The Office of Naval Research’s (ONR) Optimization-based UAV Planning program began six years ago in response to an ONR thrust in Pervasive and Persistent Sensing, which calls for automated self-control and self-tasking of sensors and sensor networks including optimization of resources and Common Operational Tactical Picture development.

The technology being developed by ONR is aimed at creating optimization-based tools for optimally allocating and deploying UAVs. Mathematical optimization is a collection of techniques (model building, algorithms, and software) for determining an optimal allocation of resources (e.g., UAVs) subject to a set of constraints (e.g., temporal, physical, logical). These tools are being combined with Bayesian techniques, which will maintain probabilistic situational awareness and operational and tactical decision aids. These decision aids will account for the timing of the selection, allocation, and operation decisions by considering multi-stage mathematical-optimization models.

The primary warfighter payoff will be a decision-support system that will be able to assist human operators in optimally selecting sensors and platforms for search and surveillance operations, allocating the selected sensors and platforms to specific missions, operating the allocated sensors during a mission, and fusing the information from the sensors.

Research Challenges and Opportunities:

- Development of mathematical models that are realistic, capture the multi-stage UAV-planning decision process, and are amenable to computational solution techniques.
- Development of rigorous mathematical-optimization algorithms for solving stochastic, multi-stage, models.
- Development of Bayesian probability models that fuse prior information with new information, update the probabilistic situational awareness, and revise the input to the optimization models.