Grant: AFC518-48

Title: Flying Underground

Organization: Colorado School of Mines

Principal Investigator: John P H Steele

Topic: Remote-Controlled, Autonomous, or Smart Machine Design

Concept Summary: The goal of this proof-of-concept project is to develop and demonstrate ground and air vehicles that are capable of autonomous navigation in an underground mine. The primary focus will be on adapting a commercial UAV to autonomously fly in the confined space of an underground mine while building a 3D model of the mine as it travels and monitors key safety metrics such, as O2 levels. Such capability will provide many benefits to the safety and health of underground miners; for example, assessment of the risk of roof falls, the estimation of excavated volume, or assessment of ore pass blockage. Having an autonomous system perform these functions removes humans from these dangerous conditions. Once developed, this technology can be applied to other tasks such as inspection operations in open stopes, exploration of abandoned workings, and potentially search and rescue—where in the air vehicles search and ground vehicles rescue.

While the challenges of developing such a system are significant, the advances in autonomous mobile robots and driverless car technology in the past few years make this goal obtainable within the constraints of this Proof-of-Concept grant. It is our intention to develop a new high-reliability air vehicle specifically designed to meet the challenges of robust flight underground as part of this project. Since we already have research platforms in place for both ground and aerial vehicles, these two efforts, code development and platform development, can be conducted in parallel.

At the end of this project we will demonstrate autonomous navigation in an existing mine using both ground and air vehicles. Further, this effort will identify the development areas and system level requirements necessary to translate this proof-of-concept design into a fieldable platform. Follow on projects will leverage the knowledge gained from this effort to develop the next generation of systems that are ready for industrial use.