

Application Title: Scalable Robots for Complex Missions Lab (SRCML)**Lead contact for RDF Application:**

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RDF Amount Requested (\$): \$1,430,108

Executive Summary

This RDF project will establish the **Scalable Robots for Complex Missions Lab (SRCML)** to serve broad Texas A&M (TAM) research communities by bringing new capabilities of scalable swarm autonomy implementation, experimentation, and validation. TAMU, as the largest and one of the top research universities in the US, is uniquely qualified and strategically positioned to successfully build and sustain this research infrastructure, making TAMU the first university with operational swarm capabilities in the US. TAMU has the physical space and existing infrastructure to support the swarm operation, and existing disciplinary and interdisciplinary expertise in robotics, wireless networking, swarm intelligence, and human-swarm interaction. The SRCML will be located in RELLIS, taking advantage of its proximity to many other core TAM facilities, world-class testing sites, and existing electronic and fabrication lab facilities as well as IT infrastructure offering greater flexibility in testing swarm autonomy and networking at different scales and distances. The fully equipped lab will house over 100+ functional robotic platforms with fundamental swarm capabilities of robot-to-robot communication, scalable ad-hoc wireless mesh networking, multi-terrain and surface mobility with embedded localization and path planning, and streamlined protocols for data collection and management. These robotic platforms will be a deployable technology infrastructure and the Lab will be the supporting facility for the initial establishment, maintenance, and deployment planning for research projects. We propose four research cores that the SRCML will focus on to establish competitive research programs: 1) **National Security Core** supporting several highest-priority areas of DoD, including swarm autonomy, distributed ISR applications, network resiliency, and infrastructure surveillance, 2) **Space Core** addressing mobility challenges, difficulties in in-situ resource utilization (ISRU), sample collection/handling, and construction, 3) **Agriculture Core** offering the flexibility and adaptability required for diverse farms at varying scales, and 4) **Urban Core** catalyzing disaster prevention/detection/recovery, search-and-rescue, sustainable and smart urban planning/design, and public safety and risk assessment research. These four areas align with TAM's strategic planning and investment, and thus we expect the leverage expected between the SRCML and the existing research infrastructure will be substantial and highly timely. The collaborators of this project and the participating units at Brazos County will directly benefit from the new capabilities offered by the SRCML. At the same time, TAM's existing capabilities play a critical role in the timely implementation of the fundamental swarm functions and thus fully equip the robots to operate in scalable swarms. During the 2-year RDF project, we will fully establish the lab facility and equip 100+ robots with fundamental swarm capabilities while the team will individually and collectively seek extramural research funds. Based on the team's demonstrated records of obtaining research funding and expected new collaborations among and beyond the research team supported by several planned proposals warrant a timely return of this RDF investment.