



United States Army Cyber Center of Excellence

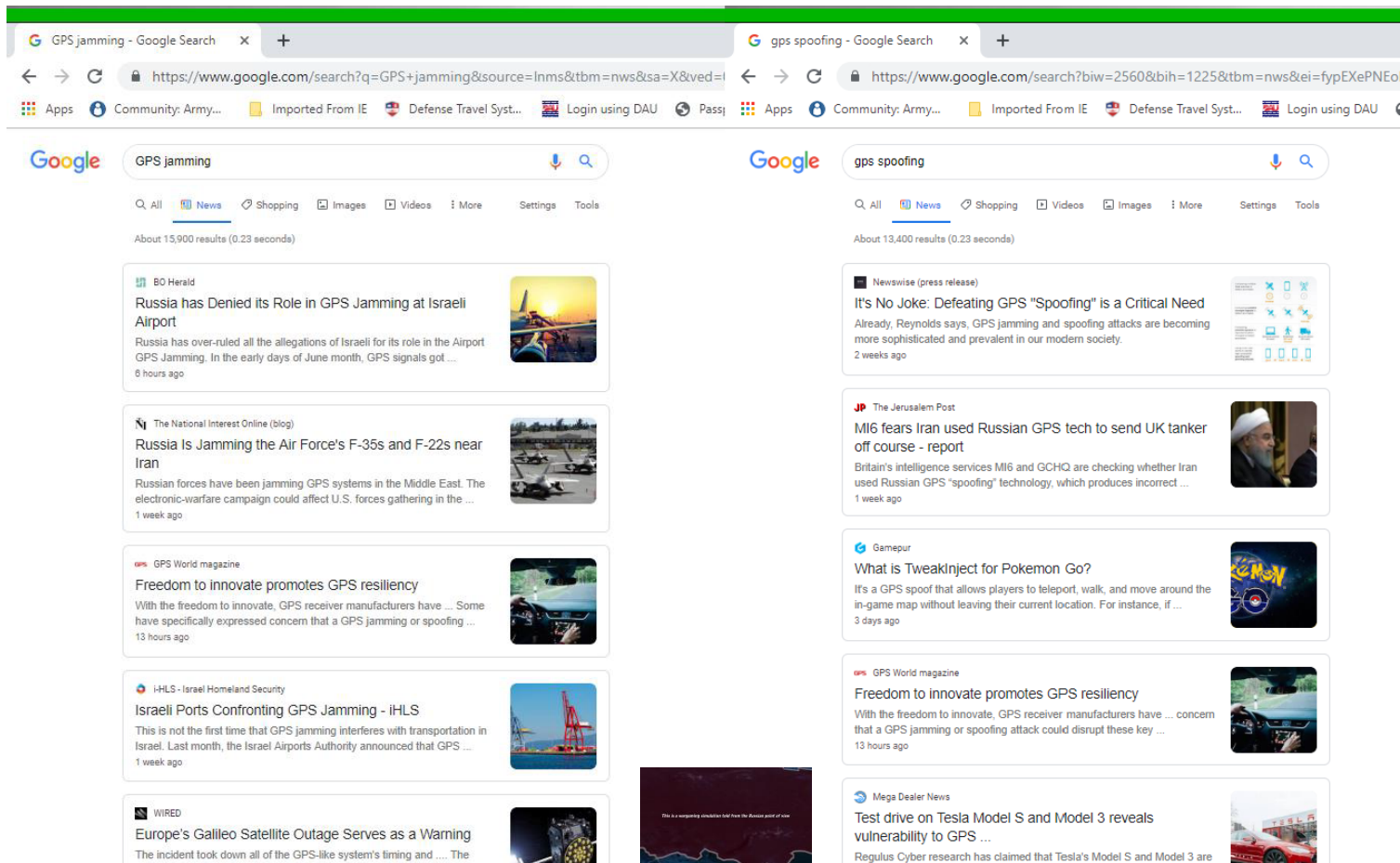
TRADOC Capability Manager (TCM) Tactical Radio (TR) A-PNT Overview

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The Problem



Army forces lack the ability to obtain and use PNT from GPS signals to conduct PNT dependent tasks, while operating in **conditions that impede or deny access to GPS** signals, including operating in dense vegetation, built-up urban and mountainous terrain, subterranean and underwater operations, and in the presence of **electromagnetic interference or enemy jamming and spoofing** of the GPS.



Assured Positioning, Navigation, and Timing Concept Diagram

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GPS \neq PNT

- PNT is a **tier three** Joint Capability Area (JCA) area under the tier two JCA Enterprise Services.
- The DoD primary provider for PNT is the GPS.
- Army forces operate in conditions that affect their ability to continuously receive and trust PNT information required to conduct military operations.
- Complex operational conditions can increase risk of disruptions to access and trust PNT information.
- Assured PNT is accomplished through the implementation of solutions that demonstrate the attributes required to maintain access to trusted PNT information.

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GPS: Global Positioning Service

EW: Electronic Warfare

PNT Service

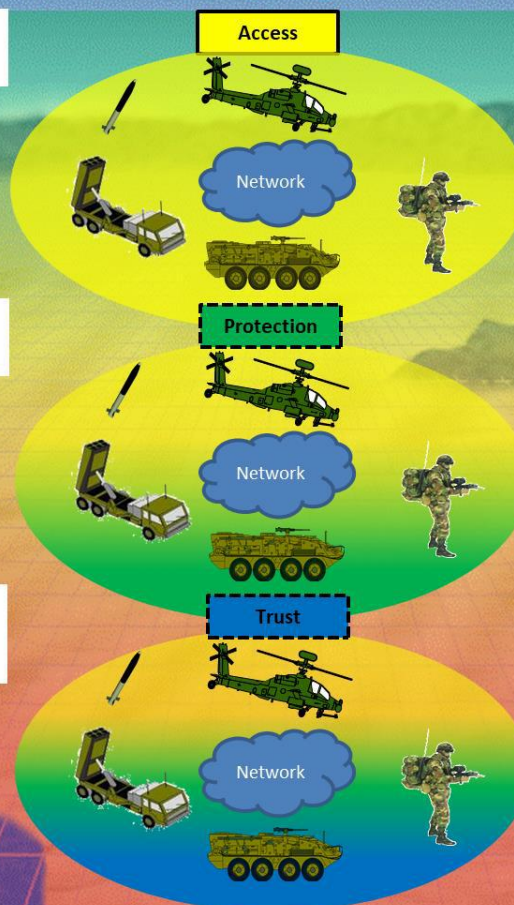
Assured PNT in moderate risk threat environment. Military GPS Receivers provide access to PNT for military operations.

Military GPS

Assured PNT in high risk threat environment. Access to GPS is protected against threats to facilitate military operations.

Assured PNT in extremely high risk threat environment. Non-GPS Augmentation provides: 1. Ability to assess if PNT can be trusted 2. Alternative trusted source of PNT

Assured PNT



Operational Conditions

Mission

Enemy

Condition 1
(Moderate Risk)

Condition 2
(High Risk)

Condition 3
(Extremely High Risk)

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"The Army of 2028 will be ready to deploy, fight, and win decisively against any adversary, anytime and anywhere, in a joint, combined, and multi domain, high-intensity conflict, while simultaneously deterring others and maintaining its ability to conduct irregular warfare." (TP 525-3-1)

The image shows a map of Russia with a thick red border. A red line starts from the bottom left, goes up, then curves to the right, ending near the bottom right. The text is centered in the middle of the map.

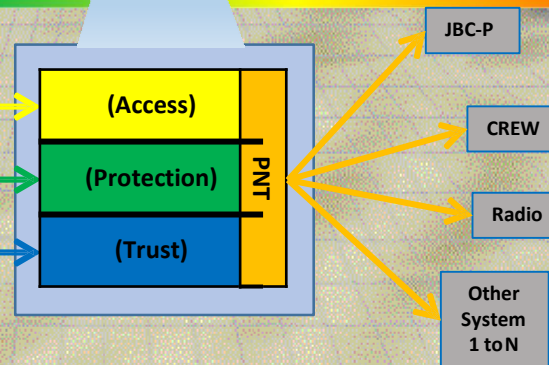
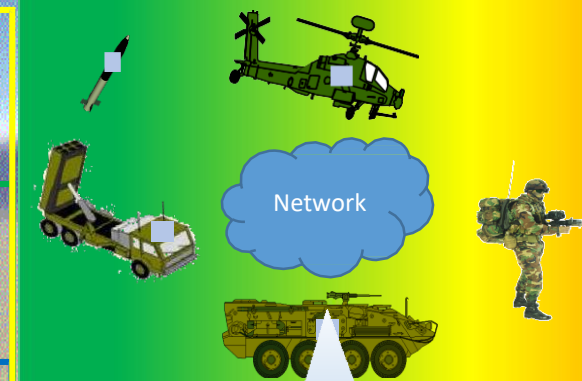
This is a wargaming simulation told from the Russian point of view

Concept Diagram for Assured Positioning, Navigation and Timing (A-PNT) Mounted A-PNT System (MAPS)

Military GPS Receivers provide access to PNT for military operations.

Point and Area protection systems provide access to PNT in High Threat environments

Non-GPS Augmentation provides:
1. Ability to assess if PNT can be trusted
2. Alternative trusted source of PNT



■ Mounted A-PNT System

Mounted Environment

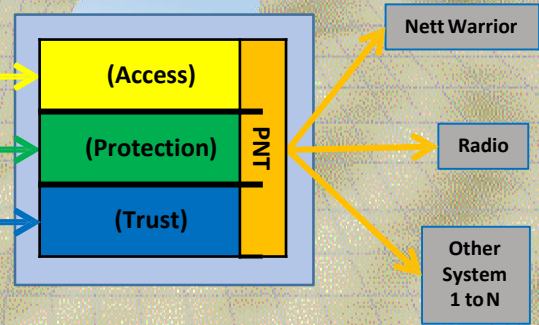
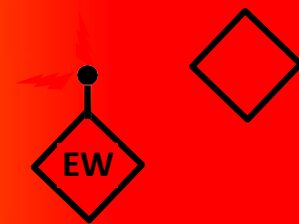
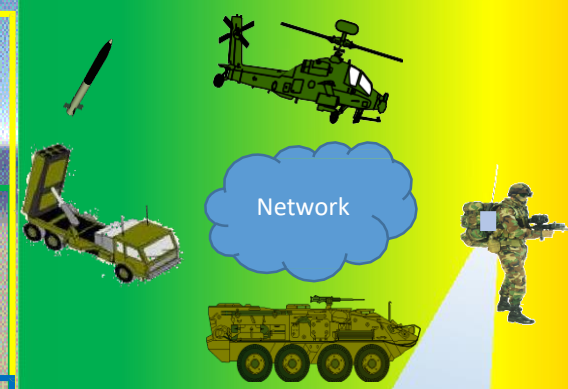
The mounted environment includes the Soldier and all systems used for communications, command and control, logistics, targeting and effects while being transported or attached to a combat platform.

Concept Diagram for Assured Positioning, Navigation and Timing (A-PNT) Dismount A-PNT System (DAPS)

Military GPS Receivers provide access to PNT for military operations.

Point and Area protection systems provide access to PNT in High Threat environments

Non-GPS Augmentation provides:
1. Ability to assess if PNT can be trusted
2. Alternative trusted source of PNT



■ Dismounted PNT System

Dismount Environment

The dismount environment includes the Soldier and all systems used for communications, command and control, logistics, targeting and effects while detached from a combat platform.

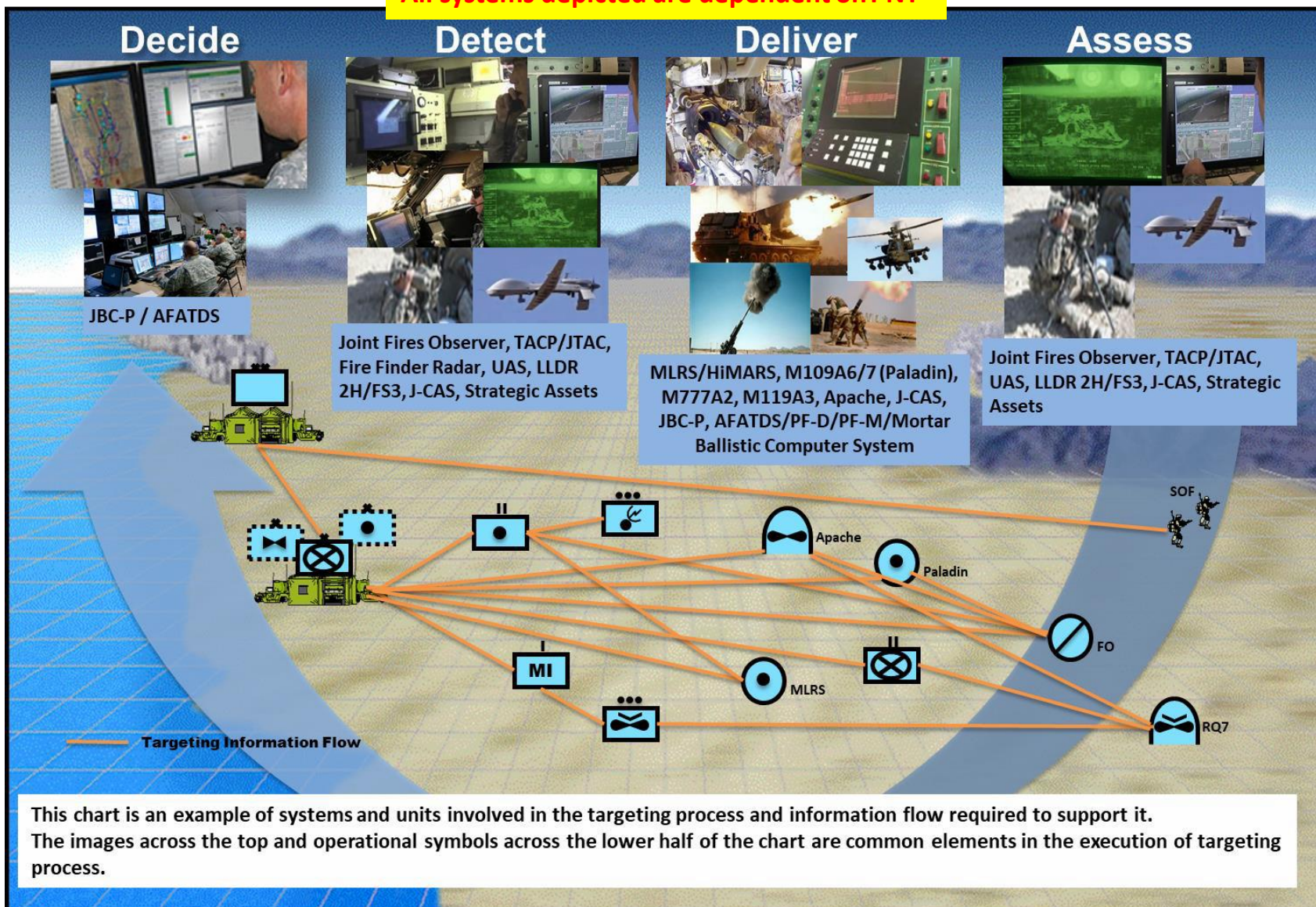


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Fires Targeting Mission Trace



All systems depicted are dependent on PNT



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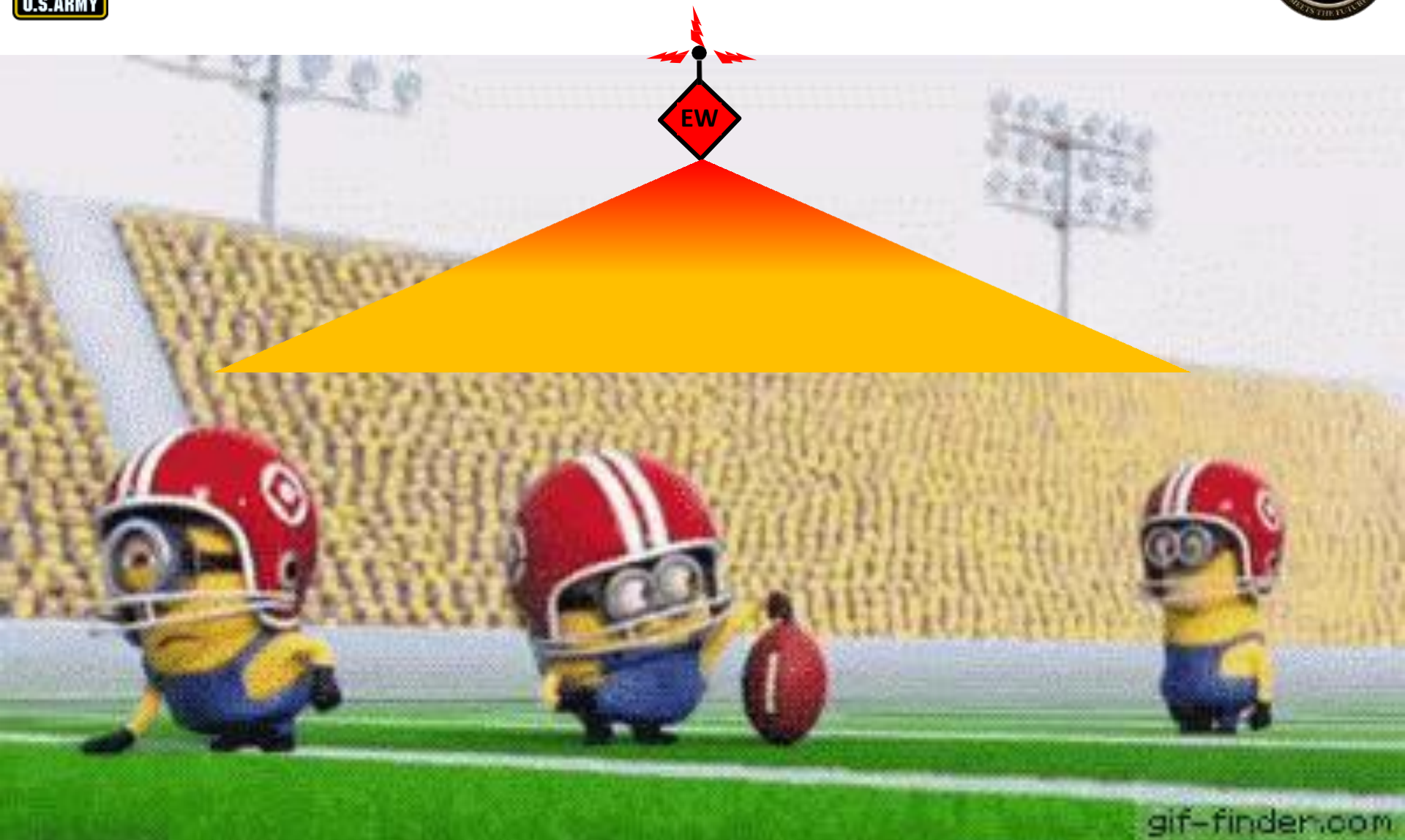
Capability Need



Attribute	Function
Assured Positioning, Navigation, and Timing	The ability to determine accurate and precise location, orientation, time and course corrections anywhere in the battlespace and provide timely and assured PNT services across the DoD Enterprise.
Access	<ol style="list-style-type: none"> 1.Enable continued access to PNT in degraded or denied electromagnetic (Jamming), space, or cyber environments. 2.Enable distribution of PNT to all systems on a platform as required by the systems being used on or by the platform. 3. Ensure operational availability and reliability of PNT systems to enable users (Soldier, system, and platform) for mission duration. Normally 72 hours without resupply or augmentation outside of the Brigade Combat Team.
Protection	<ol style="list-style-type: none"> 1. Assures the receipt of information provided by GPS signals from space in an impeded operational environment. 2. Assure that A-PNT systems sustain military GPS level accuracy when access to military GPS is available. 3.Assure A-PNT systems accuracy levels gracefully degrade or sustain military GPS level of accuracy in GPS contested or denied environment. 4. Ensure that A-PNT systems sustain accuracy levels to provide targeting solutions for precision weapon engagements in GPS denied or degraded environment. 5.Enable A-PNT systems to sense and provide feedback to tactical mission command and/or targeting systems with details of electronic warfare or cyber attacks that can inform defensive or offensive engagement decisions.
Trust	<ol style="list-style-type: none"> 1.Notify users (Soldier, system, and platform) in near real time when PNT solution cannot be trusted due to electromagnetic, space, or cyber threats. 2. Provide alternative trusted source of PNT when space based PNT can not be accessed. 3.Prevent degradation of a platform's ability to engage enemy threats and distinguish friendly forces due to loss of PNT. 4. Prevent reinitiating the military decision making process (MDMP) due to loss confidence in PNT. 5. Enable A-PNT Systems to notify users (Soldier, system, and platform) of degraded accuracy as accuracy levels degrade.
Tactical Resiliency	<ol style="list-style-type: none"> 1. Enable A-PNT systems to survive all levels of electronic or cyber-attack. 2.Enable A-PNT systems to minimize emitted signals in the multi-spectral realms that would provide indication to threat of its location. 3. Enable A-PNT systems to maintain Military GPS levels of accuracy while replacing the main power source for 2 to 5 minutes. 4. Enable A-PNT systems to interface seamlessly with supported/dependentsystems.
<i>Bonus - Facilitate changes in material approaches that result in overmatch level capability and cost efficient modernization of Army tactical forces?</i>	
1. Streamline Requirments Process	<p>Enable automated, expeditious and informed development of Basis of Issue Guidance informed by strategic planning guidance, future concepts, lessons learned and combatant command operational plans.</p> <ol style="list-style-type: none"> 2. Enable automated, expeditious and informed methods for analysis of alternatives and cost to benefit analysis.



Review Effects of GPS Jamming or Spoofing





Discussion