

Assured
Position,
Navigation, and
Timing (A-PNT)
for USMC
Ground Combat
Vehicles



DS Success Story

System Performance Analysis – Armored Reconnaissance Vehicle (ARV) Requirements Analysis Report – Assured Position, Navigation, and Timing (PNT) Study

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<p>Customer:</p>	<p>United States Marine Corps (USMC) Deputy Commandant Combat Development and Integration (DC CD&I) Capabilities Development Directorate (CDD) Ground Combat Element Division (GCED)</p>
<p>Challenge:</p>	<p>The USMC's current Amphibious Combat Vehicle (ACV) and future Advanced Reconnaissance Vehicle (ARV) designs rely on the Global Positioning System (GPS) as their primary source of position, navigation, and timing (PNT) signals which are susceptible to jamming, spoofing, and outages.</p> <p>The ACV's mission is to land and maneuver the surface assault elements of the landing force using ship-to-shore water mobility during amphibious operations to seize inland objectives and to conduct armored vehicle operations in subsequent actions ashore. The ACV must be capable of navigating a preplanned course</p>

	<p>while coming ashore to stay within a lane of maneuver that has been cleared of naval mines and other obstacles. Once ashore, the ACV will maneuver as a part of the armored Marine Air-Ground Task Force (MAGTF) and must be capable of traversing the same terrain as other key elements of the MAGTF while navigating to pre-determined waypoints.</p> <p>The ability of USMC combat vehicles to receive and employ accurate and reliable position, navigation, and timing information is essential to performing its mission during forcible entry operations and extended operations ashore. Booz Allen Hamilton was tasked with leading a study to assess operating in an environment where GPS is unavailable as a capability-based threat to inform a range of materiel solutions.</p>
<p>Approach:</p>	<p>Booz Allen Hamilton initiated and led a study that produced a detailed synopsis of the threat environment regarding the use of GPS-enabled devices, DoD-led efforts to address operating in GPS-denied environments, and potential materiel solutions that could be used to improve the ability of combat vehicles to continue to operate in degraded and denied environments.</p> <p>Booz Allen Hamilton reviewed and assessed the ACV's Validated Online Lifecycle Threat (VOLT) and associated threat modules to gather and document the threats to military GPS and PNT in unclassified terms. The understanding of the threats to PNT provided a knowledge base and starting point to conduct research into complementary and alternative technologies to GPS.</p> <p>The Booz Allen team identified and met with stakeholders and subject matter experts in the PNT community to expand upon its understanding of the threat environment, learn about current and emerging technologies that enable or support assured PNT, and gain valuable insight into ongoing DoD-led efforts to combat the GPS/PNT threat. Some of the assured PNT enabling technologies researched included the Chip-Scale Atomic Clock (CSAC), Selectively Available Anti-Spoofing Module (SAASM), Defense Advanced GPS Receiver (DAGR)/Enhanced D3 (ED3), Anti-Jam (AJ) antennas, and Inertial Navigation Systems (INS). These enabling technologies are used in many existing materiel solutions that can provide combat vehicles with improved performance when operating in GPS degraded or denied environments.</p> <p>Booz Allen Hamilton assessed several DoD-led assured PNT efforts for potential integration into USMC combat vehicles. The study team assessed the transition to Military-Code (M-code) for GPS devices led by the U.S. Air Force, the Resilient Software Assurance Modification (RASM) for DAGR, and the U.S. Army's Mounted-Assured Position, Navigation, and Timing (MAPS) program. The study team developed a brief and presented its findings to the ACV Capability Development Integrated Product Team (CD-IPT) which included several recommended courses of action (COAs).</p>
<p>Value:</p>	<p>The study recommended that the USMC's assault amphibian (AA) community should integrate the U.S. Army's Mounted Assured PNT (MAPS) Gen I system on both the Assault Amphibious Vehicle (AAV) and the ACV family of vehicles. The U.S. Army has already tested the MAPS Gen I system on several vehicle platforms and fielded it on the Stryker Infantry Fighting Vehicle (IFV). The USMC stands to benefit from better buying power and lower acquisition costs by integrating the Army's solution for assured PNT which will likely be fielded on thousands of Army vehicles.</p> <p>Since completion of the study, Program Manager Advanced Amphibious Assault (PM AAA) developed a program plan to integrate the MAPS Gen I system, and</p>

additionally an INS, on an AAV7A1 and to field the capability as soon as possible to AAV-equipped AA battalions. The Naval Information Warfare Center (NIWC) Atlantic recently integrated the A-PNT solution onto an AAV7A1 and subsequently began verification testing. The acquisition and integration of the A-PNT solution to the ACV family of vehicles will begin soon.

The results of the study, as well as subsequent integration efforts on the AAV and ACV, will inform requirements development activities on future combat vehicle programs including ARV. The study will be useful for combat developers performing requirements development activities related to assured PNT, as well as materiel developers that are integrating assured PNT capability into vehicle designs.

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