

## Command & Control

Situation awareness embraces detailed knowledge of enemy and friendly force positions and movements, target locations and priorities, and the availability of resources which may be brought to bear. To be useful, this knowledge must be present in a suitable format for command and targeting operations. A network consisting of a large number of sensors may receive target and other information in various formats, converting them as needed to report to commanders and autonomous weapon systems.

Situation awareness, by itself, is of little use without a means to respond, especially to threats. Command and control takes in the elements needed to deploy a given weapon against a target. The command element includes selection of an available resource, data passed to the weapon (e.g., target coordinates), mode of operation, and any necessary initialization procedures. Control includes in-flight target position updates or re-targeting, other in-flight commands such as varying waypoints and battle damage assessment, and detailed trajectory guidance for command-guided systems such as TOW and Patriot. In the present context, “control” does not include self-guidance of autonomous or competent munitions, except insofar as it may be altered in flight.

Both situation awareness and command and control will rely heavily on distributed networks in the future. Key requirements will be versatile, low-cost, autonomous sensors which may be readily distributed over the battlespace; a robust RF network operating either peer-to-peer or through higher nodes (such as satellites), capable of operating in adverse conditions including enemy jamming; and data-handling algorithms which optimize data throughput while remaining secure. Developments now in progress on these and related fronts include:

- Data fusion technologies, RF/EO common apertures
- High-bandwidth, electronically steerable array antennas with adaptive nulling
- Improved 3-D electromagnetic modeling of micro/millimeter wave circuits and antennas
- Higher-efficiency RF transmitters employing III-V compounds and SiC as base materials
- Low-power analog-digital converters with greater bandwidth and dynamic range
- Visualization/visionic algorithms
- Analytic decision support techniques
- Wide-area high-resolution imaging, terrain feature extraction

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