Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force											Date: February 2019	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603601F / *Conventional Weapons Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	157.676	204.756	225.817	0.000	225.817	206.783	215.366	227.204	232.407	Continuing	Continuing
63670A: *Weapon Technology Development*	-	82.406	105.132	57.895	0.000	57.895	51.830	74.854	76.367	77.895	Continuing	Continuing
63670B: *Weapon Concept Development*	-	75.270	99.624	167.922	0.000	167.922	154.953	140.512	150.837	154.512	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops, integrates, and demonstrates advance ordnance and guidance technologies for air-launched conventional weapons. The effort focuses on conventional ordnance component technologies such as war-heads, fuzes, and explosives, as well as munition guidance component technologies such as navigation and control systems and seekers. Technologies to be developed, demonstrated, and integrated into system concepts will address blast, fragmentation, penetration, low collateral damage, variable depth/location fuzing, precise guidance, and high-performance and insensitive explosives. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

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 PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601F, and 0602298F.

As directed in the FY 2018 NDAA, Sec 825, amendment to PL 114-92 FY 2016 NDAA, Sec 828 Penalty for Cost Overruns, the FY 2018 Air Force penalty total is $14.373M. The calculated percentage reduction to each research, development, test and evaluation and procurement account will be allocated proportionally from all programs, projects, or activities under such account.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force					Date: February 2019
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603601F / *Conventional Weapons Technology*		
B. Program Change Summary ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
Previous President's Budget	167.415	194.981	231.292	0.000	231.292
Current President's Budget	157.676	204.756	225.817	0.000	225.817
Total Adjustments	-9.739	9.775	-5.475	0.000	-5.475
• Congressional General Reductions	0.000	-0.225			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	10.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	5.800	0.000			
• SBIR/STTR Transfer	-3.309	0.000			
• Other Adjustments	-12.230	0.000	-5.475	0.000	-5.475

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 63670A: *Weapon Technology Development*		
Congressional Add: *Program increase - rotary launcher development*	0.000	10.000
Congressional Add Subtotals for Project: 63670A	0.000	10.000
Congressional Add Totals for all Projects	0.000	10.000

Change Summary Explanation

Decrease in FY 2018 of $12.230 million in Other Adjustments is due to realignment of funds to PE 0602212F, to support Research and Development Projects, 10 U.S.C. Section 2358.

Increase in FY 2018 of $5.800 million due reprogramming action for hypersonic weapon technology.

Decrease in FY 2020 due to realignment of $5.475 million from PE 0603601, Conventional Weapons Technology, to PE 0602602F, Conventional Munitions, for hypersonic weapon component technology maturation.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603601F / *Conventional Weapons Technology*	Project (Number/Name) 63670A / *Weapon Technology Development*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
63670A: *Weapon Technology Development*	-	82.406	105.132	57.895	0.000	57.895	51.830	74.854	76.367	77.895	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, matures, assesses, and demonstrates advanced/innovative ordnance and guidance component and subsystem technologies for air-launched conventional weapons. The project focuses on maturation of advanced explosives, fuzes, warheads, sub-munitions, and weapon airframes, carriage and dispensing; as well as innovative munition seekers, weapon aerodynamics, navigation and control, and guidance subsystem integration/simulation.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Ordnance Technologies	45.535	49.940	29.582

Description: Develop and demonstrate integrated ordnance technologies to improve conventional air-delivered munitions. Specific technical areas of focus include energetic materials, fuze technology, warhead sciences, and modeling and simulation tools.

FY 2019 Plans:

Continue to demonstrate distributed, embedded fuzing concepts for close-controlled strike, area attack, and penetration applications (layer counting at high speed), including assessing long-term safety, survivability, and functionality. Continue development of ordnance technologies to allow tailored lethality by controlling weapon fragmentation. Continue to mature ordnance technologies for rapid transition into high-speed strike weapon concepts, collecting complex arena test data for implementation into lethality modeling and simulation tools. Continue to develop test capabilities and high fidelity analysis tools into higher level engineering and fast-running models to enable the war-fighter to make more accurate weaponeering choices. Continue to develop ordnance technologies/methodologies for high-speed impact and functional defeat. Continue research for distributed and multi-point fuzing concepts to reduce the logistics tail necessary for future and fielded munitions systems, as well as safe and arm functions. Continue research into armament systems for Special Operations applications. Continue to conduct lethality analyses for air-to-air weaponry, and improve lethality and survivability tools at the mesoscale and micro-scale. Continue to mature research on distributed, collaborative, cooperative effects munitions technologies. Initiate multiple-hit target demonstration against hard and deeply buried targets. Initiate the development high fidelity test capabilities and analysis tools to evaluate ordnance technologies in relevant environments. Initiate the development of improved material models and develop further joint kinetic/directed energy common target models. Initiate development of models for progressive collapse, multiple point initiation, secondary debris and others.

FY 2020 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603601F / *Conventional Weapons Technology*	**Project (Number/Name)** 63670A / *Weapon Technology Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Complete characterization of weapon effects for distributed multi-point detonation fuze technology including safe and arm functions. Complete multiple-hit target demonstration against hard and deeply buried targets. Continue demonstration of distributed, embedded fuzing concepts for close-controlled strike, area attack, and penetration applications (layer counting at high speed), including assessing long-term safety, survivability, and functionality. Continue development of ordnance technologies to allow tailored lethality by controlling weapon fragmentation. Continue to mature ordnance technologies for rapid transition into high-speed strike weapon concepts, collecting complex arena test data for implementation into lethality modeling and simulation tools. Continue to develop test capabilities and high fidelity analysis tools into higher level engineering and fast-running models to enable the war-fighter to make more accurate weaponeering choices. Continue to develop ordnance technologies/methodologies for high-speed impact and functional defeat. Continue research into armament systems for Special Operations applications. Continue to conduct lethality analyses for air-to-air weaponry, and improve lethality and survivability tools at the mesoscale and micro-scale. Continue to mature research on distributed, collaborative, cooperative effects munitions technologies. Continue the development high fidelity test capabilities and analysis tools to evaluate ordnance technologies in relevant environments. Continue development of improved material models and develop further joint kinetic/directed energy common target models. Continue to develop models for progressive collapse, multiple point initiation, secondary debris and others. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 decreased compared to FY 2019 by $20.358 million. Funding decreased due to the completion of ordnance-related testing associated with multiple-hit weapon demonstrations, reduction of conformal warhead research, and completion of distributed embedded fuzing demonstration.			
Title: Guidance Technologies ***Description:*** Develop guidance technologies to improve the precision, controlled lethality, and flexibility of conventional, air-delivered munitions. Specific technical areas include precision navigation and terminal seekers. ***FY 2019 Plans:*** Continue hardware-in-the-loop and software-in-the-loop characterization air-to-air and air-to-ground guidance and control technologies. Continue integration of hardware-in-the-loop, software-in-the-loop, and other modeling and simulation (M&S) technologies for the demonstration of open architecture, high-speed, cooperative, and modular weapon munition concepts. Initiate the development of advanced modular and service oriented weapon architectures. Continue the design and development of seeker subsystem prototypes for platform self-defense. Continue development of advanced, high-resolution infrared (IR) scene projectors,distributed simulation concepts, software defined radio frequency (RF) test chamber, scene generation, mission, engagement, campaign level simulations, and panoramic infrared dome technologies. Continue to develop technologies for precision navigation of weapons in Global Positioning System (GPS)-denied scenarios. Continue to mature and integrate advanced carriage and release concepts and sub-systems. Continue to refine and complete fabrication of M&S center and initiate processes to enable simultaneous multi-level security M&S activities. Continue lethality analyses of in-house and Air Force	36.871	45.192	28.313

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603601F / *Conventional Weapons Technology*	**Project (Number/Name)** 63670A / *Weapon Technology Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
weapon concepts. Initiate the design of hotter/faster IR panoramic projector for advanced seeker testing. Initiate the integration of higher fidelity constructive analysis tools with engagement and mission level M&S. ***FY 2020 Plans:*** Complete hardware-in-the-loop and software-in-the-loop characterization air-to-air and air-to-ground guidance and control technologies. Continue integration of hardware-in-the-loop, software-in-the-loop, and other Modeling and Simulation technologies for the demonstration of open architecture, high-speed, cooperative, and modular weapon munition concepts. Continue the design and development of seeker subsystem prototypes for platform self-defense. Continue development of advanced, high-resolution infrared scene projectors, distributed simulation concepts, software defined Radio Frequency test chamber, scene generation, mission, engagement, campaign level simulations, and panoramic infrared dome technologies. Continue to develop technologies for precision navigation of weapons in Global Positioning System-denied scenarios. Continue to mature and integrate advanced carriage and release concepts and sub-systems. Complete fabrication of Modeling and Simulation center and initiate processes to enable simultaneous multi-level security Modeling and Simulation activities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 decreased compared to FY 2019 by $16.879 million. Funding decreased due to planned completion of multi-platform autonomy demonstration flight test, reduction of high-speed weapon component guidance research, and conclusion of modular weapon concept activities.			
Accomplishments/Planned Programs Subtotals	82.406	95.132	57.895

	FY 2018	FY 2019
Congressional Add: Program increase - rotary launcher development	0.000	10.000
FY 2018 Accomplishments: N/A		
FY 2019 Plans: Conduct Congressionally directed efforts		
Congressional Adds Subtotals	0.000	10.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603601F / *Conventional Weapons Technology*	**Project (Number/Name)** 63670A / *Weapon Technology Development*

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603601F / *Conventional Weapons Technology*	Project (Number/Name) 63670B / *Weapon Concept Development*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
63670B: *Weapon Concept Development*	-	75.270	99.624	167.922	0.000	167.922	154.953	140.512	150.837	154.512	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, refines, integrates, demonstrates, and assesses ordnance and guidance technologies to reduce risk for potential air-launched conventional weapons acquisitions. The project concentrates in two effort areas, Air-to-Air Concept Development and Air-to-Ground Concept Development. The project focuses on risk reduction of advanced explosives, fuzes, warheads, sub-munitions, and weapon airframes, carriage and dispensing; as well as innovative munition seekers, weapon aerodynamics, navigation and control, and guidance subsystem integration/simulation.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Air-to-Air Concept Development	20.098	30.188	81.207
Description: Mature, integrate, and demonstrate air-to-air weapon components and systems (ordnance, guidance, and carriage and release technologies) to demonstrate war-fighter capability. ***FY 2019 Plans:*** Continue to demonstrate weapon integration concepts for air target engagement. Continue planning and technology risk reduction for weapon concepts responsive to the 2030 timeframe threat environment (including air-to-air weapons for both offensive and defensive purposes). Continue to test prototype propulsion systems to demonstrate attributes to meet next-generation air-to-air weapon requirements. Continue to conduct lethality studies to enable design of small form factor self-defense of an air platform. Continue to develop preliminary design of air-to-air weapon concepts for sixth generation platforms. Continue to conduct wind-tunnel and limited flight experiments to characterize air-to-air maneuverability, range, and guidance and control for sixth generation weapon concept. Continue to conduct ground and arena tests of advanced weapons experimental-carriages for sixth generation weapon concept and prepare for flight worthiness testing. Continue to mature simulation architectures to assess the trades and synergies between kinetic and directed energy weapons. Continue to incorporate higher fidelity methodologies into systems level analysis including joint weapons effectiveness. Initiate highly agile airframe flight test planning. ***FY 2020 Plans:*** Continue developing the technology trade space to enable air-to-air weapons with robust capability in the future-years threat environment, including technologies for efficient propulsion, high lethality, efficient flight/high-agility, miniaturization, and cost and risk reduction for both offensive and defensive purposes. Continue to develop and test prototype propulsion systems with flexibility to enable more adaptable next generation air-to-air weapons. Continue to conduct lethality studies to enable design of small form factor warheads lethal against the future plus target set. Continue to develop preliminary design of air-to-air weapon concepts for sixth generation platforms. Continue to document missile flight dynamics trade space and conduct wind-tunnel			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603601F / *Conventional Weapons Technology*	**Project (Number/Name)** 63670B / *Weapon Concept Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
experiments to characterize airframes and validate aerodynamic codes leading to development of highly maneuverable and efficient missiles to counter advanced targets, and improve persistence and survivability of future platforms. Continue to conduct ground and arena tests of advanced weapons experimental-carriages for sixth generation weapon concept and prepare for flight worthiness testing. Continue to mature simulation architectures to assess the trades and synergies between kinetic and directed energy weapons. Continue to incorporate higher fidelity methodologies into systems level analysis including joint weapons effectiveness and perform experiments with small warheads to obtain data for lethality analysis and validate designs. Continue to plan and execute highly agile airframe ground tests and integrated sub-system experimentation. Initiate planning for major subsystem component tests to verify baseline performance for future counter-air application and platform integration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 increased compared to FY 2019 by $51.019 million. Funding increased due to significant expansion of test and experimentation activity related to counter-air technology development, miniaturization of weapon and munition component technology and subsystems, multiple ground and environmental tests, modeling and data reduction, and supporting analysis.			
Title: Air-to-Ground Concept Development	55.172	69.436	86.715
Description: Mature, integrate, and demonstrate air-to-ground weapon components and systems (ordnance, guidance, and carriage and release technologies) to demonstrate war-fighter capability. ***FY 2019 Plans:*** Complete to investigate concepts for cooperative control /multi-hit of small weapons to produce scalable effects to increase the capacity and capability of fifth generation aircraft. Complete competitive contractor processes to develop flying experimental concepts of the subsonic, standoff, low cost cruise missile capability. Continue to conduct relevant long range strike weapon technology demonstrations to reduce risk for potential follow-on acquisition programs, and finalize system detailed design for flying hypersonic munition demonstrator flight. Continue the development of munition concepts to incorporate technologies for carriage and terminal impact at high speed. Continue planning and technology risk reduction including demonstration and initial flight testing for weapons concepts responsive to the future-year threats timeframe threat environment (including hypersonic and cooperative/collaborative concepts). Continue to mature simulation architectures to assess the trades and synergies between kinetic and directed energy weapons. Continue to incorporate higher fidelity methodologies into systems level analysis including joint weapons effectiveness and to apply methodology to support future air dominance analysis. Continue to investigate kinetic/ non-kinetic payloads, networking, seeker, fuze, and defense countermeasures technology for hypersonic applications. Initiate system integration of algorithms and radios onto pathfinder weapon system to enable synchronized collaborative weapon effects. ***FY 2020 Plans:*** Complete low-cost cruise missile/small engine flight test demo. Continue to conduct relevant long range strike weapon technology demonstrations to reduce risk for potential follow-on acquisition programs, and finalize system detailed design for			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603601F / *Conventional Weapons Technology*	**Project (Number/Name)** 63670B / *Weapon Concept Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
flying hypersonic munition demonstrator flight. Continue the development of munition concepts to incorporate technologies for carriage and terminal impact at high speed. Continue planning and technology risk reduction including demonstration and initial flight testing for weapons concepts responsive to the future-year time-frame threat environment (including hypersonic and cooperative/collaborative concepts). Continue to mature simulation architectures to assess the trades and synergies between kinetic and directed energy weapons. Continue to incorporate higher fidelity methodologies into systems level analysis including joint weapons effectiveness and to apply methodology to support future air dominance analysis. Continue to investigate kinetic/ non-kinetic payloads, seeker, and fuze technology for hypersonic applications. Continue system integration of algorithms and software defined radios onto pathfinder weapon system to enable synchronized collaborative weapon effects. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 increased compared to FY 2019 by $17.279 million. Funding increased due to significant development and integration of hardware, software, and modeling capability to support next-generation munitions and weapons effects.			
Accomplishments/Planned Programs Subtotals	75.270	99.624	167.922

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.