

## At a Glance

### What it is

- The Office of Naval Research (ONR) Communications and Networks program pursues science and technology (S&T) whose results lead to technologies that are essential for integrating warriors, sensors, command and control, platforms and weapons into a networked distributed combat force.
- Commercial technologies will not address all of the Navy's warfighting requirements.

### How it works

- Spectrum and energy-efficient apertures and radios are necessary to address challenges associated with crowded spectrum, limited-platform real estate and low-bandwidth/power-constrained platforms (e.g., unmanned vehicles).
- Tactical communications technologies are needed to address the challenges of electronic attack/intercept, as well as Navy-unique issues (e.g., intermittent, low-bandwidth communications with submarines).
- Tactical networking technologies must support highly mobile tactical users/platforms with dynamic priorities and missions.

### What it will achieve

- The communications and networking technologies developed at the Office of Naval Research (ONR) provide the foundation for information dominance needed to support the operational and strategic objectives of the Sea Strike, Sea Shield and Sea Basing pillars of the U.S. Navy's Sea Power 21 initiative.

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As outlined in ONR's Naval Science and Technology Strategic Plan, flexible communications and networks architectures that provide capabilities for achieving and maintaining our communications and networks in a highly dynamic, dispersed and disadvantaged environments (disruption intermittence and limited bandwidth) are integral to achieving information dominance.



The Communications and Networks program pursues S&T whose results lead to technologies that are essential for integrating warriors, sensors, command and control, platforms and weapons into a networked distributed combat force. The program is focused on solving some of the challenges unique to the naval environment that are not being addressed by the private sector. For example, many commercial wireless technologies are dependent on a fixed cellular/802.11 infrastructure. In many cases, the wireless infrastructure for naval forces, particularly at the tactical edge, is also mobile, which introduces a unique set of challenges.

Another example is the ability to support high-bandwidth communications with submarines that are operating at useful speeds and depths. The program is focused on developing technologies to address the challenges associated with crowded spectrum; limited-platform real estate for antennas; electronic attack and electromagnetic interference; electronic intercept; increased sensor resolution and shooter demands; geographically dispersed forces with intermittent connectivity; low-bandwidth, power-constrained tactical platforms; the highly dynamic mission priorities of tactical forces; etc. The primary objectives of the program include delivering: (1) dynamic, scalable tactical communication networks; (2) high-performance, low-cost communication solutions; and (3) satellite communications denial mitigation.

### Research Challenges and Opportunities

- Spectrum and energy-efficient apertures and radios: (1) Create new techniques to improve gain-bandwidth product for electrically small antennas; (2) Develop affordable and lightweight multi-beam actively scanned apertures.
- Tactical communications: (1) Develop low-observable, high-bandwidth electro-optic/infrared and radio frequency communications with cognitive spectrum utilization and electronic protection; (2) Investigate and develop cross-layer architectures and protocols for distributed collaborative sensor nets.
- Tactical networking: (1) Develop secure protocols and algorithms for mobile ad-hoc networking (MANET) for tactical systems that are efficient and resilient to data loss, dynamic partition and merge, and node/link failures; (2) Create new paradigms and middleware for service-oriented architecture operation on low-bandwidth, tactical-edge MANET.