

# Request for Proposal

**Topic:** Intrinsically Safe Propulsion System for Mine Drone Applications

**Background:** Drone technology is quickly developing. Several commercial drones are now available which can serve various surveillance applications (aboveground). Autonomous navigation control for flying in enclosed environments is also significantly advancing, including advances for control in underground mine openings. But the major issue that is limiting the coal mining applications in particular is lack of an available permissible platform. If this barrier could be overcome, the application potential for underground mine mapping and geological surveillance would be dramatically enhanced and aid in providing mine rescue capability. The permissible platform must begin at the power/propulsion subsystem as this poses the most difficulty in achieving an intrinsically safe design. This is the focus of this RFP.

**Project Goals:** Determine the feasibility for an intrinsically safe (by MSHA standards) propulsion system for drone application and demonstrate a proof-of-concept design.

**Scope or Work:** The submitter has flexibility to tailor the proposed scope of work to meet the project goals, but the following requirements must be met.

## Phase 1 - Design Strategy

- Determine (battery) power level that would meet permissibility requirements.
- Determine how to manage (propeller) motor issues with respect to intrinsic safety requirements.
- Determine design strategy.
- Confirm design approach with Mine Safety and Health Administration Approval and Certification Center.
- Prepare preliminary design specifications.
- Confirm the validity of the design specifications with Mine Safety and Health Administration Approval and Certification Center.
- Establish milestone credibility sufficient to justify proceeding to proof-of-concept design and fabrication.

## Phase 2 – Breadboard Fabrication and Testing

- Build (breadboard) propulsion subsystem.
- Develop plan for making necessary (electrical and heat) measurements to address intrinsic safety evaluation.
- Review with Mine Safety and Health Administration Approval and Certification Center analysis data pertaining to intrinsic safety performance.
- Identify any fault analysis issues raised by MSHA and develop plan to address them.
- Address any issues raised by MSHA in assessment of the subsystem.

### Phase 3 – Proof-of-Concept Demonstration

- Develop and fabricate final propulsion subsystem.
- Demonstrate powering three or more motors sufficient to drive drone propellers that can create enough aerodynamic lift to hover a drone-type platform.
- Include a demonstration of the concept to MSHA Approval and Certification Center to get their perspective on its performance.

**Funding Plan:** The project will be funding in phases according to the Scope of Work with funding for subsequent phase dependent on a successful outcome in the previous phase.

**Submission Requirements:** The submitter is required to submit a proposal not to exceed 20 pages in length to provide documentation of how the scope will be accomplished, the project team and its experiences, a detailed budget to support the project costs and a project timeline. Proposals with advanced planning or more detail with how the scope of work will be accomplished will be rated higher than those lacking detail. It is noted that the expectation is that the submitter if necessary, will conduct the necessary prerequisite background research to become fully familiar with the MSHA intrinsic safety and permissibility requirements prior to submitting a proposal.

### **Evaluation Criteria:**

- (35%) Demonstrated knowledge of MSHA intrinsic safety and permissibility requirements
- (30%) Degree of preliminary design insight
- (20%) Prior experience in intrinsic safety design
- (15%) Cost and timeline validation