Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force											Date: February 2020	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 1203913F / *NUDET Detection System (SPACE)*							
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
Total Program Element	-	21.578	49.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	70.878
672808: *Nuc Detonation Det Sys (sensors)*	-	21.578	49.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	70.878
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In FY2021, PE1203913F, NUDET Detection System (SPACE) efforts were transferred to Appropriation 3620, Research, Development, Test & Evaluation, Space Force, PE 1203913F, NUDET Detection System (SPACE) from Appropriation 3600, Budget Activity 07 due to the creation of a new Appropriation for Space Force.

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 (SC), Treaty Monitoring (TM), and a classified mission.

The USNDS program is jointly sponsored and funded by the Department of Defense (DoD), through the Air Force (AF), 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 (GFE) to the AF's USNDS Program Office, which is responsible for all acquisition and Systems Engineering, Integration and Test (SEI&T) 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 in Program Element (PE) 1203913F with Research, Development, Test and Evaluation (RDT&E), Space Procurement, Air Force (SPAF), and Operations and Maintenance (O&M).

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 (MEO) 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 (STP) 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 (RDP), 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 fielded. The ground segment provides ground receiving analysis and reporting capabilities to national authorities, commands, and forward users as well as Department of State (DOS) for the Treaty Monitoring and Verification mission. The ground control segment is being modernized and continuously improved through an incremental, evolutionary acquisition approach.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
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The upgrades to the GNTs are the survivable/endurable UGNT which are funded with RDT&E in this PE. The UGNT provides NUDET Detection Reports to end users through survivable/endurable USNDS communications via Milstar/Advanced Extremely High Frequency (AEHF) circuits. The GNT supports ITW/AA and NFM missions. The UGNT program modifies the baseline of the GNT program and deploys as an integral part of the Space Based Infrared System Survivable (SBIRS) / Endurable Evolution (S2E2) Mobile Ground System (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 Mobile Ground System (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 (SECDEF), Joint Staff, and USSTRATCOM, delivering long-term, cost effective, multi-role, multi-mission space effects to the war fighter across the range of military operations.

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 IIIF are funded in their respective PEs.

Space acquisition must respond with speed and agility to emerging adversary threats. Space & Missile Systems Center (SMC) is transforming 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, SMC will strategically execute experimentation, prototyping, risk reduction, and other efforts to develop new or repurpose capabilities.

This PE 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 PEs 1206392F and 1206398F.

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.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	19.778	49.300	14.162	0.000	14.162
Current President's Budget	21.578	49.300	0.000	0.000	0.000
Total Adjustments	1.800	0.000	-14.162	0.000	-14.162
• 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	1.800	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	-14.162	0.000	-14.162

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*

Change Summary Explanation

FY2019: +$1.800M Reprogramming to align with SBIRS S2E2 Integration

FY 2021: -$14.162M; funds starting in FY 2021 were transferred from RDT&E, Air Force to RDT&E, Space Force.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Universal Ground NDS Terminals (UGNT) ***Description:*** The five UGNT trailers provide NUDET Detection Reports to end users through survivable/endurable USNDS communications via Milstar/AEHF circuits. The UGNT program modifies the baseline of the GNT program and deploys as an integral part of the SMGS units also in support of ITW/AA and NFM. UGNT delivers NUDET detection capabilities that meet survivable/endurable tactical warning and attack assessment requirements directed by the President, SECDEF, Joint Staff and USSTRATCOM delivering long-term, cost effective, multi-role, multi-mission space effects to the warfighter across the range of military operations. ***FY 2020 Plans:*** N/A ***FY 2021 Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A	3.815	0.000	0.000
Title: Systems Engineering/On-Orbit Support & Testing ***Description:*** Support costs included such activities as, on-orbit USNDS sensor integration, check-out/support, testing and system engineering. ***FY 2020 Plans:*** N/A ***FY 2021 Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A	3.240	0.000	0.000
Title: Integration with SBIRS S2E2 Mobile Ground Terminals (SMGTs) and On-orbit support	14.523	22.802	0.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Description: Support the Integration and test activities between UGNTs and the S2E2 SMGTs, which together provide NUDET Detection Reports and missile warning data to end users through survivable/endurable USNDS communications via Milstar/AEHF circuits. The UGNTs deploy as an integral part of the SBIRS S2E2 SMGS units also in support of ITW/AA and NFM. Support program scope analyzation for USNDS receiver and Integrated Data Denial (IDD) components. Additional support costs includes such activities as; receiver system engineering support, on-orbit NDS sensor integration, conceptual hardware and software design, check-out/support, testing, and system engineering. ***FY 2020 Plans:*** Perform series of Force Package (FPAK) High Altitude Electromagnetic Pulse (HEMP) tests on second and fifth UGNT. Conduct FPAK training activities. Support FPAK Operation Testing with FPAK unit one, two, and three. Continue to support integration activities with SBIRS S2E2 program. Support launch and checkout of USNDS payloads on GPS III Space Vehicle (SV) 02 and SV 03. Continue on-orbit system engineering analysis of the USNDS fleet. Provide SE&I, technical support and program technical support for the five USNDS mission areas. Continue Contingency Operations (COps) on-orbit support for checkout of all GPS III satellites on-orbit. Continue program office and other related support activities that may include, but are not limited to studies, technical analysis, prototyping, etc. ***FY 2021 Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A			
Title: USNDS System Engineering and Architecture Design ***Description:*** The future USNDS build consists of an ICADS satellite ground data processing system and UGNT trailers that accommodate the new NDS payload on GPS IIIF family of vehicles and are an upgrade to the current USNDS 6 program. USNDS ICADS reports endoatmospheric, transition and near-space nuclear detonations as detected by the USNDS sensors aboard the GPS satellites, DSP satellites and SABRS equipped satellites. ICADS processes NDS, State-of-Health (SOH), and navigation data from GPS IIIF. USNDS UGNT provide NUDET Detection Reports to end users through survivable/endurable USNDS communications via Milstar/AEHF circuits. USNDS also consists of the Integrated Data Denial (IDD). IDD is a Communications Security (COMSEC) device associated with the USNDS. IDD provides decryption of satellite position data and NDS sensor data used to detect, locate, and report nuclear detonations in earth's atmosphere or near-space in near real time. This IDD effort contains cryptographic modifications mandated by National Security Agency (NSA). In addition, parts obsolescence requires the start of a new IDD design and manufacturing effort. ***FY 2020 Plans:***	0.000	26.498	0.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
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C. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Support program scope analyzation for USNDS receiver and Integrated Data Denial (IDD) components. Performed database replacement evaluation and conceptual architecture design requirements. Preparation and execution of requirements definition and decomposition. Support optical algorithm study, system readiness review material development preparation and Hard Radiation Sensor (HRS), Electro Magnetic Pulse (EMP) and Spectral Imaging Geolocation Hyper-Temporal Sensor (SIGHTS) telemetry definitions. Continue program office and other related support activities that may include, but are not limited to studies, technical analysis, prototyping, etc. ***FY 2021 Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A			
Accomplishments/Planned Programs Subtotals	21.578	49.300	0.000

D. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• SPAF 01 Line Item NUDETS: *Nudet Detection Sys Space*	9.205	7.432	-	-	-	-	-	-	-	0.000	16.637

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, and an Alternate Host; funding is sent by Military Interdepartmental Purchase Request (MIPR) from DoD and DOE to Sandia, Lawrence Livermore, Los Alamos National Laboratories and other agencies on existing DOE/NNSA contracts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force			Date: February 2020
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*	**Project (Number/Name)** 672808 / *Nuc Detonation Det Sys (sensors)*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USNDS ICADS, GNT/ UGNT, and Integration Support	MIPR	Sandia National Laboratory : Albuquerque, NM	-	13.251	Nov 2018	12.183	Nov 2019	-		-		-	Continuing	Continuing	-
USNDS Technical Mission Analysis	MIPR	Aerospace : El Segundo, CA	-	1.942	Nov 2018	1.932	Dec 2019	-		-		-	Continuing	Continuing	-
USNDS Enterprise SE&I	C/CPAF	TASC : El Segundo, CA	-	1.140	Dec 2018	0.869	Dec 2019	-		-		-	Continuing	Continuing	-
USNDS System Engineering and Architecture	MIPR	Sandia National Labs : Albuquerque, NM	-	-		26.498	Jan 2020	-		-		-	Continuing	Continuing	-
		Subtotal	-	16.333		41.482		-		-		-	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USNDS Testing	Various	17th Test Squadron, JITC : Schriever AFB, CO	-	0.315	Dec 2018	0.130	Dec 2019	-		-		-	Continuing	Continuing	-
USNDS On-orbit Sensor Testing	MIPR	Various : LANL, SNL, NM	-	3.100	Dec 2018	3.915	Dec 2019	-		-		-	Continuing	Continuing	-
		Subtotal	-	3.415		4.045		-		-		-	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USNDS FFRDC	Various	Aerospace, MITRE : El Segundo, CA	-	0.761	Dec 2018	2.344	Dec 2019	-		-		-	Continuing	Continuing	-
USNDS A&AS	Various	Various : Various	-	0.989	Nov 2018	1.349	Nov 2019	-		-		-	Continuing	Continuing	-
USNDS Other Support	C/CPAF	Various : Various	-	0.080	Nov 2018	0.080	Nov 2019	-		-		-	Continuing	Continuing	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*	**Project (Number/Name)** 672808 / *Nuc Detonation Det Sys (sensors)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	-	1.830		3.773		-		-		-	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	21.578		49.300		-		-		-	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*	**Project (Number/Name)** 672808 / *Nuc Detonation Det Sys (sensors)*

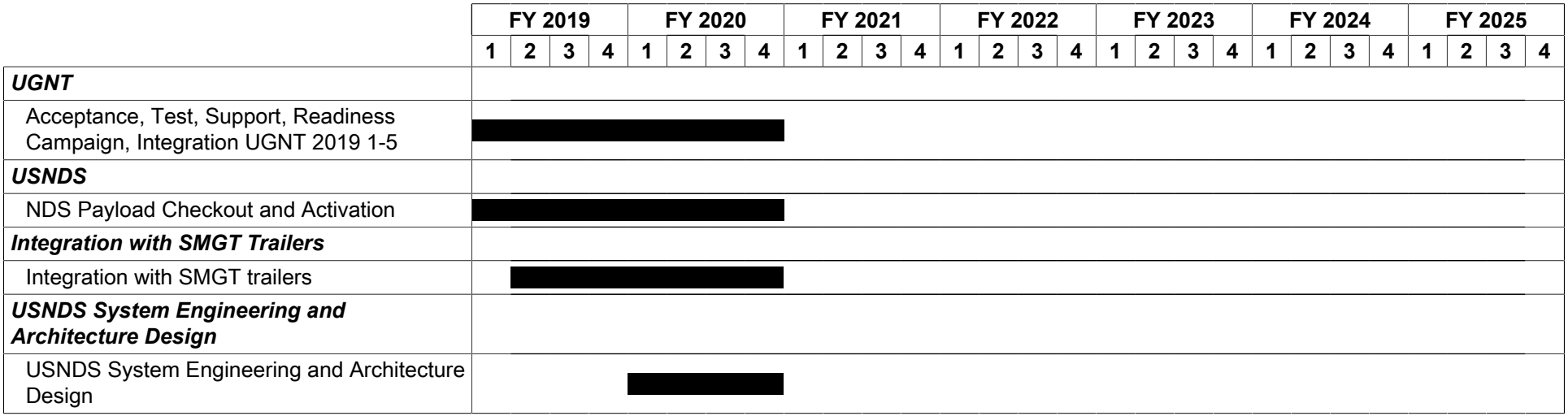

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*	**Project (Number/Name)** 672808 / *Nuc Detonation Det Sys (sensors)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UGNT				
Acceptance, Test, Support, Readiness Campaign, Integration UGNT 2019 1-5	1	2019	4	2020
USNDS				
NDS Payload Checkout and Activation	1	2019	4	2020
Integration with SMGT Trailers				
Integration with SMGT trailers	2	2019	4	2020
USNDS System Engineering and Architecture Design				
USNDS System Engineering and Architecture Design	1	2020	4	2020