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 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 1203913F / *NUDET Detection System (SPACE)*							
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	-	31.304	19.778	49.300	0.000	49.300	14.162	14.456	14.719	0.000	Continuing	Continuing
672808: *Nuc Detonation Det Sys (sensors)*	-	31.304	19.778	49.300	0.000	49.300	14.162	14.456	14.719	0.000	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This program, BA 7, PE 1203913F, project 672808, USNDS 7, is a new start.

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 (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 NDS 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 2020 Air Force	Date: February 2019
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The upgrade to the GNT is the survivable/endurable UGNT which is 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.

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 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force	Date: February 2019
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B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	31.508	19.778	16.972	0.000	16.972
Current President's Budget	31.304	19.778	49.300	0.000	49.300
Total Adjustments	-0.204	0.000	32.328	0.000	32.328
• Congressional General Reductions	-0.204	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	32.328	0.000	32.328

Change Summary Explanation

FY 2020: +26.498M to fund USNDS 7 Ground System (New Start); +5.830M to fund SBIRS S2E2 Integration Efforts

C. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Universal Ground NDS Terminals (UGNT)	22.267	3.872	0.000

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 2019 Plans:

Deliver the fifth UGNT trailer to the SBIRS S2E2 program for integration into the S2E2 Force Package (FPAK). Conduct integration and testing of UGNT vehicles one through four with S2E2. Continue rapid response to implement system resiliency and situational awareness necessary to operate in the contested space domain. Activities may include, but are not limited to program office support, studies, technical analysis, prototyping, etc. USNDS 6 program is complete after the delivery of the fifth UGNT trailer.

FY 2020 Plans:

N/A

FY 2019 to FY 2020 Increase/Decrease Statement:

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 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2020 decreased compared to FY 2019 by $3.872M. Justification for this decrease described in the plans above.			
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 2019 Plans:*** Support launch and checkout of USNDS payloads on GPS III SV01. Continue on-orbit system engineering analysis of the USNDS fleet. Provide Systems Engineering & Integration (SE&I), technical support and program technical support for the five USNDS mission areas. With the introduction of GPS III Contingency Operations (COps) in FY 2019, USNDS on-orbit support will be required for check-out of GPS III satellites already on orbit. USNDS will support Integration activities with the S2E2 SMGT trailers, Systems Engineering/On-Orbit Support & Testing cost after the delivery of the fifth UGNT trailer. ***FY 2020 Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 decrease compared to FY 2019 by $2.720M. Justification for this decrease described in the plans above.	9.037	2.720	0.000
Title: Integration with SBIRS S2E2 Mobile Ground Terminals (SMGTs) and On-orbit support ***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. Additional support costs includes such activities as, on-orbit NDS sensor integration, check-out/support, testing and system engineering. ***FY 2019 Plans:*** These efforts were previously justified under the project called UGNT and "Systems Engineering/On-Orbit Support & Testing". FY 19 plans include USNDS technical support for the integration efforts between UGNTs and SMGTs. Includes Systems Engineering/ On-Orbit Support and Testing costs after the delivery of the fifth UGNT trailer. ***FY 2020 Plans:*** Perform series of 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	0.000	13.186	22.802

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force	Date: February 2019
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C. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
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 COps on-orbit support for check-out of all GPS III satellites on orbit. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 increased compared to FY 2019 by $9.616M. Justification for this increase described in the plans above.			
Title: USNDS 7 ***Description:*** USNDS 7 consists of an ICADS 7 satellite ground data processing system and UGNT trailers that accommodate new NDS payload on GPS IIIF family of vehicles and are an upgrade to the current USNDS 6 program. USNDS 7 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 Build 7 process NDS, State-of-Health (SOH), and navigation data from GPS IIIF. USNDS 7 UGNT provide NUDET Detection Reports to end users through survivable/endurable USNDS communications via Milstar/AEHF circuits. USNDS 7 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 2019 Plans:*** N/A ***FY 2020 Plans:*** Begin USNDS 7 to include, but is not limited to initial design, development of the IDD, new algorithms, and the upgrade of ICADS software and hardware to support the USNDS payload on GPS IIIF. USNDS 7 also includes system engineering, program support, initial test planning, and finalizing requirements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 increased compared to FY 2019 by $26.498M. Justification for this increase described in the plans above.	0.000	0.000	26.498
Accomplishments/Planned Programs Subtotals	31.304	19.778	49.300

D. Other Program Funding Summary ($ in Millions)

Line Item	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
• SPAF 01 Line Item NUDETS: *Nudet Detection Sys Space*	6.370	7.705	7.432	-	7.432	6.645	6.780	6.907	0.000	Continuing	Continuing

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force	Date: February 2019
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D. Other Program Funding Summary ($ in Millions)

Line Item	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

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.

F. 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-3, RDT&E Project Cost Analysis: PB 2020 Air Force			Date: February 2019
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 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USNDS ICADS, GNT/ UGNT, and Integration Support	MIPR	Sandia National Laboratory : Albuquerque, NM	-	21.451	Nov 2017	11.451	Nov 2018	12.183	Nov 2019	-		12.183	Continuing	Continuing	-
USNDS Technical Mission Analysis	MIPR	Aerospace : El Segundo, CA	-	1.882	Nov 2017	1.942	Nov 2018	1.932	Dec 2019	-		1.932	Continuing	Continuing	-
USNDS Enterprise SE&I	C/CPAF	TASC : El Segundo, CA	-	1.140	Dec 2017	1.140	Dec 2018	0.869	Dec 2019	-		0.869	Continuing	Continuing	-
USNDS 7	MIPR	Sandia National Labs : Albuquerque, NM	-	-		-		26.498	Nov 2019	-		26.498	Continuing	Continuing	-
		Subtotal	-	24.473		14.533		41.482		-		41.482	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USNDS Testing	Various	17th Test Squadron, JITC : Schriever AFB, CO	-	0.692	Dec 2017	0.315	Dec 2018	0.130	Dec 2019	-		0.130	Continuing	Continuing	-
USNDS On-orbit Sensor Testing	MIPR	Various : LANL, SNL, NM	-	3.200	Dec 2017	3.100	Dec 2018	3.915	Dec 2019	-		3.915	Continuing	Continuing	-
		Subtotal	-	3.892		3.415		4.045		-		4.045	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USNDS FFRDC	Various	Aerospace, MITRE : El Segundo, CA	-	0.879	Nov 2017	0.761	Dec 2018	2.344	Dec 2019	-		2.344	Continuing	Continuing	-
USNDS A&AS	Various	Various : Various	-	1.980	Nov 2017	0.989	Nov 2018	1.349	Nov 2019	-		1.349	Continuing	Continuing	-
USNDS Other Support	C/CPAF	Various : Various	-	0.080	Nov 2017	0.080	Nov 2018	0.080	Nov 2019	-		0.080	Continuing	Continuing	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Air Force		Date: February 2019
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	-	2.939		1.830		3.773		-		3.773	Continuing	Continuing	N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	31.304		19.778		49.300		-		49.300	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Air Force		Date: February 2019
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)*

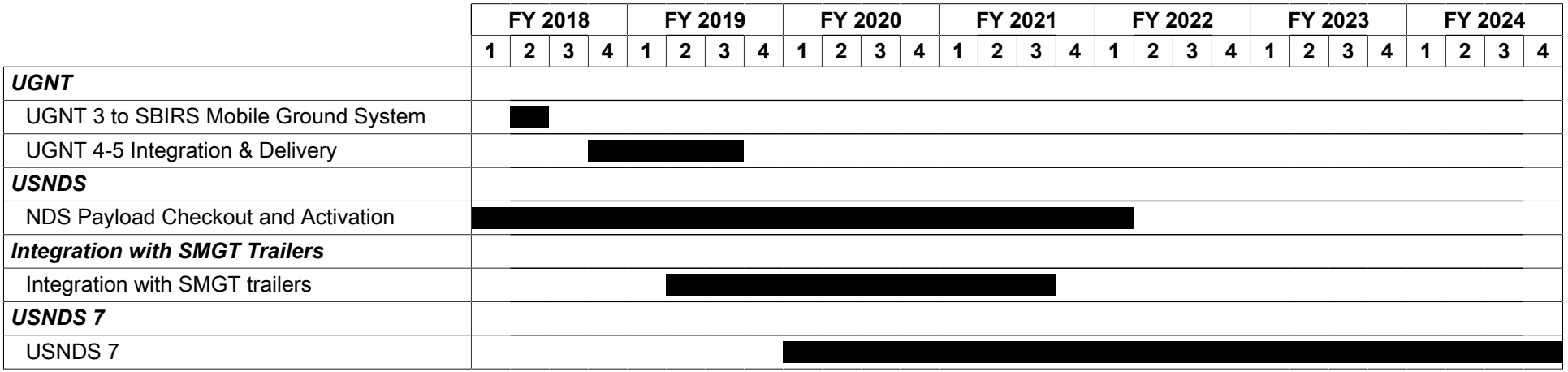

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 1203913F / *NUDET Detection System (SPACE)*	**Project (Number/Name)** 672808 / *Nuc Detonation Det Sys (sensors)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UGNT				
UGNT 3 to SBIRS Mobile Ground System	2	2018	2	2018
UGNT 4-5 Integration & Delivery	4	2018	3	2019
USNDS				
NDS Payload Checkout and Activation	1	2018	1	2022
Integration with SMGT Trailers				
Integration with SMGT trailers	2	2019	3	2021
USNDS 7				
USNDS 7	1	2020	4	2024