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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2024 Air Force **Date:** March 2023

<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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	74.393	99.901	90.713	0.000	90.713	91.293	94.302	96.899	101.090	Continuing	Continuing
620200: <i>Enterprise Transformational Appld Research</i>	-	74.393	99.901	90.713	0.000	90.713	91.293	94.302	96.899	101.090	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 the technology, so it 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 to include Operational Imperatives and Critical Technology Areas. The Explore effort engages traditional & nontraditional 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 analyses 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 of the applicable Technology Directorates, and 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 2022</b>	<b>FY 2023</b>	<b>FY 2024 Base</b>	<b>FY 2024 OCO</b>	<b>FY 2024 Total</b>
Previous President's Budget	79.901	88.672	88.852	0.000	88.852
Current President's Budget	74.393	99.901	90.713	0.000	90.713
Total Adjustments	-5.508	11.229	1.861	0.000	1.861
• Congressional General Reductions	0.000	-8.771			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	20.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-5.508	0.000			
• Other Adjustments	0.000	0.000	1.861	0.000	1.861

**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 2022</b>	<b>FY 2023</b>
	0.000	20.000
Congressional Add Subtotals for Project: 620200	0.000	20.000
Congressional Add Totals for all Projects	0.000	20.000

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

	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<b>Title:</b> Transformational Capability Incubator	74.393	79.901	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 2023 Plans:</b> Continue to develop future candidate technology programs which result from the scanning and ideation activities from the previous year, while maturing the programs already in progress from the previous year. The current technology programs include: Explore, Seedlings for Disruptive Capabilities, WARfighter-TECHnologist (WARTECH) capability demonstrations, and novel business processes. Capability demonstrations and close out will occur for FY22 Explore projects with potential new technology studies and demonstrations in areas of fog and edge computing, cement replacement material, and potential WARTECH topics that require			

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>technology maturation and studies, as well as, seedling technologies such as next generation targeted electromagnetics, In-Band lethality against seeker threats, Magnetic and star tracking for extended range navigation, and photonic integrated circuits for improved space-based position and timing. Continue to explore transformational research analytic technologies to enable validated positions and provide a solid foundation to predict future outcomes, as well as looking for more seedlings to feed the transformational capability pipeline. Continue to advance future workforce development programs and broadening partnerships to deepen and expand the scientific and technology enterprise.</p> <p><b>FY 2024 Plans:</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.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by \$79.901 million. Decrease is a result of realignment of funding from this thrust Transformational Capability Incubator into three discrete efforts: Explore, Seedlings for Disruptive Capabilities, &amp; Data to Decisions and Collaborative Learning.</p>				
<p><b>Title:</b> Explore</p> <p><b>Description:</b> Explore engages traditional &amp; non-traditional industry, gov't labs and academia through competitive opportunity calls to incubate Transformational S&amp;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.</p> <p><b>FY 2023 Plans:</b> Funding aligned within this Program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubators", \$36.000 million.</p> <p><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</p>		0.000	0.000	38.075

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
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<p>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 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 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 increased compared to FY 2023 by \$38.075 million. Increase is a result of realignment of effort from this program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator".</p>			
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<p><b>Title:</b> Seedlings for Disruptive Capabilities (SDCP)</p> <p><b>Description:</b> 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 solicits applied research to provide leap-ahead, high risk technology development. To significantly advance scientific progress of innovative concepts underpinning transformational operational capabilities to future forces, enhance organic AFRL research capabilities in an enterprise-level, cross-Directorate environment &amp; 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.</p> <p><b>FY 2023 Plans:</b></p>	-	0.000	31.700
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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>Funding aligned within this Program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator", \$31.600 million.</p> <p><b>FY 2024 Plans:</b> 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.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 increased compared to FY 2023 by \$31.700 million. Increase is a result of realignment of funding from this program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator".</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; Edison Grant program, 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. 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>		-	0.000	20.938

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p><b>FY 2023 Plans:</b> Funding aligned within this Program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubators", \$14.800 million.</p> <p><b>FY 2024 Plans:</b> 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 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 increased compared to FY 2023 by \$20.938 million. Increase is a result of realignment of funding from this program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator".</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	74.393	79.901	90.713

	<b>FY 2022</b>	<b>FY 2023</b>
<b>Congressional Add:</b> Program increase - alternative energy research	0.000	20.000
<b>FY 2022 Accomplishments:</b> Not applicable.		
<b>FY 2023 Plans:</b> Conduct Congressionally directed efforts.		
<b>Congressional Adds Subtotals</b>	0.000	20.000

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

N/A

**Remarks**

**E. Acquisition Strategy**

N/A