



Stage 2 - Research Topic Statement

Print Form

RESEARCH PROGRAMS USE ONLY

RESEARCH IDEA NO:	MT-006
DATE OF RECEIPT:	May 30, 2023
TOTAL MDT COST W/ICAP:	

RESEARCH PROGRAMS

Please submit completed forms via e-mail to MDTResearch@mt.gov. All fields are required, except the last field: XVIII, Sponsor(s). Incomplete forms will not be accepted.

TITLE (required): Remote Observation over time (Drone in a Box)

TOPIC STATEMENT:

Montana's diverse terrain and weather create unique problems for MDT Maintenance crews. Hazardous areas need to be monitored to assess risks such as avalanche and rock-slide sites. MDT Maintenance and MDT Unmanned Aircraft Systems (UAS) Program would like to explore a portable, fully automated drone solution nicknamed 'Drone in a Box'. This drone would monitor and or map hazardous sites remotely to reduce crew exposure and assess potential dangers to the traveling public.

RELATED RESEARCH SUMMARY FROM STAGE 1:

The Drone in a Box concept has been around for over a decade but only recently have we began seeing commercially available products. Most Drone in a Box solutions come with an untethered drone and operates remotely using a set of preprogrammed instructions telling the drone when to take-off, what flight path to follow, and when & where to land. Data collected during these operations is able to be accessed remotely, with the option to live stream the data in real-time. Very little research has been done by other state DOT's in this area with the exception of Alaska, Virginia and Massachusetts DOT's. The primary function for Virginia and Massachusetts DOT's was for traffic control & monitoring. Alaska is using a Drone in a Box to conduct research into equipment functionality & durability in extreme climates.

RESEARCH PROPOSED:

MDT Maintenance and MDT UAS Program management propose to deploy a Drone in a Box at one (or more) MDT locations where avalanche danger is common to monitor and map snow-pack over time. This research would propose to answer the following questions:

1. Is a Drone in a Box solution a cost effective and safer alternative to having maintenance crews physically inspect those areas?
2. Can the Drone in a Box solution be a reliable tool to collect the actionable data MDT needs to make accurate decisions?
3. Can mapping snow pack with a Drone in a Box solution in avalanche prone area's help predict occurrences to better prepare for incidents?
4. Can a Drone in a Box solution be an effective asset in assessing flooding issues during spring runoff?

A Drone in a Box would be placed at a known avalanche hot spot area during winter months and placed in flooding and/or rock-slide prone area's during the spring and summer months. Remote areas would need to be selected as the test



Stage 2 - Research Topic Statement

Print Form

site(s) to conduct the research. The Drone in a Box would be programmed with a flight plan to automatically take-off and collect the necessary data. That data would be transmitted to a cloud service that MDT would access to process and evaluate.

RESEARCH PERIOD (Time to complete research project.):

Nov 2023 to May 2025 using 2023 & 2024 field seasons for research with spring of 25 for final report.

IT COMPONENT: Identify if the project includes an IT component (purchasing of IT hardware, development of databases, acquisition of existing applications, etc.). If so, describe IT component in as much detail as possible.

The remote location(s) of the Drone in a Box would need to have access to a power source, and WiFi would need to be established using Starlink in remote areas. MDT may need to explore software specific to mapping snow pack, research will reveal this component.

FEASIBILITY, PROBABILITY OF SUCCESS, AND RISK:

Alaska DOT (AKDOT) is conducting research into a Drone in a Box solution and their results are very promising. AKDOT is collecting actionable data and the system has performed well in Alaska's climate. Conversations between MDT and AKDOT reveal synergies in our research efforts and Patrick Dryer (team member of AKDOT Drone in a Box research) agreed to be a technical panel member for this research increasing the probability of success (request Patrick Dryer AKDOT be a technical panel member to advise this research). The biggest risk with the research is the regulatory oversight the FAA may impose. Authorization to perform remote UAS operations would be needed prior to conducting the research.

URGENCY, IMPORTANCE, AND EXPECTED BENEFITS/PAY-OFF: Address urgency, timeliness, and importance of the research. Identify if the research is required for any federal or state initiative or compliance. This section must include a description of how this research will help to meet MDT's mission (i.e., serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality and/or sensitivity to the environment).

The unpredictable nature of avalanches and rock-slide pose challenges to MDT's Maintenance crews and pose risks to Montana's traveling public. MDT Maintenance would like to evaluate the benefits and efficiencies of using a Drone in a Box solution to evaluate conditions in these known hot spot locations in an effort to better predict and inform the public of potential dangers.

IMPLEMENTABILITY, IMPLEMENTATION PLAN, AND RESPONSIBILITY: Address the implementability of the expected results from the proposed project. Identify products that will enhance implementation. Identify any known implementation barriers and how these barriers might be eliminated or reduced. Identify MDT office or entity outside of MDT responsible for implementation. Describe initial implementation plan, include timeframe for implementation.

o Address the implementability of the expected results from the project:
If research demonstrates that the Drone in a Box solution is a reliable, cost effective method for monitoring avalanche and other hot spot locations then implementing the technology would be a matter of obtaining the necessary FAA authorization, purchasing the equipment and software, and training the appropriate Maintenance UAS Pilots in the operation of the equipment.

o Identify products that will enhance implementation:
There are several Drone in the Box manufacturers, the most suitable to MDT's research goals should be identified by research. MDT already possesses support equipment for Starlink for WiFi connectivity in remote locations.



Stage 2 - Research Topic Statement

Print Form

o Identify any known implementation barriers and how these barriers might be eliminated or reduced:
One obstacle to full implementation is the regulatory environment. The FAA requires a person to be able to take immediate control of the aircraft in the event of an emergency or abnormal event be on-site unless an appropriate authorization is issued. To take advantage of this equipments full capabilities and ensure efficiency, MDT would need to receive authorization from the FAA to operate this system beyond the visual line of site of the remote pilot in command. Research should explore "Shielded" BVLOS operations for FAA operational approval in rural mountainous locations.

o Identify MDT office or entity outside of MDT responsible for implementation:
The MDT UAS program office and MDT Maintenance Chiefs will be responsible for implementation, with MDT Maintenance pilots executing flight operations once research is complete.

o Describe initial implementation plan, include time-frame for implementation:
The implementation plan would consist of identifying the appropriate location to deploy the Drone in a Box solution. When those areas are identified and a budget has been established, the program would take one winter season to develop best practices and workflows. The process would begin again in the spring to assess flooding issues or to evaluate known rock-slide location. Once workflows and best practices have been established, it is expected to take an additional one to two seasons to implement statewide.

Summary:
If the research demonstrates that monitoring hazardous locations using a Drone in a Box is an effective and efficient method then obtaining the necessary FAA authorization would be the first step in implementing the technology. After that purchasing the equipment and software, and training the Maintenance UAS Pilots in the remote operation of the equipment would be next. Appropriate site locations will be identified to monitor avalanche areas during winter and rock slide or flooding prone sites during spring and summer. The program would be evaluated after the first winter/spring and summer season(s) to develop best practices and work flows. After the evaluation, it is expected to take an addition one to two seasons for statewide implementation. The MDT UAS Program Manager and MDT Maintenance Division Chiefs will be responsible for implementation.

MDT PRIORITY FOCUS AREAS: MDT may, as often as annually, identify priority research focus areas. These focus areas will be listed on <http://www.mdt.mt.gov/research/unique/solicit.shtml>.

Debris and rock-slide detection, Snow pack mapping, Avalanche monitoring

TOTAL COST ESTIMATE (If the project proposal comes in at a higher cost, it may require further approval and may be delayed.):

\$200k to \$250k

MDT FUNDING SOURCE (If MDT Research, enter SPR):

FUNDING MATCH SOURCE AND AMOUNT:

FUNDING PARTNER(S):

POTENTIAL TECHNICAL PANEL MEMBERS (At this time, individuals do not necessarily need to be identified; rather, MDT offices and outside entities can be named. However, if known, individuals may be named):

MDT Maintenance Chief - Justun Juelfs (?)



Stage 2 - Research Topic Statement

Print Form

MDT Maintenance Review - Matt Steveson
MDT UAS Program - Mike Kuni
AKDOT - Patrick Dryer (Member of AKDOT's Drone in a Box research team)

SUBMITTED BY: (required)	
NAME:	Mike Kuni
TITLE:	UAS Program Manager
AFFILIATION:	MDT Employee
ADDRESS:	HQ Helena
PHONE NO.:	406-444-6503
E-MAIL:	mkuni@mt.gov

CHAMPION: Must be internal to MDT, feel strongly that the research will benefit the Department, and is willing to chair the technical panel. Note: If a champion is not identified by you or Research staff, this topic statement will not move forward.

NAME:	Mike Kuni
TITLE:	UAS Program Manager
AFFILIATION:	MDT Employee
ADDRESS:	HQ Helena
PHONE NO.:	406-444-6503
E-MAIL:	mkuni@mt.gov

SPONSOR(S) (optional): Must be internal to MDT (Division Administrator or higher) and willing to ensure implementation occurs, as appropriate. If a sponsor is not identified by you or Research staff, this topic statement will not move forward.

NAME:	Jon Swartz
TITLE:	Maintenance Division Administrator
AFFILIATION:	MDT
ADDRESS:	
PHONE NO.:	
E-MAIL:	drouse@mt.gov