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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2023 Air Force **Date:** April 2022

<b>Appropriation/Budget Activity</b> 3620F: <i>Research, Development, Test &amp; Evaluation, Space Force I BA 7: Operational Systems Development</i>	<b>R-1 Program Element (Number/Name)</b> PE 1203913SF / <i>NUDET Detection System (SPACE)</i>
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COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	-	29.157	45.887	80.429	0.000	80.429	93.588	86.600	76.954	78.453	Continuing	Continuing
672808: <i>Nuc Detonation Det Sys (sensors)</i>	-	29.157	45.887	80.429	0.000	80.429	93.588	86.600	76.954	78.453	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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

The United States Nuclear Detonation (NUDET) Detection System (USNDS) provides a near real-time worldwide, highly survivable/endurable capability to detect, locate, and report any nuclear detonations in the earth's atmosphere or in near space. USNDS supports NUDET detection requirements across five mission areas: Integrated Tactical Warning and Attack Assessment (ITW/AA), Nuclear Force Management (NFM), Space Control, Treaty Monitoring, and a classified mission.

The USNDS program is jointly sponsored and funded by the Department of Defense (DoD), through the Space Force, and the Department of Energy (DOE), through the National Nuclear Security Administration (NNSA) and its Nuclear Detonation Detection (NA-22) office, respectively. NNSA/NA-22 supplies USNDS space sensors as Government Furnished Equipment to the Space Force's USNDS Program Office, which is responsible for all acquisition and Systems Engineering, Integration and Test activities on Space Vehicles (SVs), to include Global Positioning System (GPS) and additional hosts, and their supporting ground control segments. The AF directly funds the development of the USNDS ground segment (described below).

DoD funds their contribution to the USNDS program 1203913SF, Research, Development, Test and Evaluation, Space Force (RDT&E, SF), Procurement, Space Force, and Operations and Maintenance.

USNDS consists of space sensors and complex ground segments. The space segment sensors, funded by DOE, consists of three nuclear detection sensor payloads: the Radiation Detection Capability (RADEC) payload for Defense Support Program (DSP) satellites, the Global Burst Detection (GBD) payload for Medium Earth Orbit platforms (GPS satellites), and the Space Atmospheric Burst Reporting System (SABRS) payload for Geosynchronous Earth Orbit (GEO) platforms (classified GEO host), and Space Test Platform 3. Together, these sensors and associated communications capability provided by the host satellites comprise the global NUDET space segment detection capability for the USNDS. Space sensors communicate NUDET indications to the fixed ground segment, the RADEC Data Processor, and the Integrated Correlation and Display System (ICADS), the five deployable mobile ground segment survivable Ground Nuclear Detonation Detection System Terminals (GNTs), and the survivable/endurable Universal Ground NDS Terminals (UGNTs), when operationally accepted in 4th Quarter of FY 2023. The ground segment provides ground receiving analysis and reporting capabilities to national authorities, commands, and forward users as well as Department of State for the Treaty Monitoring and Verification mission. The ground control segment is being modernized and continuously improved through an incremental, evolutionary acquisition approach.

The upgrades to the GNTs are the survivable/endurable UGNT which are funded with RDT&E in this program. The UGNT provides NUDET Detection Reports to end users through survivable/endurable USNDS communications via MilStar/Future Communication Systems (FCS)/Advanced Extremely High Frequency (AEHF) circuits.

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<p>The GNT supports ITW/AA and NFM missions. The UGNT program modifies the baseline of the GNT subsystem and deploys as an integral part of the Space Based Infrared System Survivable (SBIRS) / Endurable Evolution (S2E2) Mobile Ground System (MGS) (SMGS) units also in support of ITW/AA and NFM. The UGNT, when integrated with the SMGS, will perform NUDET event processing with fused NDS data from GPS and DSP. SMGS capability refers to the result of the S2E2 upgrade program for the MGS mission processing capability, including the integration of UGNT. The intended end state of UGNT integration is delivery of enhanced NUDET detection capabilities which meet survivable/endurable attack assessment requirements directed by the President, Secretary of Defense, Joint Staff, USSPACECOM, and USSTRATCOM, delivering long-term, cost effective, multi-role, multi-mission space effects to warfighters across the range of military operations.</p> <p>ICADS 7 was a new start in FY 2022. ICADS 7 upgrades the ICADS 6 baseline necessary to process future GPS IIIF satellites GBD USNDS messages, address technology obsolescence, and meet updated cybersecurity requirements for system resiliency.</p> <p>This budget line includes systems engineering, research and development, on-orbit and field testing and end-to-end verification of USNDS space sensors, ground analysis and reporting systems in support of the five USNDS mission areas. Sensor integration for GPS III and GPS III Follow-on (IIIF) are funded in their respective programs.</p> <p>Space acquisition must respond with speed and agility to emerging adversary threats. Space Systems Command (SSC) has transformed the organization and implementation of space acquisition to an enterprise approach, maximizing innovation and resiliency, leveraging international, commercial, and mission partnerships, and managing program/project priorities according to an integrated unclassified/classified enterprise space architecture. Expanding the appropriate acquisition authorities and contract mechanisms to deliver capability sooner, SSC will strategically execute experimentation, prototyping, risk reduction, and other efforts to develop new or repurpose capabilities.</p> <p>This program may include necessary civilian pay expenses required to manage, execute, and deliver NUDET Detection System (SPACE) weapon system capability. The use of such program funds is in addition to the civilian pay expenses budgeted in programs 1206392SF and 1206398SF.</p> <p>This program is in Budget Activity 7, Operational System Development because this budget activity includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate production funding in the current or subsequent fiscal year.</p>		

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<b>Appropriation/Budget Activity</b> 3620F: <i>Research, Development, Test &amp; Evaluation, Space Force I BA 7: Operational Systems Development</i>	<b>R-1 Program Element (Number/Name)</b> PE 1203913SF / <i>NUDET Detection System (SPACE)</i>
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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023 Base</b>	<b>FY 2023 OCO</b>	<b>FY 2023 Total</b>
Previous President's Budget	29.157	45.887	0.000	0.000	0.000
Current President's Budget	29.157	45.887	80.429	0.000	80.429
Total Adjustments	0.000	0.000	80.429	0.000	80.429
• 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	0.000	0.000			
• Other Adjustments	0.000	0.000	80.429	0.000	80.429

**Change Summary Explanation**

FY 2023: The FY 2022 President's Budget submittal did not reflect FY 2023 through FY 2026 funding. Therefore, an explanation of the change between the two budget positions for FY 2023 cannot be made in a relevant manner.

<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>
<p><b>Title:</b> Integration with SBIRS S2E2 Mobile Ground Terminals (SMGTs)</p> <p><b>Description:</b> Support the Integration and test activities between UGNTs and the SMGTs, which together provide NUDET Detection Reports and missile warning data to end users through survivable/endurable USNDS communications via MilStar/FCS/AEHF circuits. The UGNTs deploy as an integral part of the SMGS units also in support of ITW/AA and NFM. Support program scope analyzation for USNDS receiver and NUDET Decryption Unit (NDU) components. Additional support costs includes such activities as; receiver system engineering support, conceptual hardware and software design, check-out/support, testing, and system engineering.</p> <p><b>FY 2022 Plans:</b> Continue to support S2E2 integration and testing activities due to UGNT Concept of Operations (CONOPS) change. Funds are required to support additional integration activities between the UGNT and developing SMGT. The additional integration activities will mitigate technical and schedule inefficiencies due to a shift in the S2E2 CONOPS. Important activities include execution for UGNT dry runs, run for record, operational test and evaluation, and software updates for maintaining an accredited cybersecurity posture. Funds will also provide extended Interim Contract Support (ICS) as a direct result of the new CONOPS shift for the survivable and endurable mission.</p> <p><b>FY 2023 Plans:</b></p>	14.157	6.600	3.800

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>
<p>Complete UGNT integration and testing for the survivable and endurable mission necessary for S2E2/SMGT Operational Acceptance planned for 4th Quarter FY 2023. Provide Technical Order support, UGNT shelter maintenance, shipment of UGNT systems to operational locations, Installation and Checkout, and system testing at Continental United States (CONUS) and Outside CONUS locations.</p> <p><b>FY 2022 to FY 2023 Increase/Decrease Statement:</b> FY 2023 funding decreased due to planned completion of UGNT integration with S2E2 Mobile Ground Terminals.</p>				
<p><b>Title:</b> GEO Payload Integration</p> <p><b>Description:</b> Classified Integration efforts of the GEO payload. This effort is not a new start. It changed title from SABRS Integration to GEO Payload Integration to accurately describe the effort.</p> <p><b>FY 2022 Plans:</b> Classified</p> <p><b>FY 2023 Plans:</b> N/A</p> <p><b>FY 2022 to FY 2023 Increase/Decrease Statement:</b> FY 2023 funding decreased due to completion of GEO payload integration effort in FY 2022.</p>		15.000	3.000	0.000
<p><b>Title:</b> ICADS 7</p> <p><b>Description:</b> ICADS 7 consists of satellite ground data processing systems that accommodate the new NDS payload on GPS IIIF SVs and is an upgrade to the current ICADS 6 system. ICADS 7 includes new software, hardware and cybersecurity capabilities and NDS Analysis Package Ground Station (NAPGS) ground systems. The effort includes, but not limited to, the upgrade of two new ICADS 7 test beds, the replacement of the NDU, Enhanced Receiver Subsystems (ERS), and Automated Data Processors (ADP). A non-recurring Engineering effort is required to design the replacements for the NDUs, ERSs and ADPs currently on USNDS tests beds and fielded systems. The ICADS upgrade includes data processing changes to support the new USNDS optical sensor, known as Spectral Imaging Geolocation Hyper-Temporal Sensor (SIGHTS), that will be hosted on the GPS IIIF SVs.</p> <p><b>FY 2022 Plans:</b> Begin ICADS 7 development including, but not limited to initial design, development of the NDU and ERS, new algorithms, and upgrade software and hardware to support the USNDS payload on GPS IIIF SVs. ICADS 7 activities also include systems engineering, program support, initial test planning, and finalizing requirements. ICADS ground system updates to command and control USNDS payloads, data acquisition, telemetry extraction, mission data processing, and data distribution for USNDS</p>		0.000	36.287	76.629

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>
<p>sensor payloads. ICADS 7 development includes GPS III F Mission Readiness Campaign (MRC) space segment test support, GPS III F Early Integration, on-orbit sensor integration, Functional Configuration Audit/Physical Configuration Audit (FCA/PCA) and Development, Testing and Evaluation requirements. Continue program office and other related support activities that may include, but not limited to, studies, technical analysis, prototyping, etc. ICADS 7 will complete System Requirements Review (SRR) in the 3rd quarter of 2022.</p> <p><b>FY 2023 Plans:</b> Continue to ramp up ICADS 7 development post SRR/Integrated Baseline Review including NDU, ERS, and software and hardware to support the USNDS payloads on GPS III F SVs. Continue systems engineering and test planning for GPS III F MRC, GPS III F Early Integration to include signal verification/data processing, on-orbit USNDS sensor integration, and FCA/PCA. Support next generation USNDS receiver development to include collaboration with National Security Agency for crypto enclosure framework/algorithms and upgrade ICADS testbeds to include tech refresh/hardware, initiate ground modifications to USNDS sensor payload command plans to meet more resilient GPS III F command and telemetry specifications, and begin NAPGS integration and testing. Complete long lead development of decryption unit, ICADS 7 ADP and SIGHTS ADP. Complete design through Preliminary Design Review (PDR) in 4th Quarter FY 2023 and prepare for Milestone B in 2nd Quarter FY 2024. Rapidly implement system resiliency and situational awareness necessary to operate in the contested space domain. Activities may include, but not limited to, program office support, studies, technical analysis, experimentation, prototyping, etc.</p> <p><b>FY 2022 to FY 2023 Increase/Decrease Statement:</b> FY 2023 funding increased due to ramp up of development activities to accomplish PDR, prepare for Milestone B, and plan integration and test with new GPS III F USNDS payload receivers and cryptography units.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	29.157	45.887	80.429

<b>D. Other Program Funding Summary (\$ in Millions)</b>										
<u>Line Item</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u> <u>Base</u>	<u>FY 2023</u> <u>OCO</u>	<u>FY 2023</u> <u>Total</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>Cost To</u> <u>Complete</u> <u>Total Cost</u>
• SPSF 01 01 Space Force NUDETS: <i>Nudet Detection Space</i>	6.638	6.690	7.062	-	7.062	0.000	0.000	0.000	-	Continuing Continuing

**Remarks**

**E. Acquisition Strategy**  
The USNDS Acquisition Strategy is to develop, integrate, field and sustain USNDS satellite sensors and USNDS ground data processing and distribution hardware and software as well as mission operational and technical program support to sustain the USNDS capability on GPS, DSP, Alternate Host, and SBIRS; funding is sent by Military Interdepartmental Purchase Request (MIPR) from DoD and DOE to Sandia, Los Alamos National Laboratories and other agencies on existing DOE/NNSA

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3620F: <i>Research, Development, Test &amp; Evaluation, Space Force I BA 7: Operational Systems Development</i>	PE 1203913SF / <i>NUDET Detection System (SPACE)</i>

contracts. The ICADS 7 Acquisition Strategy was approved in September 2021 to support planned sole source contract award in 3rd quarter FY 2022. USNDS ICS will continue until ICADS 7 contract has been awarded. USNDS requirements are defined in the Operational Requirements Document dated January 21, 2004.

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Air Force** **Date:** April 2022

<b>Appropriation/Budget Activity</b> 3620F / 7	<b>R-1 Program Element (Number/Name)</b> PE 1203913SF / NUDET Detection System (SPACE)	<b>Project (Number/Name)</b> 672808 / Nuc Detonation Det Sys (sensors)
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<b>Product Development (\$ in Millions)</b>				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
USNDS ICADS, GNT/UGNT, and Integration Support	MIPR	Sandia National Laboratory : Albuquerque, NM	-	8.479	Nov 2020	6.600	Nov 2021	3.800	Nov 2022	-		3.800	Continuing	Continuing	-
USNDS Technical Mission Analysis	RO	Aerospace : El Segundo, CA	-	0.846	Dec 2020	1.522	Nov 2021	1.853	Nov 2022	-		1.853	Continuing	Continuing	-
USNDS Enterprise SE&I	Various	TASC : El Segundo, CA	-	0.903	Dec 2020	0.833	Nov 2021	2.513	Nov 2022	-		2.513	Continuing	Continuing	-
Classified Development	TBD	Classified : Classified	-	15.000	Jan 2021	3.000	Nov 2021	-		-		-	Continuing	Continuing	-
ICADS 7	MIPR	Sandia National Laboratory : Albuquerque, NM	-	-		26.135	May 2022	62.209	Nov 2022	-		62.209	Continuing	Continuing	-
<b>Subtotal</b>			-	25.228		38.090		70.375		-		70.375	Continuing	Continuing	N/A

<b>Test and Evaluation (\$ in Millions)</b>				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
USNDS On-orbit Sensor Testing	MIPR	Various : LANL, SNL, NM	-	1.977	Dec 2020	3.368	Dec 2021	3.747	Nov 2022	-		3.747	Continuing	Continuing	-
<b>Subtotal</b>			-	1.977		3.368		3.747		-		3.747	Continuing	Continuing	N/A

<b>Management Services (\$ in Millions)</b>				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
USNDS FFRDC	RO	Aerospace, MITRE : El Segundo, CA	-	0.352	Dec 2020	0.750	Nov 2021	0.913	Nov 2022	-		0.913	Continuing	Continuing	-
USNDS A&AS	Various	Various : Various	-	1.569	Nov 2020	3.599	Nov 2021	5.314	Nov 2022	-		5.314	Continuing	Continuing	-
USNDS Other Support	Various	Various : Various	-	0.031	Nov 2020	0.080	Nov 2021	0.080	Nov 2022	-		0.080	Continuing	Continuing	-
<b>Subtotal</b>			-	1.952		4.429		6.307		-		6.307	Continuing	Continuing	N/A



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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2023 Air Force			<b>Date:</b> April 2022
<b>Appropriation/Budget Activity</b> 3620F / 7	<b>R-1 Program Element (Number/Name)</b> PE 1203913SF / NUDET Detection System (SPACE)	<b>Project (Number/Name)</b> 672808 / Nuc Detonation Det Sys (sensors)	

FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

<b>UGNT</b>	
Integration between UGNTs and the S2E2 SMGTs	
<b>Geosynchronous Earth Orbit (GEO) Payload</b>	
GEO Payload Integration	
<b>ICADS 7</b>	
ICADS 7 Development	
System Requirements Review (SRR)	
Preliminary Design Review (PDR)	
Milestone B	
Critical Design Review (CDR)	
Test Readiness Review (TRR)	

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2023 Air Force		<b>Date:</b> April 2022
<b>Appropriation/Budget Activity</b> 3620F / 7	<b>R-1 Program Element (Number/Name)</b> PE 1203913SF / <i>NUDET Detection System (SPACE)</i>	<b>Project (Number/Name)</b> 672808 / <i>Nuc Detonation Det Sys (sensors)</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>UGNT</b>				
Integration between UGNTs and the S2E2 SMGTs	1	2021	4	2023
<b>Geosynchronous Earth Orbit (GEO) Payload</b>				
GEO Payload Integration	1	2021	4	2022
<b>ICADS 7</b>				
ICADS 7 Development	3	2022	4	2027
System Requirements Review (SRR)	4	2022	4	2022
Preliminary Design Review (PDR)	4	2023	4	2023
Milestone B	2	2024	2	2024
Critical Design Review (CDR)	4	2024	4	2024
Test Readiness Review (TRR)	1	2027	1	2027