Exhibit A: Project Description
(Scope of Work, Special Requirements)

Project Title: Autonomous Aerial Systems for Wildfire Management in Montana

Specific objectives of the project are:

1. Establish a field laboratory for unmanned aircraft systems (UAS) research and development where UAS can be deployed consistently to measure and monitor forests and fuels.
2. Contract with Montana's UAS companies to collect and test data from at least ten different platforms and instruments.
3. Develop two research UAS complementary to private sector systems.
4. Train at least 12 pilots, students, and researchers in the deployment and application of UAS.
5. Develop capacity to operate in the regulated environment.
6. Work with vendors to understand how to develop client bases in natural resources and wildfire.
7. Develop workflows and algorithms to characterize fuel treatments and relate to existing field and remote sensing measurements.
8. Formulate policies and procedures for UAS operations.
9. Solicit research from at least five other research groups within MUS to stimulate diversification of application of UAS to natural resource problems.

Objectives will be achieved using the following methods and approaches:

1. **Concentrate research activities at the MFCES Lubrecht Experimental Forest (LEF).** LEF is an ideal laboratory for deployment of UAS to study remote sensing of fuel treatment design and effectiveness. It is a working forest containing a broad array of silvicultural prescriptions, fuel treatments (mechanical and fire), and stand conditions. Additionally, the Forest maintains a current plot-based forest inventory, broad expanses of field-mapped tree stems, and an array of remote sensing data including two airborne laser scanning datasets and associated maps of individual trees. Much of the research this project leverages at LEF has been conducted by the PIs of this project.
2. **Contract with each of the Section 333 exempted companies (Table 1) in Montana to collect and test data from at least 10 different privately-owned UAS in fuel treatment test beds at LEF**. These systems are small, autonomous, hand-launched units with 15-60 minute flight times and variable abilities to produce photogrammetric quality data using efficient work flows. The team will gather commercial input on UAS flight operations, training, and education through UM's Office of Autonomous Aerial Systems, the first office in the MUS system to address UAS policies for higher education. By applying UAS to study remote sensing of fuel treatment design and effectiveness, the research team can create a framework for connecting scientists with private entrepreneurs to improve fuels management. This structure can be used with additional applications products in related disciplines.

Table 1. Section 333 Exempted Companies in Montana

Company	Location	Aircraft	Operation
Roger W. Meyer Professional	*Lambert*	*eBee, UX5*	*Mapping & Surveying*
Electric Eye Aerial Scanning	*Belgrade*	*X8*	*Aerial Photography/Video*
Thomas Hall	*Billings*	*Phantom 2, Inspire 1*	*Aerial Photography/Video*
Montana Aerial Solutions	*Billings*	*Iris+*	*Photography/Video/Inspection/ Mapping & Survey*
Real Help, Inc.	*Bigfork*	*Phantom 2*	*Photography/Video/Search & Rescue*
R. Stephen White	*Bozeman*	*Inspire 1, Cinestar 8, Hexacopter*	*Aerial Photography/Video/Inspection*
GravityShots.com	*Whitefish*	*Inspire 1, Cinestar 6, Cinestar 8*	*Aerial Photography/Video/Mapping & Survey*
Coldwater Group LLC	*Helena*	*Inspire 1, Aero-M*	*Aerial Photography/Video*
Onebindingsystems LLC	*Bozeman*	*Inspire 1*	*Photography/Video/Inspection/Cell Tower/Search & Rescue*
Birds Eye of Big Sky LLC	*Kalispell*	*Phantom 2, Inspire 1, Cinestar **	*Aerial Photography/Video/Inspection/ Mapping & Survey*
Elevated Productions LLC	*Bozeman*	*X8*	*Closed Set Filming/Aerial Photography/Video*
Kirk Vriesman	*Arlee*	*Phantom 3 Pro*	*Photography/Video/Inspection/Survey*
Edward Regan	*Bozeman*	*?*	*?*

3. **Develop two UM UAS (one fixed wing; one rotor wing) complementary to the UAS currently being operated in the private sector in Montana.** They will be capable of producing accurate 3-D models of forests and fuels at plot to sub-watershed scales. Systems shall include aircraft, guidance systems, gps/imu, payload (multispectral cameras), and software. The team will develop and test these systems in parallel with private sector instruments in order to improve current practices and techniques and to provide research development platforms with portability back to the private sector.
4. **Train pilots, students, and researchers in the deployment and application of UAS, initially by collaborating with Advanced Aviation Solutions, LLC (ADAVSO) on the development of a complete UAS training curriculum.** ADAVSO is a technically proficient Idaho-based company with a Montana business license. A course of study will be developed with pre-requisites, ground school, simulation, and hands on/live flight training. Ultimately this course will rely on input from the thirteen small businesses with 333 exemptions in Montana.
5. **Develop capacity to operate in the regulated environment.** This will include training and certifying operators and formulating policies and procedures for UAS operations. The team will

host “fly-ins” at LEF to examine comparative performance of alternative UAS tools for producing specific data sets and will put in-place a secure data services system that ingests, processes and distributes image products. This will all establish a continuous improvement model so that feedback from algorithm testing leads to “off-the-shelf” products. This project will in essence be a test bed for virtual alternative platform and sensor evaluation.

6. **Develop workflows and algorithms to characterize fuel treatments and relate to existing measurements from aerial and terrestrial lasers as well as field plots.** Existing data on forest condition at LEF allow researchers to validate fuel products such as fuel load, arrangement, and flammability. In a post-treatment assessment teams can then quantify to what degree a treatment achieved its goal (e.g., reduced total fuel load).
7. **Work with vendors to help understand how to develop a client base in natural resource related fields, including training with vendors in understanding policies, infrastructure capabilities, and university research outcomes.** This collaboration provides a clearinghouse that gives applications specialists a place to start designing and accomplishing data acquisitions. The team will assist in project/acquisition design and budgeting.
8. **Formulate policies and procedures for UAS operations.** The purpose of these policies is to ensure that the university acquires and operates UAS efficiently, safely and ethically and in full compliance with all applicable federal and state rules and regulations. Because of the potential legal and risk management issues involved in managing a COA or contracting private entities, faculty, staff and students of the university who wish to pursue UAS operations must apply to AASO; its steering committee reviews operations plans and assists applicants in meeting FAA requirements. Hence the team will be able to connect the UAS providers to an applications framework that stresses existing system capabilities.
9. **Solicit research from other faculty to stimulate diversification of application of UAS to natural resource problems.** We have identified MUS six faculty engaged in research bridging silviculture, forest ecology, rangeland science, hydrology, and fire behavior. The common thread relating these researchers is a need for measurements of vegetated landscapes at a resolution of individual trees, shrubs and fuels. UAS are expected to provide researchers with key insights into the spatial variability of forest processes in a collaborative environment that will gain additional support, leverage future research, and involve more faculty and students over time.