DoD 5G Overview

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DoD 5G Context

• **5G is transformational**
  - Not just new radios and cell phones
  - “Ubiquitous connectivity”: human-to-human, machine-to-machine, human-to-machine

• **Critical for DoD use, but – there is no such thing as a secure system**
  - DoD must use networks in which we have "zero trust”
  - Must operate through adversary impediments

• **DoD must partner with industry to understand and influence 5G**
  - Fully utilize the advantages
  - Mitigate and work with the vulnerabilities
  - Collaborative experimentation to leverage the > $350B industry investment in the U.S. over the next 5 years

Ultimately, the military that masters ubiquitous connectivity will maintain overmatch.
Promote Technology Development

- **Hosting 5G Demonstrations** – Prototype and experiment from nets to apps
- **RF Technology** – Leverage US millimeter wave expertise
- **Dynamic Spectrum Sharing** – Evaluate sharing for key DoD systems
- **Open Architecture and Virtualization** – New architectures for innovation & security
- **Workforce Development** – DoD expertise for 5G and beyond

Assess, Mitigate, and Operate Through 5G Vulnerabilities

- **Threat Intelligence** – Understanding adversaries’ capabilities
- **Minimizing 5G Infrastructure Risks** – Mitigate supply chain vulnerabilities
- **Operate Through** – Use 5G globally despite adversary capabilities
- **5G Security Assessments** – Discover, assess, and mitigate vulnerabilities
- **Cybersecurity and Zero-Trust** – New architectures for in-depth security

Influence 5G Standards and Policies

- **Standards Bodies** – DoD-wide engagement w/ 5G organizations, e.g., 3GPP
- **Advanced Spectrum Management** – Modernize policies to be dynamic
- **5G-Enabled Concepts of Operation** – Modernize DoD telecom use
- **Technology Control Measures** – Review foreign investments, export controls

Engagement Partners

- **International Allies and Partners** – Supply chains, assessments, experiments
- **Industry Engagement** – Engage with 5G industry ecosystem
- **Congressional Engagement** – Strengthen incentives, fix open market distortions
**DoD 5G Prototyping & Experimentation**

- **Accelerate – Hasten DoD’s adoption of 5G**
  - At-scale test facilities that enable rapid experimentation & dual-use application prototyping
  - Red/blue-teaming to identify and mitigate vulnerabilities

- **Operate Through – Ensure that US forces can operate through wherever and whenever we deploy**
  - Dynamic spectrum utilization
  - “Zero Trust” architectures
  - DoD-specific enhancements to commercial technology

- **Innovate – Enhance 5G technology and invest in future “Next G” technologies**
  - There is no finish line.

**5G to Next G – Use Cases**

- Logistics Asset Management
- Robust Distributed C2
- Augmented & Virtual Reality
- Smart Depot / Warehouse

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Initial Experiments – Tranche 1

• **Hill AFB, UT**
  - Dynamic spectrum sharing system for coexistence between 5G and high-power military radars in midband spectrum
  - Evaluating impact on 5G use and airborne system performance

• **Joint Base Lewis-McChord, WA**
  - 5G-networked Augmented Reality/Virtual Reality (AR/VR) for distributed ground combat training, scaling to brigade level

• **Naval Base San Diego, CA**
  - Smart warehouse focusing on transshipment
  - Digitizing, automating, integrating Navy logistics systems

• **Marine Corps Logistics Base Albany, GA**
  - Smart warehouse focusing on vehicle maintenance
  - Digitizing, automating, integrating Marine Corps logistics systems

Tranche 1.5

• **Nellis AFB, NV**
  - Robust distributed command and control
  - Disaggregate combined air operations functions (operational planning, common operating picture, etc.) using 5G
Augmented Reality/Virtual Reality
Joint Base Lewis McChord (JBLM), WA

• AR/VR
  - Develop/integrate 5G-networked AR/VR hardware and software to support enhanced distributed ground combat training
  - Demonstrate 5G-networked AR/VR prototype in lab
  - Demonstrate 5G-networked AR/VR prototype in the field at the brigade level

• JBLM and Yakima Training Center (YTC)
  - Design, build, and deploy mobile 5G network infrastructure and devices
    - JBLM Mission Training Center
    - Yakima Training Center
  - Employ and test advanced 5G features

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Smart Warehouse
Naval Base San Diego, CA

- **Smart Warehouse**
  - Digitization, automation, and optimization
  - Autonomous systems
  - AR/VR systems
  - Machine vision
  - Integration Navy logistics systems

- **Naval Base San Diego**
  - Design and deploy 5G infrastructure in and around warehouse test site
  - Employ and test advanced 5G features
• **Smart Warehouse**
  - Digitization, automation, and optimization
  - Autonomous systems
  - AR/VR systems
  - Machine vision
  - Integration Marine Corps logistics systems

• **USMC Logistics Base Albany**
  - Design and deploy 5G infrastructure in and around warehouse test site
  - Employ and test advanced 5G features
Dynamic Spectrum Sharing Access
Hill AFB, UT

• Dynamic Spectrum Sharing
  - Develop Sharing Coexistence System (SCS) prototype
  - Provide interoperability between airborne radar and 5G cellular system in 3.1-3.45 GHz Band
  - Promising SCS can be evaluated with users and airborne system

• Hill Air Force Base, UT
  - Design, build, and deploy mobile 5G network infrastructure and devices (cell on wheels)
  - Deploy on Hill AFB and Utah Test and Training Range
  - Evaluate with real-world at-scale network
Robust Distributed Command & Control
Nellis AFB / NTTR

• Objective
  - Leverage 5G technologies and networks to operate apart from fixed infrastructure and reduce centers of gravity vulnerable to adversary attack

• 5G testbed at Nellis AFB and Nevada Test and Training Range (NTTR)
  - Build a localized, private 5G cellular network service environment based on a Core (5G Private network) plus nomadic 5G sites as a testbed for future military operations centers
  - Develop Operational and Tactical command and control (C2) applications/services for disaggregated and distributed C2
  - Produce network enhancements, such as network slicing and software-defined networking, to support secure military operations and planning in a distributed environment
Robust Distributed Command & Control
Nellis AFB / NTTR

• Phase 1: Disaggregate & disperse
  - Relocate warfighting functions (operational planning, common operating picture, sortie generation) across Nellis AFB to alternate fixed locations using 5G solutions

• Phase 2: Enhance survivability
  - Develop solutions for 5G-equipped forces to conduct warfighting functions and operations while mobile within 5G network

• Phase 3: Rapid mobile lethality
  - Develop fully agile and mobile hardware / software solutions to present adversaries with unachievable kill chains while increasing pace of friendly operations

Develop a scalable / tailorable / survivable communications range to expand as 5G – Next G technology and infrastructure becomes more prolific across multiple COCOMs.

Distribution Statement A; Approved for public release, Distribution is unlimited.
<table>
<thead>
<tr>
<th>Experiment Title</th>
<th>Services</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship-wide / Pier Connectivity</td>
<td>Navy</td>
<td>Naval Station Norfolk, VA</td>
</tr>
<tr>
<td>Enhancing Aircraft Mission Readiness</td>
<td>Air Force, Navy, Marine Corps</td>
<td>JB Pearl Harbor - Hickam, HI</td>
</tr>
<tr>
<td>Augmented Reality Support for Medical Training and Telemedicine</td>
<td>Army, Air Force</td>
<td>Joint Base San Antonio (JBSA), TX</td>
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<tr>
<td>Wireless Connectivity for Tactical Operations Centers and Combat Operations Centers</td>
<td>Army</td>
<td>The National Training Center (NTC), CA and Fort Hood, TX</td>
</tr>
<tr>
<td>DoD 5G Core Security Experimentation Network</td>
<td>Air Force</td>
<td>Joint Base San Antonio (JBSA), TX and multiple remote locations</td>
</tr>
<tr>
<td>Bi-directional Spectrum Sharing – DoD/Commercial</td>
<td>Air Force</td>
<td>Tinker AFB, OK</td>
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DoD’s Security Needs

- Many DoD use cases have security requirements similar to commercial use cases
- DoD also needs to protect against more sophisticated national security threats
- DoD also needs to ensure resilient operations in multiple threat environments

Diagram:

- Threat Sophistication
- Domestic Operations
- Allied Countries
- Partner Countries
- Adversarial Countries
- DoD Use of Custom Systems
- DoD Use of Commercial (e.g. 5G) Systems

- Decreased U.S. influence over network operations
- Increased threat environment

- National Security Issues
  - Multiple Levels of Security
  - Operations Security

- Economic / Cost Issues
Example DoD 5G Outcomes

Accelerate 5G

- 5G that can be deployed at DoD sites – more quickly, lower cost – e.g.,
  - Enterprise TTPs
  - Pre-approved “bill of materials”
  - Expedited ATOs

- 5G that improves DoD facility operations – increase efficiency, lower cost – e.g.,
  - Networked automated vehicles, e.g., tractors, forklifts
  - Networked automated logistics hardware and software

- 5G that improves DoD tactical operations – rapid deployment / adaptation – e.g.,
  - Deployable 5G multi-antenna systems
  - Deployable 5G base stations
  - Accredited 5G endpoints (phones, sensors, machines)
  - Mission planning AR/VR applications with real-time sensor integration

Operate Through

- Counter adversary attempts to deny access to the RF spectrum, e.g.,
  - Hardware and software for dynamically using the spectrum

- Counter adversary attempts to deny access to 5G networks, e.g.,
  - “Zero Trust” architectures that mitigate attacks on network roles / authorities

Innovate for “Next G”

- Enhance 5G technology and invest in future “Next G” technologies, e.g.,
  - Highly directional mid-band systems for LPI/LPD
  - Robust network protocols for multiple security levels

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• The military that masters “ubiquitous connectivity” will maintain overmatch.

• 5G is not a race...there is no finish line. Hence our emphasis on 5G to Next G.

• 5G technologies are both enablers of and sources of vulnerability for:
  - Economic security - Homeland security - National Security

Leverage and accelerate innovation of U.S. 5G industry
Questions?