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ASSURED POSITIONING, NAVIGATION AND TIMING (A-PNT) REQUEST FOR INFORMATION (RFI)

1.0 DESCRIPTION

1.1. The Space and Naval Warfare Systems Command (SPAWAR), in support of the Program Executive Office Command, Control, Communications, Computers, and Intelligence (PEO C4I) Communications Program Office (PMW/A 170), and Program Executive Office Integrated Warfare Systems (PEO IWS) 6.0 is seeking information from industry on approaches, products and/or solutions for the development and implementation of an A-PNT Navigation Suite.

1.2. THIS IS A REQUEST FOR INFORMATION (RFI) ONLY. This RFI is issued solely for information and planning purposes and does not constitute a Request for Proposal (RFP) or a promise to issue an RFP in the future. Responses to this RFI are not offers and do not commit the Government to a contract for any supply or service whatsoever. At this time, the Navy is not seeking proposals and will not accept unsolicited proposals. Respondents are advised that the U.S. Government will not pay for any information or administrative costs incurred in response to this RFI and that all costs incurred or associated with responding to this RFI will be solely at the interested party's expense. Any businesses, regardless of size, having the capabilities to perform the tasking below are encouraged to reply to this RFI. Not responding to this RFI does not preclude participation in any future RFP, if any is issued. If an RFP is issued, it will be synopsisized on the FEDBIZOPPS website at <http://www.fbo.gov> and the SPAWAR e-Commerce Central website at <https://e-commerce.spawar.navy.mil>. It is the responsibility of the potential responders to monitor these sites for additional information pertaining to this requirement.

1.3. This RFI seeks information in the form of white paper descriptions of products and/or solutions for the development and implementation of an A-PNT Navigation Suite within the parameters set forth below. The Government is interested in innovative ways to enhance the future navigation suite to navigate in a GPS denied environment.

1.4. A Government sponsored Industry Day will be held 2 June 2015 in San Diego, California, occurring after Government evaluation of the submitted white papers. A plenary session will be conducted in which the Government will reiterate and clarify requirements and answer questions. Respondents will then be afforded an opportunity to present the products and/or solutions that were described in their white paper submissions, in scheduled one-on-one sessions with the Government.

2.0 BACKGROUND

PEO C4I and PEO IWS are responsible for the acquisition, integration, delivery, and support of interoperable communications and navigation systems enabling seamless operations for the fleet, joint and coalition warfighters. PEO C4I and PEO IWS are assessing alternatives for the development, acquisition, fielding, and maintenance of modern, robust, secure, integrated and interoperable network-centric A-PNT capabilities for the fleet.

This Request for Information and subsequent Industry Day will assist the Government in developing an Analysis of Alternatives (AoA) to support future acquisition planning and activities. The Government is in the material solution planning stage only for this technology and has not incorporated the A-PNT requirements into a Government Program of Record (PoR). The Government is conducting this RFI and Industry Day to assist in the analysis of technologies and solutions for use in future acquisition planning activities.

The Government anticipates an A-PNT Suite will be an ensemble of navigation sensors and systems that may use internal and external references. The Government is specifically interested in solutions that do not require an extra-platform data link to provide valid PNT information. The A-PNT Suite will compute

and provide uninterrupted PNT information with a degree of accuracy sufficient to meet mission requirements. Reported parameters will include but are not limited to three dimensional position, velocities and accelerations, both linear and angular, attitude and attitude rates (as required), time, and frequency in the formats required by shipboard user systems. The heart of the A-PNT Suite will be based on Global Positioning System (GPS) and the Inertial Navigation System (INS). The future GPS implementation for surface platforms will be instantiated by the GPS-Based Position, Navigation, and Timing Service (GPNTS), which will distribute requisite information across the appropriate networks and interfaces to shipboard combat, weapons, and C4I systems as necessary. For submarine platforms, the Enhanced Control Display Unit (ECDU) provides the GPS implementation, collection and distribution architecture. The INS implementation will be instantiated by the INS-Replacement for both surface and submarine platforms. GPNTS and INS-R will be in the baseline for the future navigation suite.

Fleet operations could continue weeks at a time without reliable GPS information. An affordable family of navigation systems, coherently organized into a single System of Systems Architecture (SoSA) will be necessary to ensure that PNT information can still be generated within such an environment to a level that will facilitate mission success.

2.1. Current Navigation Suite

Current shipboard navigation Programs of Record (PoRs) are resident within SPAWAR Fleet Readiness Directorate (FRD) and PEO IWS. The Government anticipates that an A-PNT architecture will enhance and provide redundant, supplementary PNT data in the absence of reliable PNT data from the current navigation systems, as detailed below. The Government does not intend that an A-PNT suite will replace any of the current programs of record detailed below, rather the Government is interested in alternative ways in acquire the navigation data these systems provide.

NAVSSI currently serves as the primary source for PNT information on major combatants and will be replaced by GPNTS beginning in the FY20 timeframe. NAVSSI is an unclassified system designed to integrate the inputs of the various shipboard navigation sensor data and provide the best common PNT data solution to shipboard users. NAVSSI hosts dual redundant GPS receivers and a precise time source which includes a rubidium clock for time and frequency generation with a holdover capability in the absence of the GPS primary reference source. NAVSSI also implements a Navigation Source Integration (NSI) software application that performs reasonability checks on incoming sensor data, identifies the best quality inputs for position, velocities, and accelerations, and distributes to platform users the best measurements along with a blended solution. NAVSSI incorporates a wide variety of external interface protocols and hardware architectures for communication with sensor systems, users, and platform networks.

The AN/WRN-6(V) serves as a source for PNT information on non-major combatants, including more than 200 U.S. Navy surface, USCG, and Military Sealift Command (MSC) platforms. It also serves as a tertiary navigation aid on 30 U.S. submarines.

The current legacy PoRs within PEO IWS include the AN/WSN-7/7A Ring Laser Gyro Navigator (RLGN) INS, AN/WSN-2/2A Stabilized Gyrocompass, AN/WSN-7B Ring Laser Gyrocompass (RLG), Electro-magnetic (EM) Logs, Digital EM Logs (DEML) Digital Flux Gate Magnetic Compass (DFGMC) and Battle Force Tactical Trainer (BFTT) Navigation Simulator (NAVSIM). The Government anticipates an A-PNT suite will provide alternative acquisition methods to the data these systems provide, as detailed below.

The AN/WSN-7/7A is the primary source of Ships Attitude (roll, pitch, heading) and Attitude rate data and provides a position and velocity to platform users.

The AN/WSN-2/2A Stabilized Gyrocompass Set is a legacy gyrocompass that provides attitude data platforms users. These units are being replaced by the AN/WSN-7B Ring Laser Gyrocompass (RLG).

The gyrocompasses serve as the primary attitude source for those platforms not equipped with the AN/WSN-7.

The legacy speed log systems are the Electro-magnetic (EM) Logs and Digital EM Logs (DEML). They measure own ship speed (OSS) relative to the water in a single axis, and distance traveled from a given starting point. Various versions are provided to all Navy platforms. These systems are being replaced by the Digital Hybrid Speed Log (DHYSL) which will provide the baseline for an enhanced speed determination.

DFGMC systems are electronic magnetic compass systems, which use digital processing techniques to determine the heading of the vessel referenced to magnetic North.

BFTT is designed to provide coordinated, realistic shipboard multi-mission and multi-warfare training. This capability includes the ability to provide a simulated at-sea environment to include simulated navigation. The BFTT NAVSIM provides simulated own ship position and motion data to NAVSSI for distribution during BFTT training exercises.

2.2. Planned Production

A-PNT Suite ship sets may be composed of sensors, systems, and software solutions developed and produced by multiple industry entities. An acquisition and integration strategy remains to be determined. The results of this RFI will inform the capability development process. Procurement activities, if any, would begin in the FY2018 through FY2022 time frame.

3.0 TECHNICAL DISCUSSION AND REQUESTED INFORMATION

3.1. General Architecture

A-PNT solution space includes sensors, systems, and software solutions. A-PNT sensors and systems would interface with the applicable PNT collection and distribution infrastructure (as instantiated in either the GPNTS or ECDU architecture). If appropriate, software solutions may be considered for hosting on, and integration with the existing PNT infrastructure, to include replacement or augmentation of existing software. The data collection and distribution infrastructure for A-PNT includes a processing capability for the evaluation of available navigation sources and integration of those sources into a common A-PNT solution.

Particular attention should be given to multi-sensor integration of PNT data, agnostic of the source. Both sensors and software should deliver/handle the body of requisite data, accuracies, probabilities and solution sets to allow for the optimal navigation solution in both GPS uninterrupted and impeded environments without operator input. Sensors and systems to be considered for an A-PNT architecture could provide all, or any subset, of the following navigation-related parameters, or measurements essential to the calculation of these parameters:

- Three dimensional position (location) of the sensor or system directly relatable to the WGS-84 reference frame
- Three dimensional velocity
- Three dimensional acceleration
- Three dimensional jerk
- Pitch, pitch rate, and pitch acceleration
- Heading, heading rate, and heading acceleration
- Roll, roll rate, and roll acceleration
- Depth
- Precise Time directly relatable to Universal Coordinated Time (UTC) as defined by the US Naval Observatory
- Precise and stable time interval

- Precise and stable frequency

Software solutions will fuse the above-stated parameters into a blended PNT solution, to include integrity and reasonableness assessments resulting in the selection of the best measurements and parameters and the rejection of measurements that are not consistent with the ensemble of available measurements. Sensors, systems, and software solutions that are inherently resistant to manipulation or denial of service are a high priority to the Government in developing the capabilities for an A-PNT architecture.

Note that, in accordance with Public Law 111–383 Section 913, any solution incorporating a new GPS receiver must include the ability of that receiver to use the M-Code signal-in-space.

Figure 1 depicts the notional functional block diagram of the envisioned A-PNT Suite, and illustrates the solution space under consideration. The A-PNT Suite will support mission critical PNT data services for weapons, navigation, and other systems requiring navigation information.

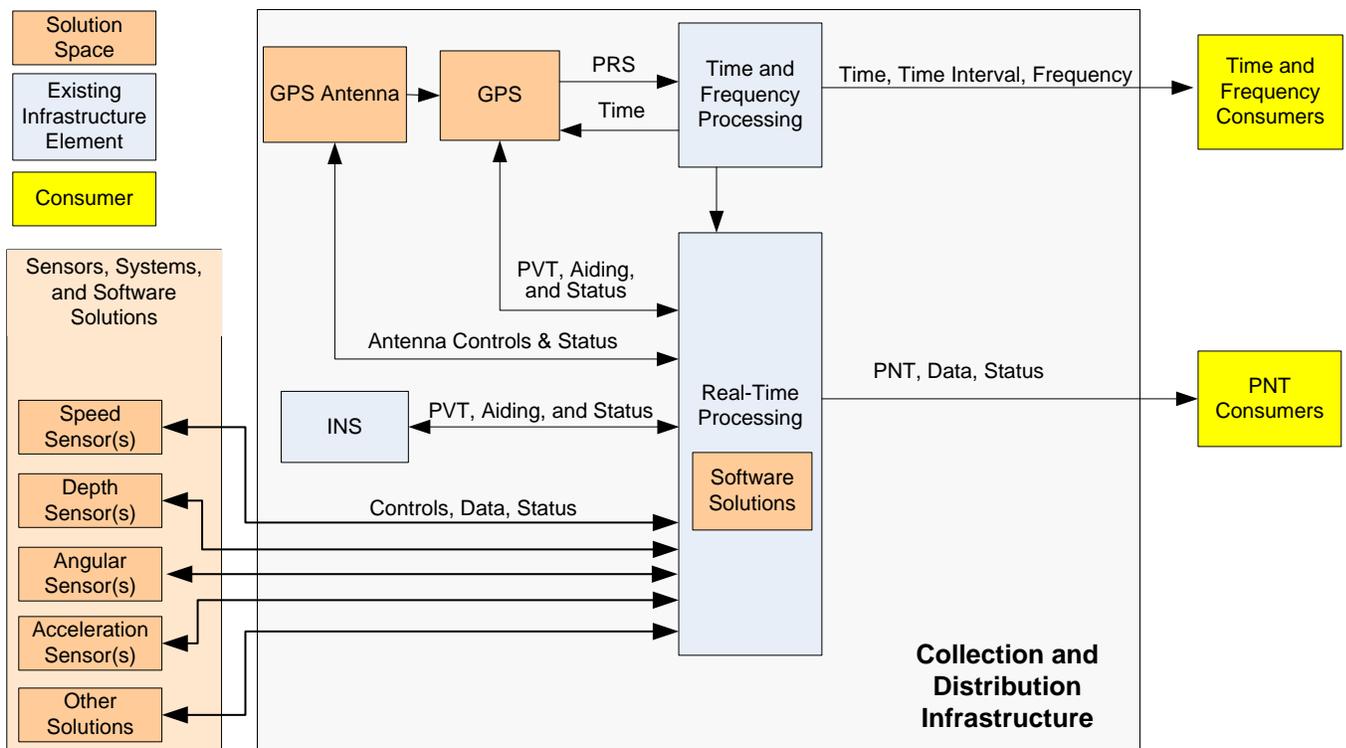


Figure 1. Notional A-PNT Architecture

3.2. Security

The A-PNT Suite will provide services to various mission critical systems such as combat and weapons systems. The PNT data is unclassified and used by all classification enclaves; therefore, the A-PNT Suite must operate at the UNCLASSIFIED level, which can then provide the PNT data to higher classified systems.

3.3. Open System Architecture

The Government is interested in sensors and systems with non-proprietary interfaces external to the subject sensor or system, to include the specifications applicable to input data, operating environment, calibration, output accuracy, and any performance limitations. Detailed design of the technologies implemented to achieve the posited performance may be held as proprietary; however, a functional description of the technology, to include principles of operation and limitations must be provided with

sufficient detail to assess the legitimacy of the posited performance in response to this RFI. Additionally, the Government is interested in software solutions with a non-proprietary application program interface; all required input parameters must be identified in order to assess the legitimacy of the software in response to the requirements in this RFI.

3.4. Reference Documentation

Two technical reference documents, listed in Appendix B, associated with the A-PNT requirements can be accessed from the following location: A-PNT RFI Project site on the NESI website, <https://nesi.spawar.navy.mil>. In order to obtain access to this secure website, each company must:

- 1) Sign and return the A-PNT Bidder's Repository Non-Disclosure Agreement (NDA) posted on the SPAWAR E-commerce website, entitled "Bidder's Repository NDA" to Michael Ferlo, michael.ferlo@navy.mil
- 2) Have an active DD 2345 on file with Defense Logistics Information Service (DLIS). If the company does not have an active DD 2345 on file and cannot provide a Joint Certification Program (JCP) number, please visit DLIS at <http://www.dlis.dla.mil/jcp/> for more information on how to complete and submit the DD 2345.
- 3) Provide the e-mail address and phone number for each requested user, and the company's JCP number to, Michael Ferlo at michael.ferlo@navy.mil.

Each company may request NESI access for up to two representatives. Each user is required to be a U.S. DoD contractor and have a valid DoD or ECA issued PKI certificate to gain access to the website. If a requestor is a U.S. DoD contractor and does not have a valid DoD or ECA-issued PKI certificate, contact Michael Ferlo for further instruction. The Government will provide instructions on how to access the secured site to the approved company representatives after their Bidder's Repository NDAs have been received and JCP number verified.

3.5. Written Response

3.5.1. Response Content

Candidate organizations need not identify a complete A-PNT Suite solution. Interested parties are requested to respond in writing to this RFI with a single white paper per company in Microsoft Word for Office 2003-compatible format, no more than thirty (30) pages (not including the administrative information described in paragraph 4.2.1 and associated subparagraphs), 10 pt. Times New Roman font, to include the following content:

- 1 Provide a high level concept description of the sensor, system, or software solution, and how it satisfies the objectives discussed in this RFI.
- 2 Describe your capabilities to produce the sensor, system, or software solution identified in answer to this RFI. Respondents shall also describe whether the proposed solution/technology is currently deployed on any naval platform (surface ship or submarine).
- 3 Describe or indicate in accordance with the Technology Readiness Assessment Guidance (April 2011) the current state of technology readiness of the sensor, system, or software solution for operation in the surface and subsurface maritime environments.
- 4 Provide Rough Order of Magnitude (ROM) cost to the Government for the integration of the identified sensor, system, or software solution with the A-PNT Suite via the SoSA architecture.
- 5 Provide a per-unit ROM cost to the Government of the identified sensor, system, or licensed software solution (if applicable)
- 6 Identify Government Furnished Information (GFI) needed for development, production and integration of the identified sensor, system, or software solution.

- 7 Respondents shall identify the Size, Weight and Power (SWaP) required to enable the proposed solution/technology, parameter list, accuracies, availability (e.g., celestial tracker may not work under some environmental conditions), and any US or international standards (ISO, IEEE, STANAG, etc.) which have been incorporated into the design.
- 8 Describe how the proposed solution(s) adheres to Open Architecture (OA) standards (see references) allowing for simplified integration both within the A-PNT Suite, and eliminates proprietary or closed interfaces.
- 9 Described coverage of PNT capability gaps as identified in the Assured PNT Joint Capabilities Document (JCD) and Initial Capability Document (ICD).
- 10 Describe what factors the Government should consider in developing an acquisition strategy to encourage innovation and higher quality of proposed solutions.

4.0 RESPONSE SUBMITTAL

4.1. White papers are due **no later than 8 May 2015 at 12:00 PM Pacific Time**. Responses shall be submitted to via email only to Michael Ferlo at michael.ferlo@navy.mil. To aid the Government in its review and evaluation, any proprietary information submitted must be clearly marked and segregated. Please be advised that all submissions become Government property and will not be returned.

PEO C4I PMW/A 170 and PEO IWS 6.0 intend to utilize the following support contractors to assist in the handling, reviewing and processing of white papers: Booz Allen Hamilton, DCS Corporation, and Applied Research Lab/Penn State University (ARL/PSU). Respondents shall clearly identify in their submittals if the support contractors have permission to view the white papers. The Government intends to utilize findings from this RFI and subsequent Industry Day in developing the A-PNT Analysis of Alternatives, which is being conducted by the Applied Research Lab/Penn State University (ARL/PSU) and University Affiliated Research Center (UARC): Applied Physics Lab/Johns Hopkins University (ARL/JHU). Respondents shall clearly identify if information submitted as part of this RFI can be used as input into the Government's AoA.

If any respondent does not currently have a Proprietary Data Protection Agreement (PDPA) that would permit the below Government support contractor(s) to provide support in review of proprietary information in the white papers submitted in response to this RFI, the respondent is requested to either: 1) include a statement in the response to this RFI that the respondent will allow the Government to release proprietary data to the Government support contractor(s) identified below, or 2) execute PDPAs with these Government support contractor(s) for this purpose.

The points of contact for submission of the PDPA are:

Company: Booz Allen Hamilton (BAH)
POC: Carolyn Brown
Telephone Number: 520-257-1640
Email Address: brown_carolyn@bah.com

University Affiliated Research Center (UARC): Applied Research Lab/Penn State University (ARL/PSU)
POC: Natalie Nadianos
Telephone Number: 814-865-8082
Email Address: njn2@only.arl.psu.edu

University Affiliated Research Center (UARC): Applied Physics Lab/Johns Hopkins University (ARL/JHU)
POC: Kimberly Funk
Telephone Number: 240-228-3738
Email Address: Kimberly.Funk@jhuapl.edu

Company: DCS Corporation
POC: Tom Sgroi
Telephone Number: 571-227-6138
Email Address: tsgroi@dscorp.com

4.2. The white paper shall be comprised of two (2) sections.

4.2.1. Section 1 shall provide administrative information and shall include, at a minimum, the following information, without page limitations:

4.2.1.1. Name, mailing address, overnight delivery address (if different from mailing address), phone number, fax number, e-mail address of designated point of contact, Cage Code, and DUNS number.

4.2.1.2. Copies of executed PDPAs with the Government support contractors identified in Paragraph 4.1, or a statement of release permitting the Government to release respondent's proprietary data to the identified Government support contractors. In the absence of either executed PDPAs or a statement of release, the Government will assume that the respondent does NOT agree to the release of its proprietary information included in the response/submission to Government support contractors.

4.2.1.3. Business type (i.e., large business, small business, small disadvantaged business, 8(a)-certified small disadvantaged business, HUBZone small business, woman-owned small business, veteran-owned small business, service-disabled veteran-owned small business) based upon North American Industry Classification System (NAICS) code 334511, Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing. Please refer to Federal Acquisition Regulation (FAR) Part 19 for additional detailed information on Small Business Size Standards. The FAR is available at <http://www.acquisition.gov/comp/far/index.html>.

4.2.2 Section 2 of the white paper shall provide the information requested in Section 3.5 of this RFI and is limited to thirty (30) pages as stated in Section 3.5.

5.0 INDUSTRY EXCHANGES

An Industry Day will be held 2 June 2015, at the NTC Command Center at Liberty Station, in San Diego, California from 9:00 am to 5:00 pm. The NTC Command Center is located at Liberty Station, 2640 Historic Decatur Road, San Diego, CA, 92106.

The Industry Day will consist of a Government briefing session, followed by Q&A and scheduled individual meetings between the Government and company representatives. The Government briefing session will cover the Government's requirements followed by an open question session during which Industry will be allowed to ask general questions. Any questions asked during the open session shall be in writing and shall be submitted to the Industry Day facilitator prior to the start of the Q&A session. Questions presented at this time will be answered to the fullest extent possible; however, any changes or clarifications will be issued on the SPAWAR E-Commerce website. Full disclosure of the questions asked during the open Q&A session will also be issued on the website.

Following the Government's presentation and Q&A session, respondents will be afforded an opportunity to present the products and/or solutions that were described in their white paper submissions, in scheduled one-on-one meetings with the Government. The individual meetings between the Government and each company will allow the Government to ask additional questions and clarifications on the company's white paper submission as well as afford the company the time to present additional details on their solutions.

Industry representative attendees should arrive before 9:00 a.m. PDT for check-in and registration. Check-in will begin at 7:30 am and the conference will begin promptly at 9:00 a.m. PDT. No cameras, tape recorders, or other reproduction devices are allowed during Industry Day.

Reservations for the Industry Day are required in writing via e-mail to **Michael Ferlo** at michael.ferlo@navy.mil no later than **14 May 2015**. Please provide the names of each industry

representative planning to attend Industry Day. The number of representatives from each company is limited to two representatives from each company. A primary point of contact shall be annotated for any changes or questions. Upon receipt of reservation for Industry Day, the company will be provided the time slot for their one on one meeting with the Government.

6.0 QUESTIONS

Questions regarding this announcement shall be submitted in writing by e-mail to the Contracting Specialist Michael Ferlo, at michael.ferlo@navy.mil. Verbal questions will NOT be accepted. Questions will be answered by posting answers to the SPAWAR E-Commerce Central website; accordingly, questions shall NOT contain proprietary or classified information. The Government does not guarantee that questions will be answered.

APPENDIX A ACRONYM LIST

A-PNT	Assured Positioning, Navigation, and Timing
APL/JHU	Applied Physics Laboratory/Johns Hopkins University
ARL/PSU	Applied Research Laboratory/Penn State University
BAH	Booz Allen Hamilton
BFTT	Battle Force Tactical Trainer
CDU	Control Display Unit
CG	Guided-Missile Cruiser
CSG	Carrier Strike Group
CVN	Nuclear Powered Aircraft Carrier
DDG	Guided Missile Destroyer
DEML	Digital EM Log
DFGMC	Digital Flux Gate Magnetic Compass
DHYSL	Digital Hybrid Speed Log
DoDD	Department of Defense, Directive
DUNS	Dun and Bradstreet Number
ECDU	Enhanced Control Display Unit
EM	Electromagnetic Log
ESG	Expeditionary Strike Group
FAR	Federal Acquisition Regulation
FEDBIZOPPS	Federal Business Opportunities
FFG	Guided-Missile Frigate
FMS	Foreign Military Sales
FRD	Fleet Response Directorate
FY	Fiscal Year
GFI	Government Furnished Information
GPNTS	Global Positioning System Based Positioning, Navigation and Timing Service
GPS	Global Positioning System
ICD	Initial Capability Document
ID	Input Data
INS	Inertial Navigation System
JCD	Joint Capability Document
LCC	Amphibious Command Ship
LHA	Amphibious Assault Ship
LHD	Multi-Purpose Amphibious Assault Ship
LSD	Landing Ship, Dock

MAC	Mission Assurance Category
MCM	Mine Countermeasures
M-Code	Military Code
MSC	Military Sealift Command
NAICS	North American Industry Classification System
NAVSIM	Navigation Simulator
NAVSSI	Navigation Sensor System Interface
NSI	Navigation Source Integration
OA	Open Architecture
OSS	Own Ships Speed
PDPA	Proprietary Data Protection Agreement
PEO C4I	Program Executive Officer Command, Control, Communications, Computers and Intelligence
PEO IWS	Program Executive Officer Integrated Warfare Systems
PMW/A 170	Program Manager Warfare Communications
PNT	Positioning, Navigation and Timing
PoR	Program of Record
PRS	Primary Reference Source
PVT	Position, Velocity, Time
RFI	Request for Information
RFP	Request for Proposal
RLGN	Ring Laser Gyro Navigator
ROM	Rough Order of Magnitude
SCDU	Secondary Control Display Unit
SOA	Service Oriented Architecture
SoSA	System of Systems Architecture
SPAWAR	Space and Naval Warfare Systems Command
SSGN	Nuclear-Powered Cruise Missile Attack Submarine
SSN	Nuclear-Powered Attack Submarine
SWAP	Size, Weight and Power
T&F	Timing & Frequency
UARC	University Affiliated Research Center
USCG	United States Coast Guard
UTC	Universal Coordinated Time
WGS	World Geodetic System

APPENDIX B REFERENCE LIST

1. Public Law 111–383 Section 913 - M-Code signal-in-space (available on the internet)
2. Open Systems Architecture Contract Guidebook for Program Manager, Version 1.1, May 2013 (available on SPAWAR E-Commerce)
3. Joint PNT Assurance Initial Capability Document (ICD) (March 2010) approved 30 April 2010 (available on NESI)
4. PNT Joint Capability Document (JCD), USSTRATCOM/J84, September 2006 (available on NESI)
5. Technology Readiness Assessment (TRA) Guidance, April 2011 by Assistant Secretary of Defense for Research and Engineering (ASD(R&E)) (available on SPAWAR E-Commerce)