| Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Navy | Date: February 2015 |
|---|---|
| **Appropriation/Budget Activity**<br>1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development* | **R-1 Program Element (Number/Name)**<br>PE 0305160N *I Navy Meteorological and Ocean Sensors-Space(METOC)* |

| COST ($ in Millions) | Prior Years | FY 2014 | FY 2015 | FY 2016 Base | FY 2016 OCO | FY 2016 Total | FY 2017 | FY 2018 | FY 2019 | FY 2020 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Program Element | 1.558 | 0.726 | 0.359 | 0.599 | - | 0.599 | 60.679 | 0.680 | 0.677 | 0.691 | Continuing | Continuing |
| 0524: *Navy METOC Support (SPACE)* | 1.558 | 0.726 | 0.359 | 0.599 | - | 0.599 | 0.670 | 0.680 | 0.677 | 0.691 | Continuing | Continuing |
| 1452: *GEO SAT* | 0.000 | - | - | - | - | - | 60.009 | - | - | - | - | 60.009 |

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

This program element supports the Navy's requirements in meteorological and oceanographic (METOC) space-based remote sensors. These requirements include commitments to satellite, sensor, and operational demonstration/development activities as well as the transition to fleet applications associated with two satellite programs: 1) the joint Defense Meteorological Satellite Program (DMSP), 2) the Geodetic/geophysical Satellite (GEOSAT) Follow-On 2 (GFO-2) altimetry satellite funded entirely by Navy.

The Navy METOC Space-Based Sensing Capabilities project provides for Navy participation in Navy/Air Force cooperative efforts leading to DMSP sensor development, and specifically participation in the calibration and validation of instruments and delivery of satellite products to the fleet. The passive microwave instruments carried on the DMSP satellites provide global and atmospheric data of direct operational relevance, including sea surface wind, sea ice, and precipitation.

The GEOSAT Follow-On-2 (GFO-2) program will provide a polar-orbiting satellite that measures sea surface topography using a precise altimeter.
Both the GEOSAT Follow-On-2 and Navy METOC Support (Space) projects fulfill Navy's obligation to develop naval service-unique, mission critical space-based METOC technology.

| B. Program Change Summary ($ in Millions) | FY 2014 | FY 2015 | FY 2016 Base | FY 2016 OCO | FY 2016 Total |
|---|---|---|---|---|---|
| Previous President's Budget | 0.742 | 0.359 | 0.645 | - | 0.645 |
| Current President's Budget | 0.726 | 0.359 | 0.599 | - | 0.599 |
| Total Adjustments | -0.016 | - | -0.046 | - | -0.046 |
| • Congressional General Reductions | - | - | | | |
| • Congressional Directed Reductions | - | - | | | |
| • Congressional Rescissions | - | - | | | |
| • Congressional Adds | - | - | | | |
| • Congressional Directed Transfers | - | - | | | |
| • Reprogrammings | - | - | | | |
| • SBIR/STTR Transfer | -0.016 | - | | | |
| • Rate/Misc Adjustments | - | - | -0.046 | - | -0.046 |

| Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Navy | Date: February 2015 |
|---|---|
| **Appropriation/Budget Activity**<br>1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development* | **R-1 Program Element (Number/Name)**<br>PE 0305160N *I Navy Meteorological and Ocean Sensors-Space(METOC)* |

**Change Summary Explanation**

The FY 2016 funding request was reduced by $0.1 million to account for the availability of prior year execution balances.

Schedule: The Navy has delayed all Geodetic/geophysical Satellite (GEOSAT) Follow-On 2 (GFO-2) altimetry satellite development efforts until FY 2017.

| Exhibit R-2A, RDT&E Project Justification: PB 2016 Navy | | | Date: February 2015 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | Project (Number/Name)<br>0524 / *Navy METOC Support (SPACE)* | |

| COST ($ in Millions) | Prior Years | FY 2014 | FY 2015 | FY 2016 Base | FY 2016 OCO | FY 2016 Total | FY 2017 | FY 2018 | FY 2019 | FY 2020 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0524: *Navy METOC Support (SPACE)* | 1.558 | 0.726 | 0.359 | 0.599 | - | 0.599 | 0.670 | 0.680 | 0.677 | 0.691 | Continuing | Continuing |
| Quantity of RDT&E Articles | | - | - | - | - | - | - | - | - | - | | |

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

The Meteorology and Oceanography (METOC) Space-Based Sensing Capabilities project provides for Navy participation in the Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/Imager and Special Sensor Microwave Imager Sounder calibration/validation efforts in support of the fleet operational requirements. The passive microwave instrument carried on DMSP provides global oceanic and atmospheric data of direct operational relevance, including sea surface wind speed, sea ice, and precipitation.

The METOC Space-Based Sensing Capabilities project ensures the naval service's operational requirements are satisfied primarily through demonstration of technologies for inclusion on operational constellations such as DMSP, the Joint Polar Satellite System (JPSS) and the National Oceanic and Atmospheric Administration's Geostationary Operational Environmental Satellites (GOES). These efforts fulfill naval service unique requirements that are not funded within the DMSP, JPSS or GOES programs, and are in accordance with current inter-agency agreements.

The primary focus of the FY 2016 request is to continue assessment of planned environmental satellite sensor launches scheduled in FY16.

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2014 | FY 2015 | FY 2016 Base | FY 2016 OCO | FY 2016 Total |
|---|---|---|---|---|---|
| ***Title:*** METOC Space-Based Sensing Capabilities | 0.726 | 0.359 | 0.599 | - | 0.599 |
| ***Articles:*** | - | - | - | - | - |
| ***FY 2014 Accomplishments:***<br>Continued performance assessment on National Polar-orbiting Operational Environmental Satellite System Preparatory Project (NPP) and Defense Meteorological Satellite Program (DMSP) satellite sensor suites. Continued assessment of planned Joint Polar Satellite System (JPSS) sensors and assessment of other national, commercial, and foreign earth observing satellite system's sensor data for use in Navy Atmospheric and Oceanographic Prediction Models. | | | | | |
| ***FY 2015 Plans:***<br>Continue performance assessment of planned national earth observing satellite system's sensor data Sentinel 3a and 3b launch for use in Navy Atmospheric and Oceanographic Prediction Models. | | | | | |
| ***FY 2016 Base Plans:*** | | | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2016 Navy | | Date: February 2015 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | **Project (Number/Name)**<br>0524 / *Navy METOC Support (SPACE)* |

| B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each) | FY 2014 | FY 2015 | FY 2016 Base | FY 2016 OCO | FY 2016 Total |
|---|---|---|---|---|---|
| Continue performance assessment on NPP and DMSP satellite sensor suites. Continue assessment of planned environmental satellite sensor launches such as Geostationary Operational Environmental Satellite R-Series (GOES-R) and Global Change Observation Mission (GCOM) W-2 scheduled in FY16.<br>***FY 2016 OCO Plans:***<br>N/A | | | | | |
| **Accomplishments/Planned Programs Subtotals** | 0.726 | 0.359 | 0.599 | - | 0.599 |

**C. Other Program Funding Summary ($ in Millions)**

| Line Item | FY 2014 | FY 2015 | FY 2016 Base | FY 2016 OCO | FY 2016 Total | FY 2017 | FY 2018 | FY 2019 | FY 2020 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| • RDTEN/0603207N/2342: *METOC DATA ASSIMILATION AND MOD* | 9.942 | 4.937 | 8.168 | - | 8.168 | 9.372 | 9.430 | 10.107 | 10.290 | Continuing | Continuing |
| • OPN/4226: *Meteorological Equipment* | 19.118 | 12.825 | 15.090 | - | 15.090 | 13.397 | 12.992 | 13.342 | 13.132 | Continuing | Continuing |

**Remarks**

**D. Acquisition Strategy**

Naval service unique, space based Meteorology and Oceanography (METOC) requirements. Particular sensors or data sources with unique naval service mission needs are targeted to accelerate acquisition or ensure threshold accomplishment of Joint or converged national program plans. The Joint Polar Satellite System (JPSS) program will collect global microwave radiometry and sounding data to produce microwave imagery and other meteorological and oceanographic data. Conical Microwave Imager Sounder (CMIS) can be viewed as the follow-on instrument to the Special Sensor Microwave (SSM) instruments Navy developed for the Defense Meteorological Satellite Program. These CMIS sensors will be acquired as part of the JPSS architecture which supports these Navy requirements in the future. Maintenance of rigorous sensor calibration and data validation for operational SSM instruments continues along with algorithm development in support of fleet applications. The Advanced Altimeter technologies will improve radar altimeter resolution and aerial coverage to support Navy requirements for sea surface topography measurement in the littorals.

**E. Performance Metrics**

Goal: Provide precise and near real-time METOC forecasting to the warfighter using existing and future space-based satellite derived data, including ocean surface wind speed, rain rate, ice concentration, and soil moisture measurements.
Metric: Provide precise ocean surface wind speed within plus or minus 2.0 meters per second, the rain over land and ocean rate within plus or minus 5.0 millimeters per hour, soil moisture measurements within plus or minus 10%; and sea ice concentrations within plus or minus 10%.

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2016 Navy | | | Date: February 2015 |
|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | R-1 Program Element (Number/Name)<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | Project (Number/Name)<br>0524 / *Navy METOC Support (SPACE)* | |

**Product Development ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2014 Cost | FY 2014 Award Date | FY 2015 Cost | FY 2015 Award Date | FY 2016 Base Cost | FY 2016 Base Award Date | FY 2016 OCO Cost | FY 2016 OCO Award Date | FY 2016 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Software Development | WR | Naval Research Laboratory : Monterey, CA | 1.272 | 0.601 | Nov 2013 | 0.289 | Nov 2014 | 0.483 | Nov 2015 | - | | 0.483 | Continuing | Continuing | Continuing |
| | | **Subtotal** | 1.272 | 0.601 | | 0.289 | | 0.483 | | - | | 0.483 | - | - | - |

**Support ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2014 Cost | FY 2014 Award Date | FY 2015 Cost | FY 2015 Award Date | FY 2016 Base Cost | FY 2016 Base Award Date | FY 2016 OCO Cost | FY 2016 OCO Award Date | FY 2016 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Support | WR | SSC Pacific : San Diego, CA | 0.230 | 0.100 | Nov 2013 | 0.050 | Nov 2014 | 0.083 | Nov 2015 | - | | 0.083 | Continuing | Continuing | Continuing |
| | | **Subtotal** | 0.230 | 0.100 | | 0.050 | | 0.083 | | - | | 0.083 | - | - | - |

**Management Services ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2014 Cost | FY 2014 Award Date | FY 2015 Cost | FY 2015 Award Date | FY 2016 Base Cost | FY 2016 Base Award Date | FY 2016 OCO Cost | FY 2016 OCO Award Date | FY 2016 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acquisition Management | C/CPFF | PSS/BAH : San Diego, CA | 0.056 | 0.025 | Nov 2013 | 0.020 | Nov 2014 | 0.033 | Nov 2015 | - | | 0.033 | Continuing | Continuing | Continuing |
| | | **Subtotal** | 0.056 | 0.025 | | 0.020 | | 0.033 | | - | | 0.033 | - | - | - |

| | Prior Years | FY 2014 | | FY 2015 | | FY 2016 Base | | FY 2016 OCO | | FY 2016 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Cost Totals** | 1.558 | 0.726 | | 0.359 | | 0.599 | | - | | 0.599 | - | - | - |

**Remarks**

| Exhibit R-4, RDT&E Schedule Profile: PB 2016 Navy | | Date: February 2015 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | **Project (Number/Name)**<br>0524 / *Navy METOC Support (SPACE)* |

| | FY 2014 | | | | FY 2015 | | | | FY 2016 | | | | FY 2017 | | | | FY 2018 | | | | FY 2019 | | | | FY 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 |
| ***Proj 0524*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Navy METOC Support (SPACE): Schedule Detail | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Exhibit R-4A, RDT&E Schedule Details: PB 2016 Navy | | Date: February 2015 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | **Project (Number/Name)**<br>0524 / *Navy METOC Support (SPACE)* |

## Schedule Details

| | Start | | End | |
|---|---|---|---|---|
| **Events by Sub Project** | **Quarter** | **Year** | **Quarter** | **Year** |
| ***Proj 0524*** | | | | |
| Navy METOC Support (SPACE): Schedule Detail | 1 | 2014 | 1 | 2020 |

| Exhibit R-2A, RDT&E Project Justification: PB 2016 Navy | | | | | | | | | | | Date: February 2015 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>1319 / 7 | | | | | R-1 Program Element (Number/Name)<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | | | | Project (Number/Name)<br>1452 / *GEO SAT* | | | |
| **COST ($ in Millions)** | **Prior Years** | **FY 2014** | **FY 2015** | **FY 2016 Base** | **FY 2016 OCO** | **FY 2016 Total** | **FY 2017** | **FY 2018** | **FY 2019** | **FY 2020** | **Cost To Complete** | **Total Cost** |
| 1452: *GEO SAT* | - | - | - | - | - | - | 60.009 | - | - | - | - | 60.009 |
| Quantity of RDT&E Articles | | - | - | - | - | - | - | - | - | - | | |

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

This project provides a Polar-orbiting satellite (the Geodetic/geophysical Satellite (GEOSAT) Follow-On 2 (GFO-2)) that measures sea surface topography using a precise altimeter. Mission data will be collected by the Spacecraft Operations Center and passed to the Payload Operations Center, and Altimetry Data Fusion Center, which are co-located at the Naval Oceanographic Office, Stennis Space Center, MS. Mission data is used in global and regional scale ocean forecast models. GFO-2 will provide a capability for precise mesoscale (e.g., fronts and eddies) and basin-scale oceanography. This capability will support tactical anti-submarine warfare, mine warfare, naval special warfare mission planning, tactical decision aids, and sensor/weapon performance prediction. GFO-2 will also provide an undersea warfare battlespace characterization capability that supports submarine detectability, weapon settings, sound velocity profiles, tropical cyclone intensity, and track forecasts.

GFO-2 data will be made freely available to other agencies, such as the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration, who value its input to studies involving global warming and climate change, including El Nino Southern Oscillation effects.
Ocean topography data was previously provided by GEOSAT from 1985 until the satellite failed in January 1990. The Geodetic/geophysical Satellite Follow-On satellite was launched in February 1998 and deorbited in November 2008. The GEOSAT GFO-2 will provide for the continuation of this capability.

The Navy has delayed all Geodetic/geophysical Satellite (GEOSAT) Follow-On 2 (GFO-2) altimetry satellite development efforts until FY 2017.

**B. Accomplishments/Planned Programs ($ in Millions)**

N/A

**C. Other Program Funding Summary ($ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

Navy will revise Acquisition Strategy to support restart in FY17.

**E. Performance Metrics**

Goal: Provide Meteorology and Oceanography (METOC) GEOSAT derived mission data to improve the accuracy of global and regional scale oceanographic forecast models.
Metric: Anti-Submarine Warfare capability is highly dependent on the operational environment. GEOSAT Follow-On 1 demonstrated that a space based altimeter provided the equivalent of approximately a 500-fold increase in available subsurface observations and a 10-fold increase in available surface observations, critical

| Exhibit R-2A, RDT&E Project Justification: PB 2016 Navy | | Date: February 2015 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | **Project (Number/Name)**<br>1452 / *GEO SAT* |

to characterization of the ocean environment and oceanographic modeling. War-gaming models show that this increased knowledge of the subsurface acoustic propagation resulting from one altimeter reduced the probability of losing a ship to subsurface attack from 80% to 20% for various scenarios.

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2016 Navy | | Date: February 2015 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | **Project (Number/Name)**<br>1452 / *GEO SAT* |

**Product Development ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2014 Cost | FY 2014 Award Date | FY 2015 Cost | FY 2015 Award Date | FY 2016 Base Cost | FY 2016 Base Award Date | FY 2016 OCO Cost | FY 2016 OCO Award Date | FY 2016 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product Development | TBD | TBD : TBD | 0.000 | - | | - | | - | | - | | - | 60.009 | 60.009 | - |
| | | **Subtotal** | 0.000 | - | | - | | - | | - | | - | 60.009 | 60.009 | - |

| | Prior Years | FY 2014 | | FY 2015 | | FY 2016 Base | | FY 2016 OCO | | FY 2016 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Cost Totals** | 0.000 | - | | - | | - | | - | | - | 60.009 | 60.009 | - |

**Remarks**

| Exhibit R-4, RDT&E Schedule Profile: PB 2016 Navy | | Date: February 2015 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | **Project (Number/Name)**<br>1452 / *GEO SAT* |

| | FY 2014 | | | | FY 2015 | | | | FY 2016 | | | | FY 2017 | | | | FY 2018 | | | | FY 2019 | | | | FY 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 |
| ***Proj 1452*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GEO SAT: Schedule Detail | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Exhibit R-4A, RDT&E Schedule Details: PB 2016 Navy | | Date: February 2015 |
|---|---|---|
| **Appropriation/Budget Activity**<br>1319 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0305160N / *Navy Meteorological and Ocean Sensors-Space(METOC)* | **Project (Number/Name)**<br>1452 / *GEO SAT* |

## Schedule Details

| | Start | | End | |
|---|---|---|---|---|
| **Events by Sub Project** | **Quarter** | **Year** | **Quarter** | **Year** |
| ***Proj 1452*** | | | | |
| GEO SAT: Schedule Detail | 1 | 2017 | 4 | 2017 |