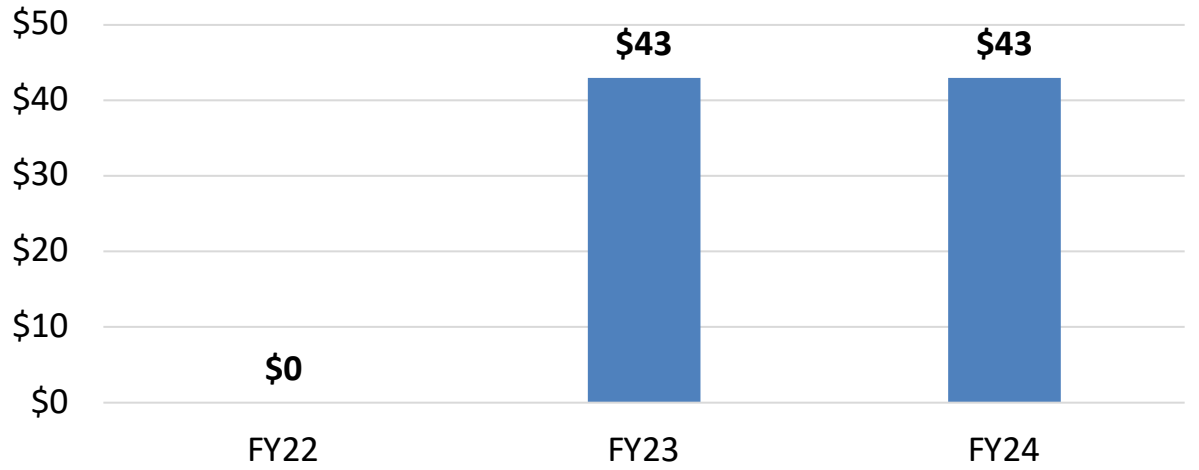
Next Generation Microelectronics – Advanced Manufacturing Tools

- Addresses the development of new manufacturing tools for the design, fabrication, packaging, assembly, testing, and digital emulation of the next generation of advanced microsystems.
- Specifically, these advanced microsystems include three-dimensional heterogeneous integration (3DHI) and designs targeted for use in extreme environments such as high voltage, high current, high temperature, low temperature, and radiation exposure.
- New tools to improve manufacturing and testing will be designed, built, and characterized; these tools will enable cost-effective on-shoring of automated processes for packaging, assembly, and testing of advanced microsystems.

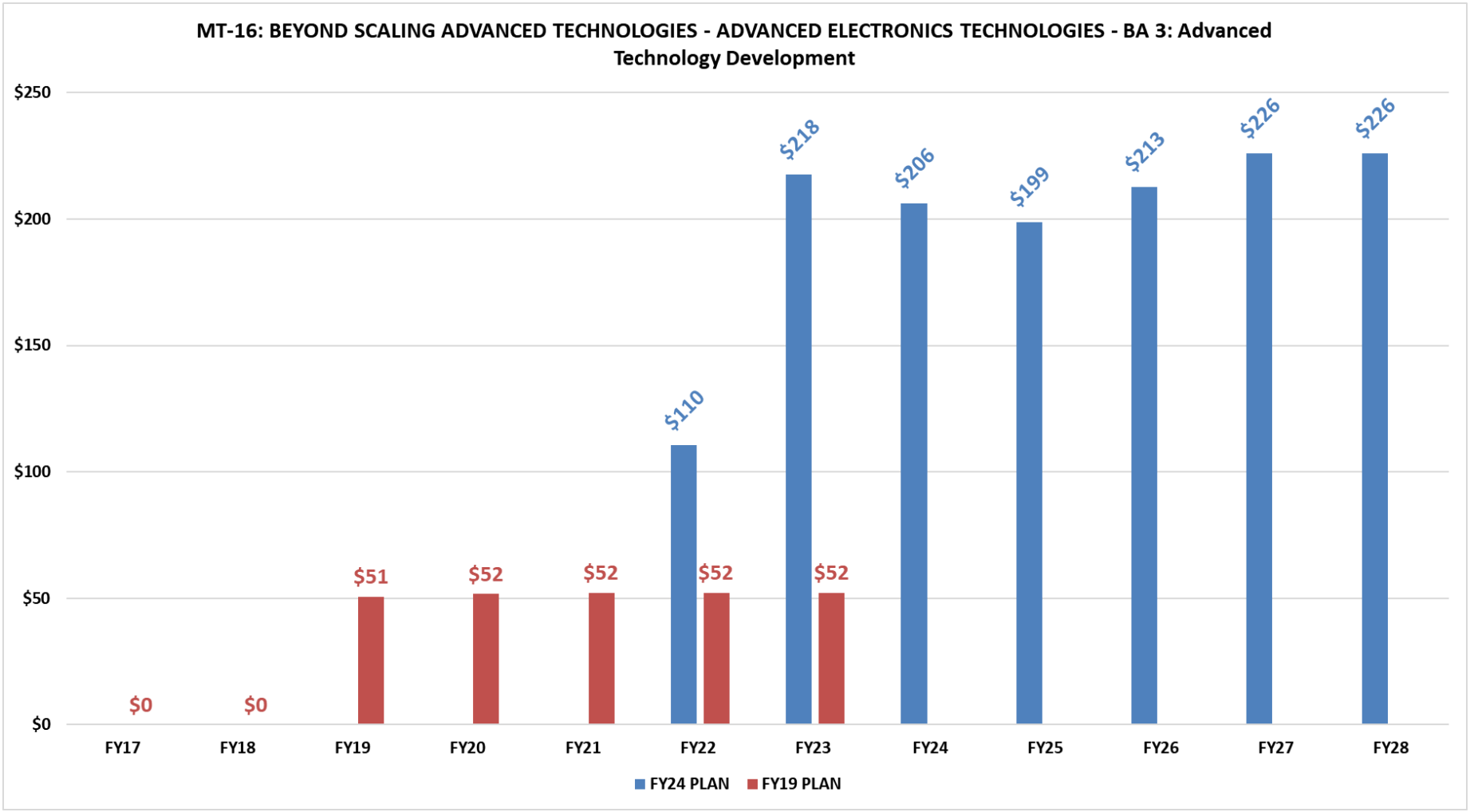


Next Generation Microelectronics - Advanced Manufacturing for Extreme Environment Electronics

- Addresses design, fabrication, packaging, assembly, testing, and digital emulation of next gen microsystems targeted for use in extreme environments: high voltage, high current, high temperature, low temperature, radiation exposure.
- New manufacturing methods along with new testing and evaluation methods will be created, with emphasis on developing techniques to enable in-situ measurements of microsystems while operating in the extreme environments.
- These new manufacturing methods will also focus on a higher degree of automation in the packaging, assembly, and testing processes.
- This effort will also develop techniques to significantly improve thermal management, inter-chip power delivery, package integrity.



MT-16: BEYOND SCALING ADVANCED TECHNOLOGIES - ADVANCED ELECTRONICS TECHNOLOGIES - BA 3: Advanced Technology Development

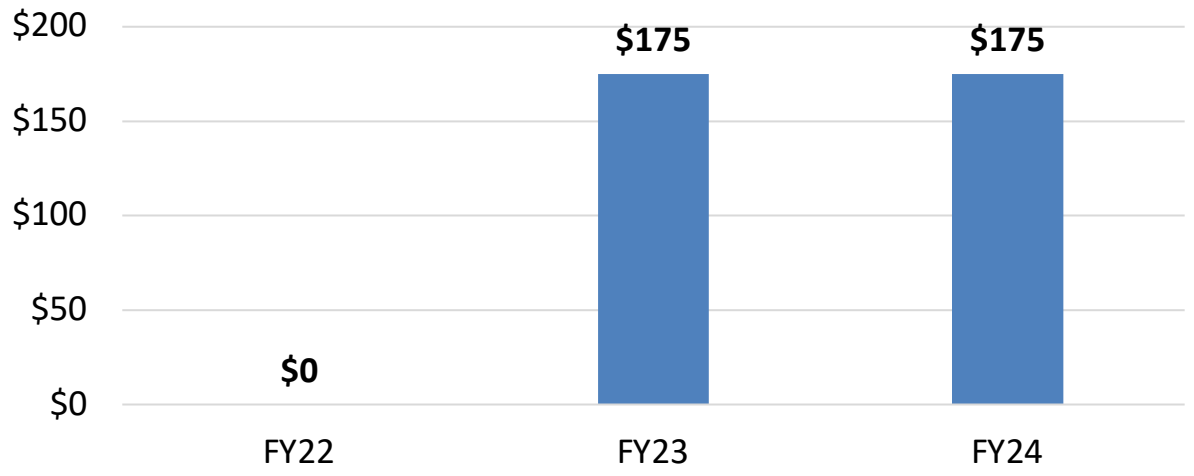


- The Beyond Scaling Advanced Technologies Project supports activities to enable and accelerate the transition of disruptive microelectronics advancement, including those developed under the Beyond Scaling Sciences (ES-02) and Beyond Scaling Technology (ELT-02) projects.
- Funding under this project will include developing new technologies and capabilities in commercial settings, establishing access to these new processes and to commercial state-of-the-art foundries, enabling prototyping, developing manufacturable processes for three-dimensional heterogeneous integration (including integrated photonics), advancing new architectures and integration technologies for advanced field programmable gate arrays (FPGAs), and innovating back end of line technologies for wide bandgap semiconductors.

Examples: Nex-Gen Microelectronics Manufacturing (NGMM) and Programmable Logic For Applications In Defense (PLAID)

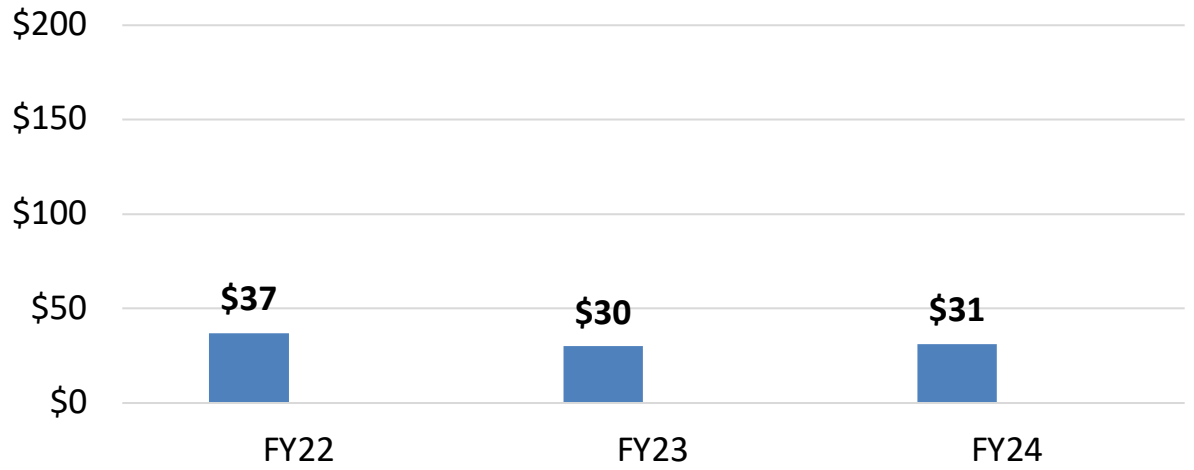
Next Generation Microelectronics Manufacturing (NGMM)

- Manufacturing next-generation microsystems using three-dimensional heterogeneous integration (3DHI), including design, fabrication, packaging, assembly, and testing.
- This capability, a National Network for Next Generation Microelectronics Manufacturing, will emphasize design innovations to sustain U.S. leadership in semiconductors and enhance the use of manufacturing automation in the design, assembly, and testing of 3DHI prototypes.
- The baseline capability will allow users from across the country to quickly and efficiently develop working prototypes based on early-stage research and development; will enable a wide range of organizations and stakeholders to accelerate a domestic 3DHI ecosystem.

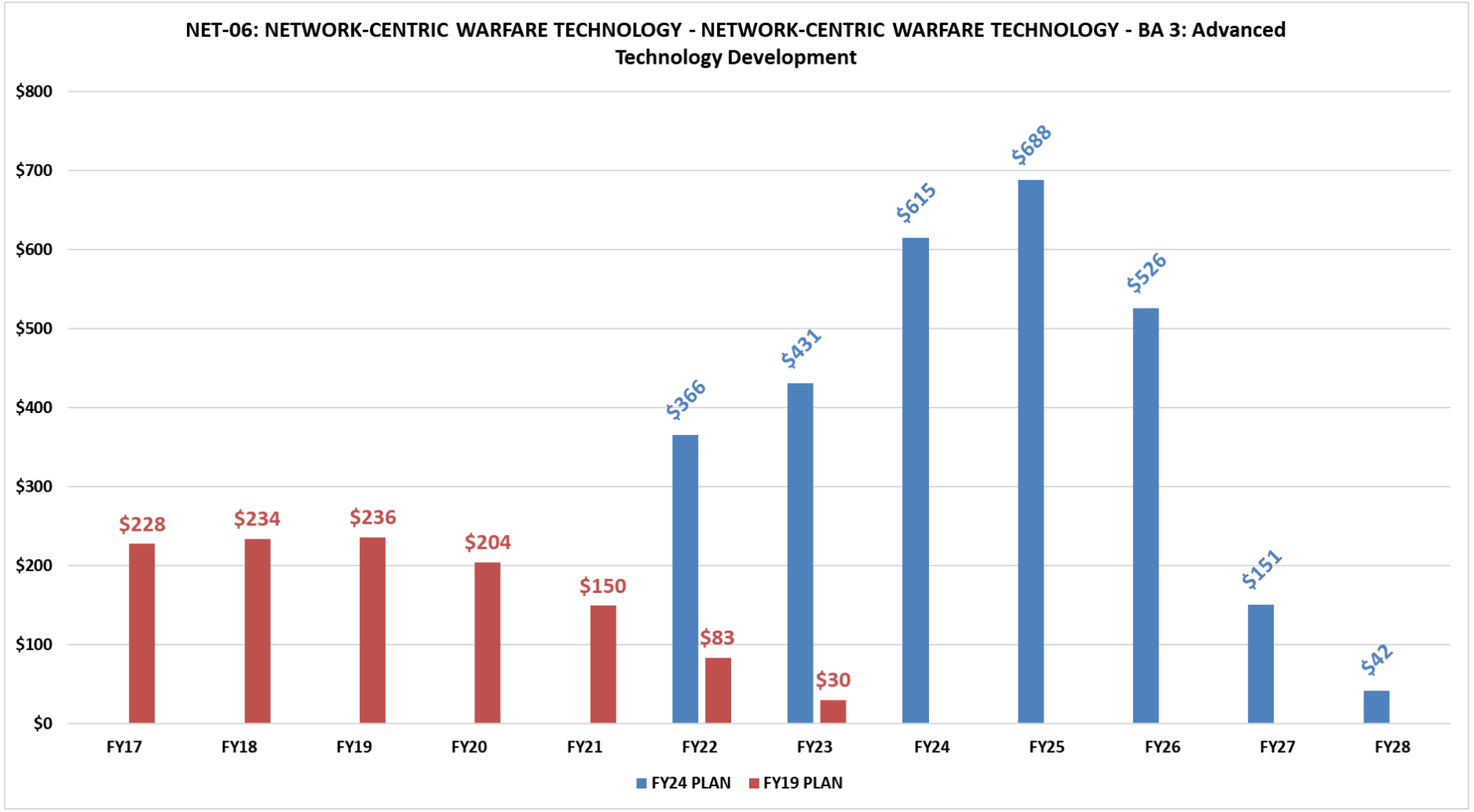


Programmable Logic for Applications In Defense (PLAID)

- Developing a heterogeneous compute platform that can support processing of large data arrays.
- Current computing architectures are subject to scaling, bandwidth, and memory limitations, and the large size of today's chips limits the movement of data resulting in a fundamental trade-off between circuit size and data throughput.
- The PLAID program will break this paradigm with new architecture development and will achieve more than a 10X increase in on-chip bandwidth; will expedite deployment into DoD systems by engaging the defense industrial base to map DoD-relevant radio frequency (RF) processing problems onto the new architecture.

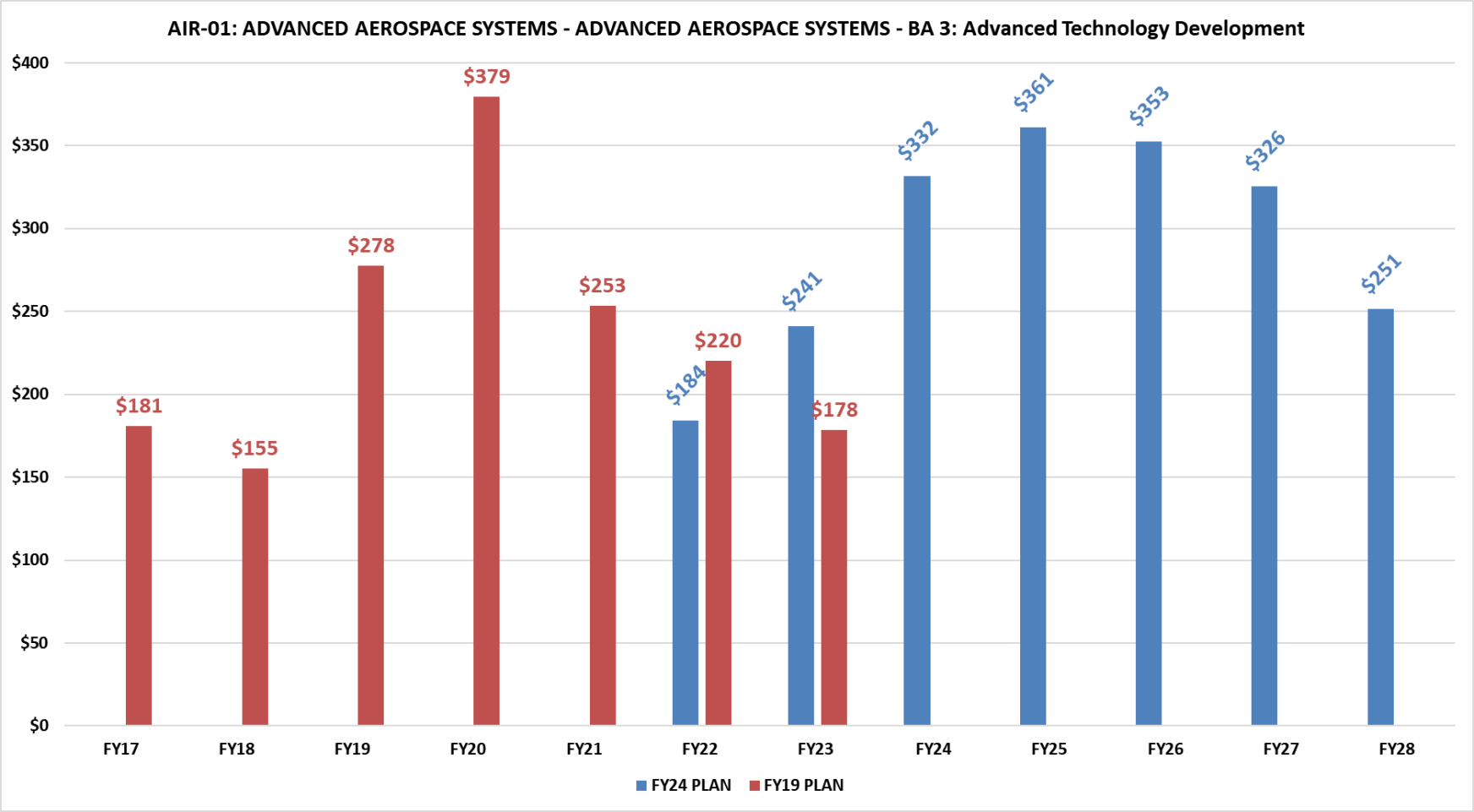


NET-06: NETWORK-CENTRIC WARFARE TECHNOLOGY - NETWORK-CENTRIC WARFARE TECHNOLOGY - BA 3: Advanced Technology Development



- Advanced Technology Development associated with the Network-Centric Warfare Technology Program that addresses high payoff opportunities to develop and rapidly mature advanced technologies and systems required for today's network-centric warfare concepts.
- It is imperative for the future of the U.S. forces to operate flawlessly with each other, regardless of which services and systems are involved in any particular mission.
- The overarching goal of this PE is to enable technologies at all levels, regardless of service component, to operate as one system.
- This project funds classified DARPA programs that are reported in accordance with Title 10, United States Code, Section 119(a)(1) or its successor..

AIR-01: ADVANCED AEROSPACE SYSTEMS - ADVANCED AEROSPACE SYSTEMS - BA 3: Advanced Technology Development

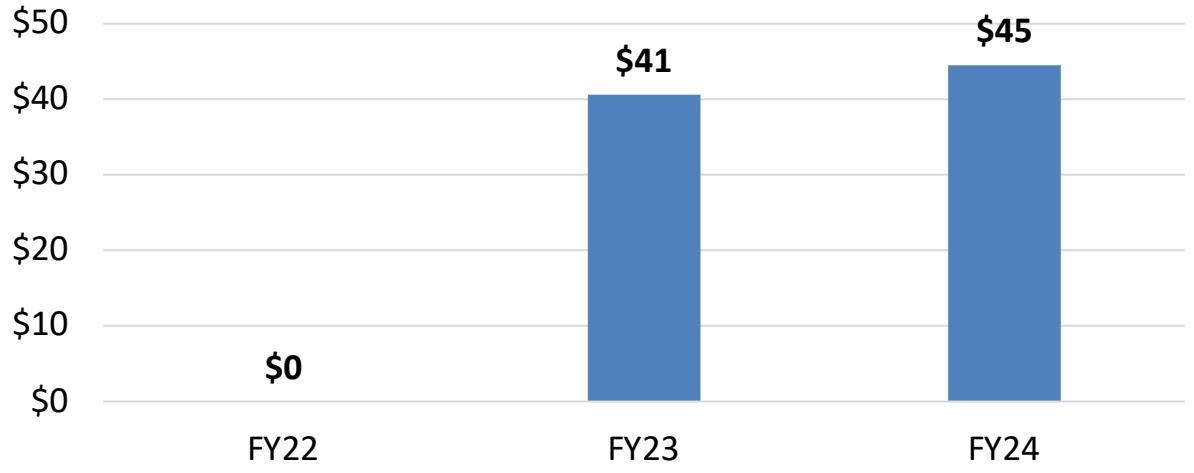


- Focused on exploiting high pay-off opportunities to provide revolutionary new system capabilities, as opposed to incremental or evolutionary advancements, in order to achieve undeterrable air presence at dramatically reduced costs.
- Rapid prototyping and experimentation of integrated system concepts, as well as enabling vehicle subsystems will be conducted.
- Programs will explore new architectural concepts that employ a mix of weapon technologies that achieve lethality through a combination of overwhelming performance and overwhelming numbers rather than through the use of singular and costly high value assets.
- Examination and evaluation of emerging aerospace threats, technologies, concepts, use of autonomy to minimize risk, and applications for missiles, munitions, and vehicle systems.

Examples: Control of Revolutionary Aircraft with Novel Effectors (CRANE) and LongShot

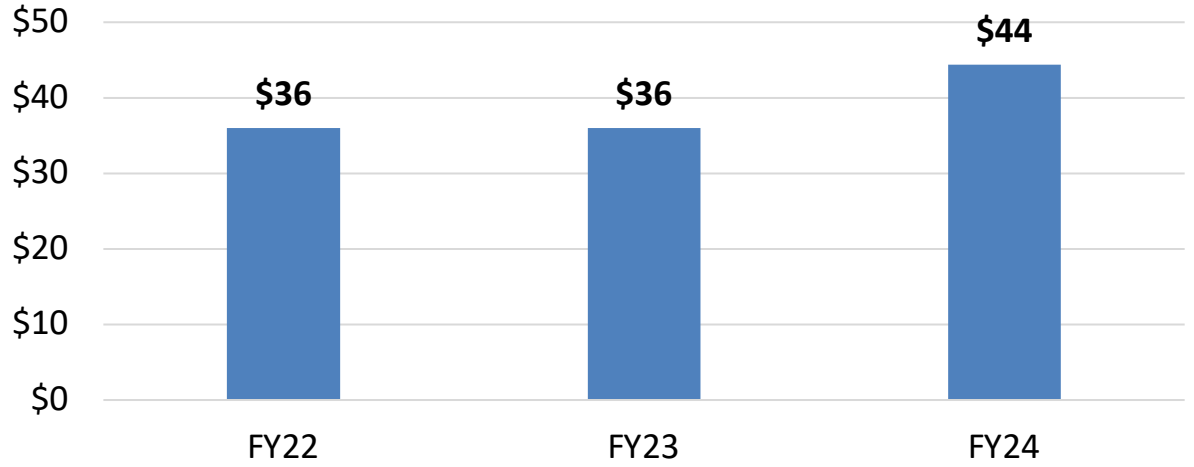
Control of Revolutionary Aircraft with Novel Effectors (CRANE)

- Develop and demonstrate revolutionary improvements in aircraft controls technology; design, build, and flight test an aircraft 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 mechanisms which alter the aerodynamic flow field thru ejection or suction of fluid via an orifice on a lifting body.
- Assess 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.

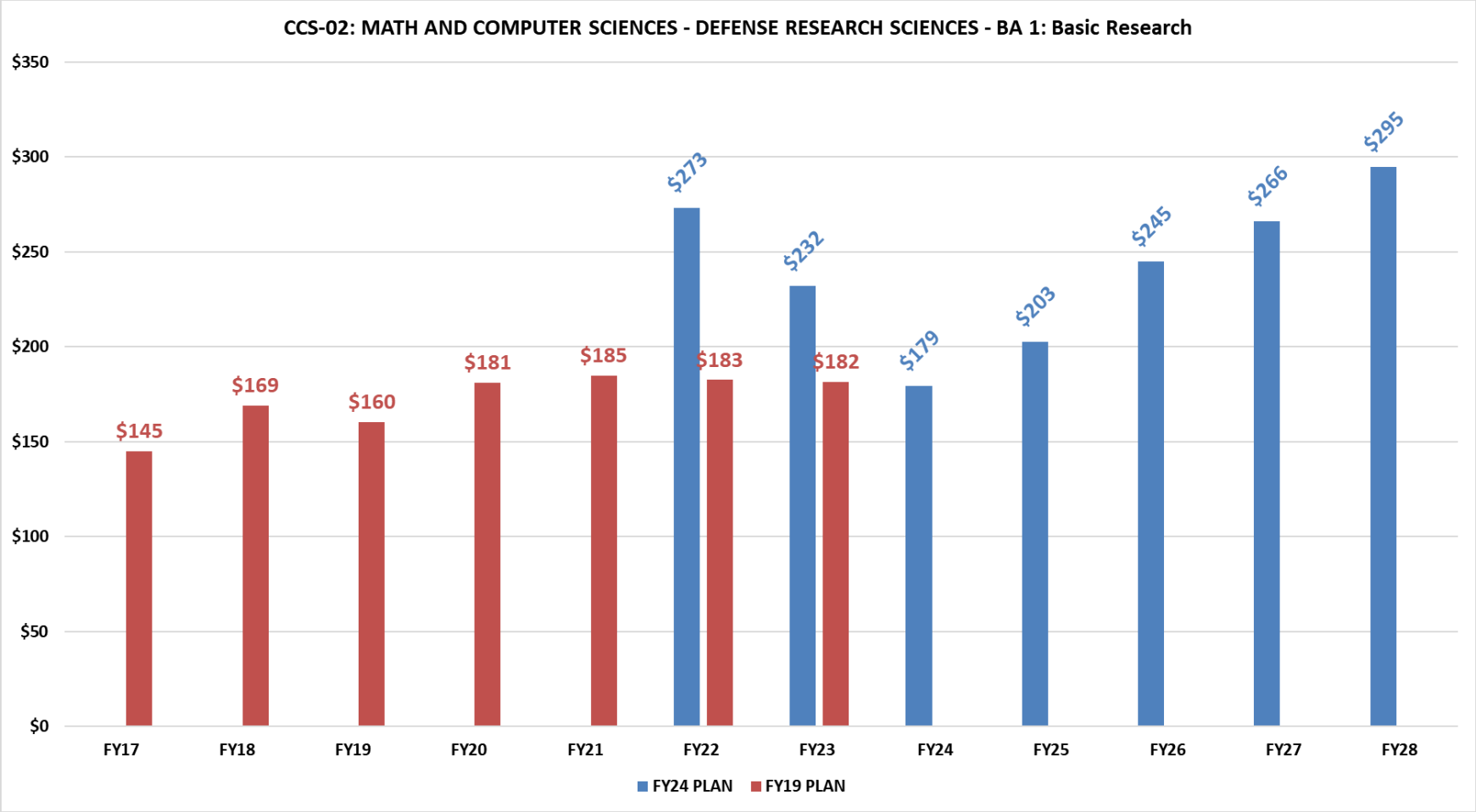


LongShot

- Developing and flight demonstrating an air-launched Unmanned Aerial Vehicle (UAV) capable of engaging multiple adversary targets from standoff ranges using existing air-to-air missiles.
- LongShot will be deployed either externally from existing fighters or internally from existing bombers; will capitalize on a slower speed, fuel efficient air vehicle for ingress, while retaining highly energetic air-to-air missiles for end-game target engagements, which provides several key benefits that increase weapon effectiveness.
- Will address the stability and control challenges of launching air-to-air missiles from a relatively small UAV in an operational environment; transition partners include the Navy and Air Force.



CCS-02: MATH AND COMPUTER SCIENCES - DEFENSE RESEARCH SCIENCES - BA 1: Basic Research

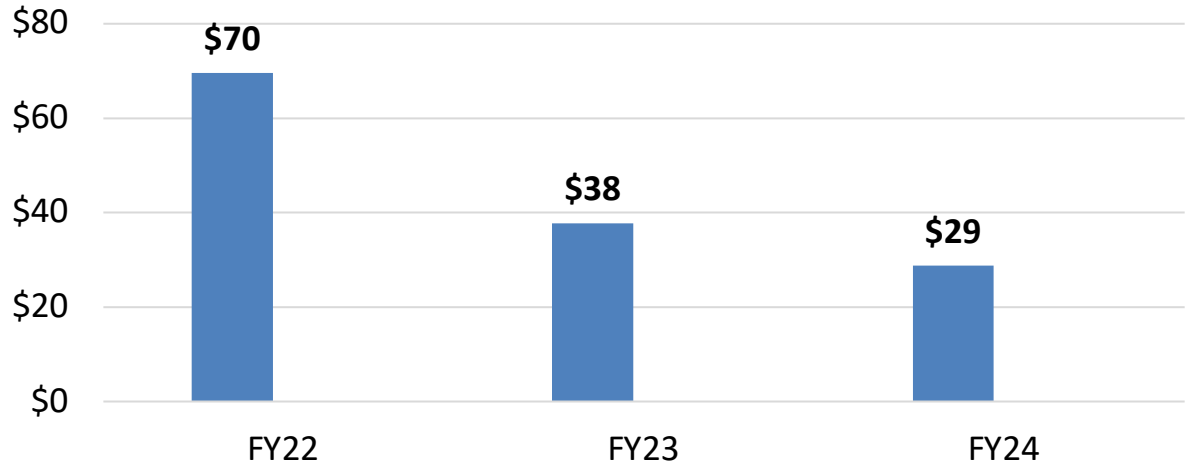


- The Math and Computer Sciences project supports scientific study and experimentation on new mathematical and computational algorithms, models, and mechanisms in support of long-term national security objectives.
- This project aims to magnify these opportunities and mitigate these threats by leveraging emerging mathematical and computational capabilities including artificial intelligence (AI), computational social science, machine learning and reasoning, data science, quantum science, complex systems modeling and simulation, and theories of computation and programming.
- The basic research conducted under the Math and Computer Sciences project will produce breakthroughs that enable new capabilities for national and homeland security.

Examples: Foundational AI Science and Alternative Computing

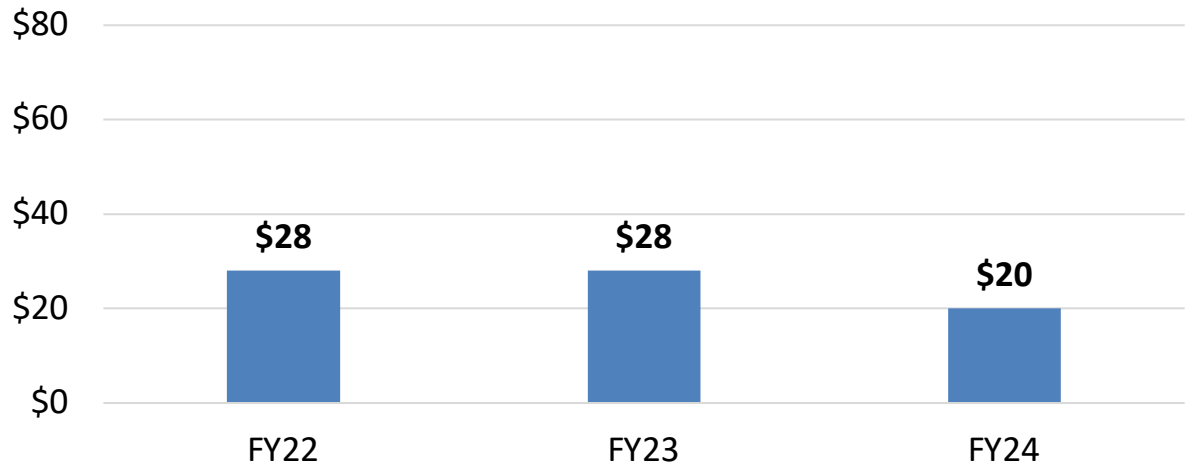
Foundational Artificial Intelligence Science

- Current AI technologies are challenged in handling uncertainty and incompleteness of training protocols and data; prevents the successful integration of AI technology into many transformative DoD applications.
- Foundational AI Science thrust will focus on the development of new learning architectures that enhance AI systems' ability to handle uncertainty, reduce vulnerabilities, and improve robustness for DoD AI systems.
- One focus area is the ability to detect and accommodate novelty - i.e., violations of implicit or explicit assumptions - in AI applications.
- Another focus area is the development of a model framework for quantifying performance expectations and limits of AI systems as trusted human partners and collaborators.

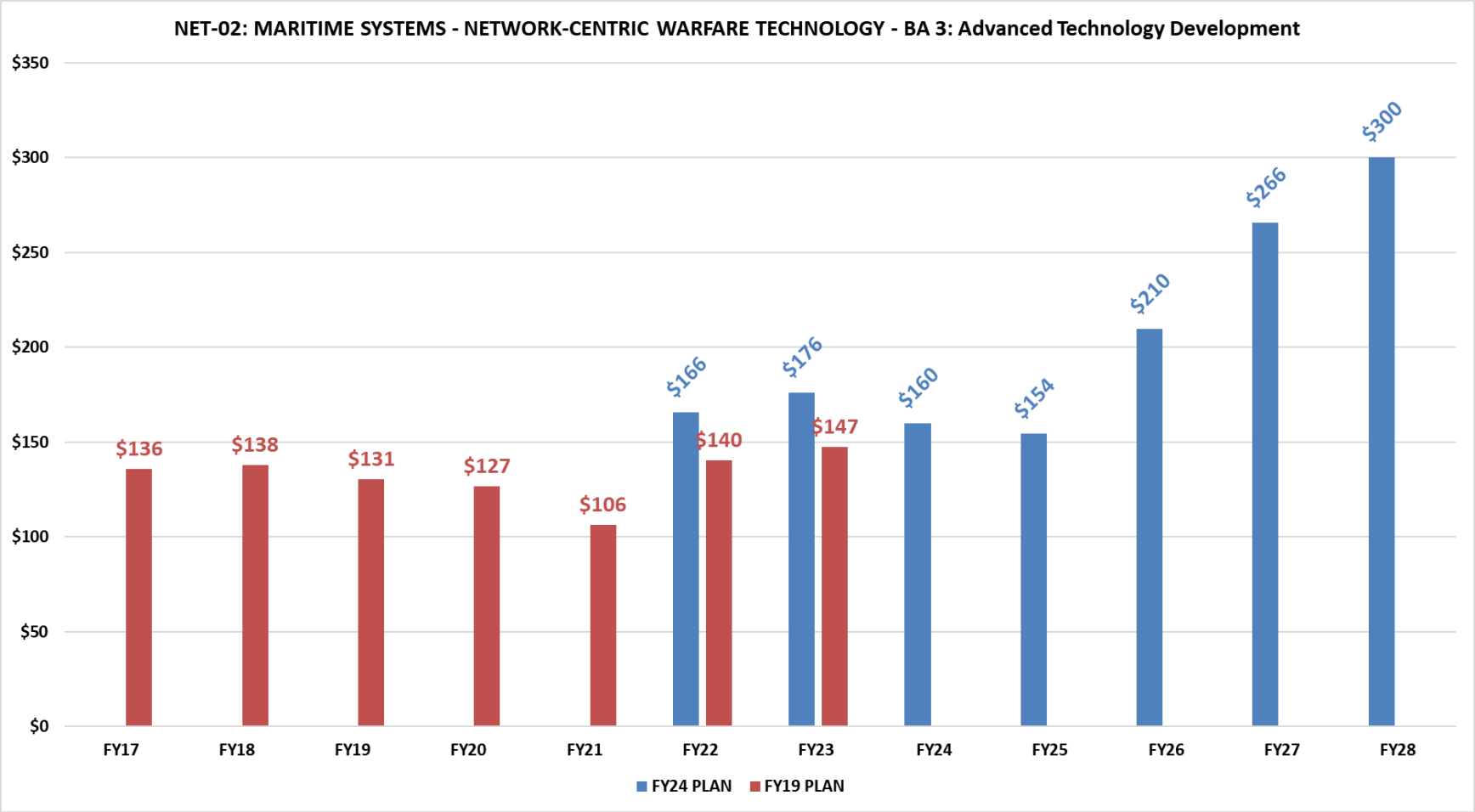


Alternative Computing

- Exploring and developing new computational primitives for modeling and simulating complex systems; despite decades of rapid advancement in electronic computing, there remain important national security relevant challenge problems that do not lend themselves to achieving tractable solutions under size, weight, and power (SWaP) constrained conditions.
- For example, simulation of complex nonlinear phenomena such as turbulence, fluid flow, and plasma dynamics can be challenging even using currently available high-power computing resources.
- Goal of the Alternative Computing thrust is to develop novel architectural and algorithmic approaches to enable fast and accurate simulations for problems that are practically intractable using electronic computers.



NET-02: MARITIME SYSTEMS - NETWORK-CENTRIC WARFARE TECHNOLOGY - BA 3: Advanced Technology Development

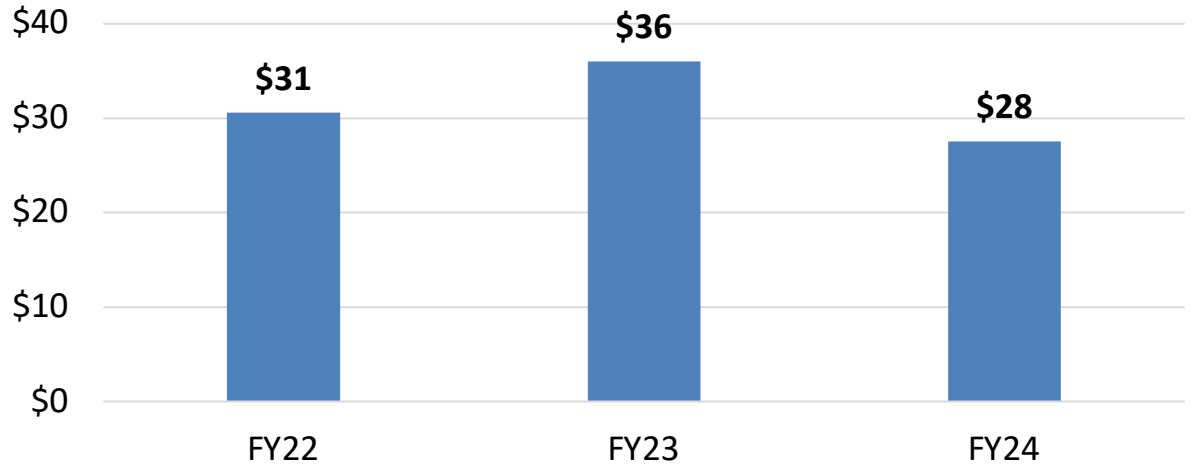


- The Maritime Systems project is identifying, developing and rapidly maturing critical advanced technologies and system concepts for the naval forces' role in today's network-centric warfare concept.
- Improvements in communications between and among submarines, surface ships and naval aircraft have allowed these forces to operate seamlessly with each other and with other Service's network-centric systems.
- Naval forces will play an ever-increasing role in network-centric warfare because of their forward deployed nature, their unique capability to operate simultaneously in the air, on the sea and under the sea, and their versatile ability to provide both rapid strike and project sustained force.

Examples: No Manning Required Ship (NOMARS) and Advanced Propulsors, Experimental (APEX)

No Manning Required Ship (NOMARS)

- Developing small, low-cost, disaggregated naval platforms to demonstrate the ability to perform persistent power projection and force application combat missions currently conducted from large, high value capital ships.
- The NOMARS program will design a ship that can operate autonomously for long durations at sea, enabling a ship design process that eliminates considerations associated with crew. NOMARS focuses on exploring novel approaches to the design of the sea frame (the ship without mission systems) while accommodating representative payload size, weight, and power.
- The goal of the program is to demonstrate the feasibility of Unmanned Surface Vessels (USVs) that operate autonomously for months to years without human intervention, in large numbers, with only periodic, depot-based maintenance.



Advanced Propulsors, Experimental (APEX)

- Current submarine propulsor and propeller designs have reached the technical limits of achieving significant improvements, constrain ship layouts, and maneuvering capabilities.
- The Advanced Propulsor, Experimental (APEX) program is developing and demonstrating a new generation of submarine propulsor designs enabling revolutionary improvements in submarine design, maneuverability, speed, and quieting that will transform future submarine designs.
- APEX program is building upon technologies developed in Advanced Maritime Defense Technologies Concepts budgeted in PE 0602702E, Project TT-03.
- The anticipated transition is to the Navy.