



# 2027 Challenge: Multidomain Autonomy of Uncrewed Systems



# Multidomain Autonomy of Uncrewed Systems

**1. Challenge Summary:** Uncrewed systems today often operate as isolated platforms with limited autonomy, unreliable communications, and constrained ability to collaborate across air, land, maritime, and space domains, or to seamlessly share data. In contested environments, these shortcomings reduce the speed and reliability of sensing, decision-making, and effects, while increasing operator burden and susceptibility to disruption, deception, and attrition. Similar limitations also hinder civilian applications, such as disaster response, border monitoring, and critical-infrastructure protection. Emerging trends such as resilient autonomy, cooperative sensing, decentralised mission management, and predictive sustainment could enable multi-domain uncrewed vehicles to function as an integrated system that adapts in real time and remains effective despite interference and losses.

The Alliance seeks interoperable data-driven solutions that enable trusted, scalable, multi-domain autonomy and seamless integration of uncrewed and crewed platforms, allowing secure workflows and a data-rich tasking environment, based on consolidated command, control, communication, cybersecurity, computers, intelligence, surveillance and reconnaissance (C5ISR).

**2. Illustrative Scenario:** A large Allied port experiences a cyber-attack on vessel traffic control systems, global navigation satellite systems (GNSS), and communications. A multi-domain mix of autonomous uncrewed platforms—space, air, ground and maritime—is deployed, building up a data-rich common operational picture with integrated inference to uncover strategic adversary intentionality and likely next steps. Decentralised mission management guarantees coordination and orchestrated operations despite jamming, GNSS denial, spoofing, and intermittent connectivity, relying in part on innovative small satellites made from novel composites. Suddenly, a vessel carrying fertilizer spoofs loss of control authority, risking an explosive grounding. Further autonomous sensing nodes, featuring reduced electro-optic and infrared signatures as well as aspects of stealth, are dispatched. Integration with crewed response enables a rapid, effective, and de-risked threat curtailment. After onboard action, uncrewed platforms evacuate casualties, resupply materiel and carry out autonomous in-situ repairs. Similar capabilities are warranted in disaster response, border security, or organised-crime interdiction, as well as in direct military uses.

**3. Exemplar Enabling Technologies:** The following list provides illustrative examples of technologies that may contribute to this challenge. The list is not exhaustive, and NATO DIANA encourages integrated and novel approaches that extend beyond it:



## **Resilient Autonomy and Navigation**

- Autonomous navigation to operate safely and effectively with degraded GNSS, uncertain maps and unknown terrain, dynamic obstacles across domains, and adversarial contestation.
- New subsystems and device components enabling autonomy to improve onboard perception, compute, timing, and power for low-size, weight and power (low-SWaP) autonomous platforms.
- New materials and design for manufacturing and signature reduction, to lower detectability and to enable survivability in multidomain contested and austere environments.

## **Multi-platform Orchestration and Cooperative Sensing**

- Multiplatform orchestration methods to coordinate tasking, deconfliction, and effects delivery across heterogeneous assets.
- Co-operative sensing and decentralised build-up of the common operational picture to fuse distributed observations, resist deception, and maintain situational awareness under disruption.

## **Sustainment, Repair, and Scalable Production**

- Predictive maintenance and in-situ autonomous repair to reduce downtime and logistics burden and sustain tempo under attrition and distance.
- Advanced, additive and adaptive manufacturing to enable rapid replacement, mission-tailored variants, and distributed production closer to the point of need.

## **Persistent, High-altitude and Space-enabled Support**

- Structural power composite materials for high-altitude and space assets to extend endurance and enable persistent sensing and communications.
- In-orbit and in-air services to support servicing, replenishment, and extension of uncrewed capabilities in high-altitude and space environments.