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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2025 Air Force **Date:** March 2024

<b>Appropriation/Budget Activity</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force I BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 0602020F / <i>Future AF Capabilities Applied Research</i>
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COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	93.684	90.713	85.477	0.000	85.477	90.742	93.428	97.709	99.895	Continuing	Continuing
620200: <i>Enterprise Transformational Appld Research</i>	-	93.684	90.713	85.477	0.000	85.477	90.742	93.428	97.709	99.895	Continuing	Continuing

**A. Mission Description and Budget Item Justification**

This program element develops multidisciplinary applied research efforts to accelerate the technology pipeline of transformational capabilities by reducing risk and maturing technologies so they can transition in support of larger advanced technology development capability investments. These activities are selected to enable solutions to the Department of the Air Force (DAF)s highest priorities. The Explore effort engages traditional & non-traditional industry, government laboratories, and academia through 12-24 month feasibility studies and demonstrations. The Seedlings for Disruptive Capabilities Program (SDCP) facilitates Air Force Research Laboratory (AFRL) cross-disciplinary applied research to provide leap-ahead, high risk technology development. Modeling, simulation, and analysis activities will continue to explore transformational research analytic technologies to enable validated positions and provide a solid foundation with emphasis to predict future outcomes and technology needs, as well as looking for more seedlings to feed the transformational capability pipeline. Efforts will advance future workforce development projects and will broaden partnerships to deepen and expand the scientific and technology enterprise. Applied research efforts span a broad spectrum of activities, and established processes allow agility and flexibility to meet higher demand signals.

AFRL will plan and manage these funds at the enterprise level to achieve a high level of collaboration executed across all the applicable Technology Directorates and will apply the research toward disruptive capabilities. Building off the technology competencies and ecosystems of the Technology Directorates brings together the needed expertise and components to develop the transformational capabilities.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be executed in the Technology Directorates in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
Previous President's Budget	99.901	90.713	91.293	0.000	91.293
Current President's Budget	93.684	90.713	85.477	0.000	85.477
Total Adjustments	-6.217	0.000	-5.816	0.000	-5.816
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-2.670	0.000			
• Other Adjustments	-3.547	0.000	-5.816	0.000	-5.816

**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

**Project:** 620200: *Enterprise Transformational Appld Research*

Congressional Add: *Program increase - alternative energy research*

Congressional Add Subtotals for Project: 620200

Congressional Add Totals for all Projects

	<b>FY 2023</b>	<b>FY 2024</b>
	19.268	-
	19.268	-
	19.268	-

**Change Summary Explanation**

FY 2025 decrease \$3.500M funding is due to transfer into USSF Program Element 1026601SF/Space Technology, Project 620200/Enterprise Transformational Appld Research.

**C. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>
<b>Title:</b> Transformational Capability Incubator	74.416	0.000	0.000
<b>Description:</b> This effort was previously titled "AF Explore" but was updated to include USSF support. Integrates cross-enterprise multi-directorate transformational applied research efforts to accelerate the "pipeline" of technology-enabled capability candidates pursuing the five strategic capabilities outlined in the Air Force Science and Technology Strategy. The Air Force Research Laboratory will plan and manage these research activities at the enterprise level with decentralized execution to achieve the intent of the Strategy.			
<b>FY 2024 Plans:</b>			

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>
To clarify intent, the activities from this effort have been realigned into three discrete thrusts: Explore, Seedlings for Disruptive Capabilities, and Data to Decisions and Collaborative Learning.				
<b>FY 2025 Plans:</b> Not applicable.				
<b>FY 2024 to FY 2025 Increase/Decrease Statement:</b> Not applicable.				
<b>Title:</b> Explore		0.000	38.075	38.093
<b>Description:</b> Explore engages traditional & non-traditional industry, government labs and academia through competitive opportunity calls to incubate transformational Science and Technology (S&T). Its strategy-informed construct works to uncover game-changing and leap-ahead technologies that address DAF future force priorities. Explore's three-step process identifies, invests in, and matures these technologies through 12-24 month feasibility studies and proof of concept activities. The technology areas are identified through concept decomposition, horizon-scanning, and broad competitive calls to the nation's best and brightest innovators in industry, academia, government, non-profits, and other non-traditional partners. Promising technologies are accelerated through aggressive, short duration applied research and development efforts. These efforts assess operational viability and demonstrate feasibility of transformational warfighter capabilities, including their associated business and use cases. To do this, a variety of approaches are used including modeling and simulation, military utility experimentation, exercise participation, technical analysis, technology/concept maturation, risk reduction activities, and subject matter expertise input. Explore informs future areas of research and aids in identifying emerging technologies which could enable larger advanced technology development capability investments.				
<b>FY 2024 Plans:</b> Funding identified previously as part of the overall "Transformational Capability Incubators" effort. Initiate efforts which support immediate priorities of the Department of the Air Force which may include, but are not limited to, transformational needs within the intelligence, surveillance, and reconnaissance envelope to include data support, software tools, automation, and machine learning; impacting adversaries kill chain and technology in kill chain analysis; affordable weapons to include weapon transfer/loading, high speed affordable weapons, and delivery mechanisms to include the use of decoys; alternative positioning, navigation, and timing technologies; and novel computing and communication approaches. Continue investments in multiple energy solutions such as those to explore loader technologies, rechargeable energy solutions, flexible power generation, renewable power generation, energy storage, energy transfer, and wireless power distribution for agile combat employment, new engine technology, and transformative ways to provide power to an aircraft or forward operating location. Continue investments in universal support equipment to include new capabilities and technology to support flightline support equipment and generate new capabilities that will support agile combat employment operations. Continue investments in electronic warfare to include				

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>
<p>autonomous modeling and simulation at the edge, resilient communications, and algorithm development. Continue investments in distributed command and control including technology within distributed human-human teaming leveraging complex machine tools, AI enabled planning for contested environments, and workflow-based system-of-systems deployment. Continue investments in fog and edge computing to include computing solutions to process sensor data in real time, generate insights, and interact with the data in a distributed manner with the ability to send data to the cloud for additional processing. This further includes human computer interface technologies, energy efficient computing and architecture for data collection and processing, and collaborative computing, fusion, and networking. Complete initial investments in resilient distributed command and control including technology within distributed human-human teaming leveraging complex machine tools, AI enabled planning for contested environments, and workflow-based system-of-systems deployment. Complete investments in runway independence to include vertical takeoff and landing.</p> <p><b>FY 2025 Plans:</b></p> <ul style="list-style-type: none"> <li>- Initiate efforts which support immediate priorities of the Department of the Air Force (DAF) within areas of building blue kill chains, breaking red kill chains, contested logistics, and command, control, and communications battle management (C3BM)</li> <li>- Continue investments that were established to support immediate priorities of the DAF which may include, but are not limited to, transformational needs within:               <ul style="list-style-type: none"> <li>-- Intelligence, surveillance, and reconnaissance to include data support, software tools, autonomy, and machine learning and impacting adversaries kill chain and technology in kill chain analysis.</li> <li>-- Future connected, survivable, and agile Autonomous Air-to-Air Refueling platforms to deliver fuel leveraging enterprise activities in autonomy and air vehicle design.</li> <li>-- Multiple energy solutions such as those to explore loader technologies, rechargeable energy solutions, flexible power generation, renewable power generation, energy storage, energy transfer, wireless power distribution for agile combat employment, new engine technology, and transformative ways to provide power to an aircraft or forward operating location.</li> </ul> </li> <li>- Complete investments in fog and edge computing to include computing solutions to process sensor data in real time, generate insights, and interact with the data in a distributed manner with the ability to send data to the cloud for additional processing. This further includes human computer interface technologies, energy efficient computing, architecture for data collection and processing, and collaborative computing, fusion, and networking.</li> <li>- Complete investments in common support equipment that include new capabilities and technology to support flightline support equipment and generate new capabilities that will support agile combat employment operations.</li> <li>- Complete investments in electronic warfare to include autonomous modeling and simulation at the edge, resilient communications, and algorithm development.</li> <li>- Complete investments in high-speed affordable weapons</li> <li>- Complete initial investments in counter-intelligence, surveillance, and reconnaissance</li> </ul> <p><b>FY 2024 to FY 2025 Increase/Decrease Statement:</b></p>			

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>
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FY 2025 decreased compared to FY 2024 by 0.018 million as a result of a transfer of 2.364 to USSF Program Element 1206601SF/Space Technology, Project 620200/Enterprise Transformational Appld Research. This effort sees an increased emphasis on renewable energy, future blue capabilities, logistics, and command, control, and communications.			
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<b>Title:</b> Seedlings for Disruptive Capabilities (SDCP)	0.000	31.700	33.257
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**Description:** Integrates cross-enterprise multi-directorate transformational applied research efforts to accelerate the pipeline of technology-enabled capability candidates pursuing the Department of the Air Force Operational Imperatives. Seedlings for Disruptive Capabilities solicit applied research to provide leap-ahead, high risk technology development. Significantly advances scientific progress of innovative concepts underpinning transformational operational capabilities to future forces, enhance organic AFRL research capabilities in an enterprise-level, cross-Directorate environment & fortify external research partnerships to leverage key emerging technology developments in academia, industry, and/or government laboratories. The Air Force Research Laboratory will plan and manage these research activities at the enterprise level with decentralized execution to achieve the intent of the strategy.

**FY 2024 Plans:**

Effort previously incorporated as part of the FY23 effort called "Transformational Capability Incubator". Initiate efforts which support immediate priorities of the Department of the Air Force by implementing cross-disciplinary applied research to provide leap-ahead, high risk technology development in areas such as extended range weapons, coherent radars for increase detection of UAVs, wideband agile RF communications, networking quantum, or scalable affordable phased arrays for Space. Complete research in defending aircraft with next-generation targeted electromagnetics - electronic attack and counter electronic capabilities. Complete research in in-band lethality against seeker threats - modes of lethality for directed energy. Complete research in magnetic and star tracking for extended range navigation - accurate navigation over water. Complete research in photonic integrated circuits for space communications, position, navigation, and timing - architectures resilient to GPS denial. Continue research in infrastructure for trusted satellite autonomy for tactical rapid adversarial protection - safe, high assurance autonomy methodologies and human-autonomy interactions to react, plan and decide on appropriate actions in space. Continue research in spectral/polarization-sensitive event-based camera for intelligence, reconnaissance, and surveillance air moving target indicator - only reports changes in scene dynamics with enhanced target identification and real-world predictive power. Continue research in "Rainfly" - novel artificial intelligence-enabled methodologies to discover and characterize adversaries' defense systems to gain insight into organizational functionality.

**FY 2025 Plans:**

- Initiate efforts which support immediate priorities of the Department of the Air Force by implementing cross-disciplinary applied research to provide leap-ahead, high risk technology development in areas such as RF communications for high altitude platforms.

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>
<p>- Initiate programs in optical atomic clocks for advanced alternative PNT, laser resilient optical mirrors for ground and space-based imagery systems, high-voltage gallium oxide radio-frequency static induction transistors for dramatic increase in radar power density, and passively augmented LIDAR for attritable sensing in contested environments</p> <p>- Complete research in infrastructure for trusted satellite autonomy for tactical rapid adversarial protection - safe, high assurance autonomy methodologies and human-autonomy interactions to react, plan and decide on appropriate actions in space battle management.</p> <p>- Complete research in spectral/polarization-sensitive event-based cameras for intelligence, reconnaissance, and surveillance air moving target indicator; only reports changes in scene dynamics with enhanced target identification and real-world predictive power.</p> <p>- Complete research in "Rainfly" - novel artificial intelligence-enabled methodologies to discover and characterize adversaries' defense systems to gain insight into organizational functionality.</p> <p>- Continue research in distributed coherent radars for UAV swarms developing magnitude improvements in detection range and target location accuracy.</p> <p>- Continue research in optimizing and affordably manufacturing long range weapons.</p> <p>- Continue research in wideband agile RF communications for high altitude modular platforms enabling a proliferated network of sensors to operate in contested environments.</p> <p><b>FY 2024 to FY 2025 Increase/Decrease Statement:</b> FY 2025 increased compared to FY 2024 by \$1.557 million. Increase is a result of maturing seedling topics of coherent UAV radars, long range weapons, and wideband agile RF into full lines of effort.</p>			
<p><b>Title:</b> Data to Decisions and Collaborative Learning</p> <p><b>Description:</b> Perform modeling, simulation, and analyses assessing the military utility of candidate transformational component applied research investments. Enhance the use of advanced systems for decision-making and a variety of innovations required to connect experts with operators in pursuit of achieving future force capabilities through applied research. Leverage best-in-class data analytics that connect warfighters with scientists and engineers, and innovating laboratory processes to accelerate technology maturation. Conduct a variety of strategic enterprise-level activities, including but not limited to regional campus hubs, scientists and engineers working with the leading national innovators; promoting technical proficiency in our military members, centers for excellence, and the Air Force Research Laboratory (AFRL) Front Door. AFRL collaborates with thousands of subject matter experts inside and outside government, academia, and industry enhancing and developing DoD relevant capabilities. Implements continuous lab process innovation via Air Force "TechConnect" tools connecting people with people and building a pipeline of ideas from external sources; leveraging AI-fueled tech connect platforms and supporting future force capabilities with real-time feedback loops through these tools, data analytics, and new connections to non-traditional partners.</p> <p><b>FY 2024 Plans:</b></p>	0.000	20.938	14.127

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>
<p>Effort previously incorporated as part of the FY23 effort called "Transformational Capability Incubator". Continue modeling, simulation, &amp; analyses enabling validated positions and providing a solid foundation for predicting future outcomes. Continue Air Force Research Laboratory's tech connect platforms connecting entrepreneurs, small business, industry, academia, &amp; military with Air Force and Space Force science and technology ecosystem. Continue internships and undergraduate research opportunities to build the science and technology workforce pipeline. Continue "Savage Future", connecting warfighters with the science and technology community, enabling understanding of both the problems and optimal solutions to accelerate results. Continue the Edison Grant program building the military science and engineering pipeline by promoting technical proficiency of our uniformed scientists and engineers.</p> <p><b>FY 2025 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue modeling, simulation, &amp; analyses enabling validated positions and providing a solid foundation for predicting future outcomes</li> <li>- Continue Air Force Research Laboratory's tech connect platforms connecting entrepreneurs, small business, industry, academia, &amp; military with Air Force and Space Force science and technology ecosystem</li> <li>- Continue internships and undergraduate research opportunities to build the science and technology workforce pipeline.</li> <li>- Continue "Savage Future", connecting warfighters with the science and technology community, enabling understanding of both the problems and optimal solutions to accelerate results.</li> <li>- Continue the AFRL MidAtlantic and MidWest Regional Networks, building a collaborative network of small business, large business, academia, and ventures to risk reduce key dual purpose technology solutions addressing DAF priorities.</li> </ul> <p><b>FY 2024 to FY 2025 Increase/Decrease Statement:</b> FY 2025 decreased compared to FY 2024 by \$6.811 million as a result of a transfer to USSF Program Element 1206601SF/Space Technology, Project 620200/Enterprise Transformational Appld Research.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	74.416	90.713	85.477

	<b>FY 2023</b>	<b>FY 2024</b>
<b>Congressional Add:</b> Program increase - alternative energy research	19.268	-
<b>FY 2023 Accomplishments:</b> Conduct Congressionally directed efforts.		
<b>Congressional Adds Subtotals</b>	19.268	-

**D. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

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3600: *Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research*

**R-1 Program Element (Number/Name)**  
PE 0602020F *I Future AF Capabilities Applied Research*

**E. Acquisition Strategy**

N/A