



- **Incorporate UGV and USV capability into the NPS ARSENL swarm system**
  - **Hardware integration:** Utilize self contained ARSENL “Swarm Brick” (autopilot, payload, & power supply) to quickly add autonomy package to suitable rock crawler and higher-speed UGV and small USV platforms
  - **Firmware update:** Incorporate ARESENL-specific communications and failsafes into the open-source APMRover firmware (UGV & USV version of the ArduPilot firmware already in use in ARSENL UAVs)
  - **Multi-domain autonomy:** Use of the Mission-based Architecture for Swarm Autonomy (MASC) approach to develop of atomic “plays” for use with new platforms and robust, mission-informed “tactics” and “phases” leveraging cross-domain heterogeneity

- **On-UAV software & and ground control applications**

- All software & hardware designs maintained on the NPS Git server
- Publicly available as appropriate (password protected as required)

- **Architectural documentation and diagrams**

- NPS Technical Report
- Operational checklists & guidance for new systems

- **Field Experiment after action reports**

- Per event thresholds and objectives
- Per mission/sortie objectives & results
- Lessons learned & results analysis

- **ONR interest in the “super swarm”**

- Large multi-vehicle system of air, surface, subsurface, and ground vehicles
- Currently available multi-vehicle systems lack of support for this vision
- ARSENL experience with heterogeneous aerial swarms

- **This project will leverage ARSENL experience with heterogeneous aerial swarms to begin exploration of large-scale multi-vehicle systems that bridge the air, surface, and land domains (i.e., multi-domain swarming)**

- **Aligns with CRUSER and ASN (RD&A) unmanned vehicle priorities**

- Incorporation of advanced autonomy into unmanned systems
- Cross-domain connectivity & human-autonomy teaming