

Rural

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Project Title:  
Development and Testing of an  
Unmanned Aerial System (UAS)  
Cellular & Wi-Fi Repeater: Phase 1

Task Number: 3280

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## Developing an Unmanned Aerial Platform for Communication Systems

Investigating the use of unmanned systems to provide a communications repeater to expand Caltrans communications coverage in rural areas

### WHAT IS THE NEED?

Caltrans has shown a continued interest in the use of technology to improve safety of workers and the traveling public during highway maintenance operations. This research has included various approaches to improve communications for workers in the field to enhance safety while simultaneously improving the effectiveness of maintenance operations and emergency response. Early Caltrans efforts included research and development of a mobile real-time information system for use by snowplow operators. Recent Caltrans efforts in this area include the handheld terminal / diagnostic controller research and development to provide a single hardware kit running specialized apps to control ITS field elements such as Changeable Message Signs (CMS) and Closed-Circuit TV (CCTV) cameras. Caltrans has also supported a series of projects to enhance maintenance response through its Responder projects, including the Responder development projects, the Responder field testing research, and the current Responder research to transition this successful system to a third-party commercial contractor.

Two of Caltrans' stated goals are:

- Safety and Health: Provide a safe transportation system for workers and users and promote health through active transportation and reduced pollution in communities.
- Stewardship and Efficiency: Money counts. Responsibly manage California's transportation-related assets.

Effective communications are essential for both goals. In order for Caltrans to efficiently and safely manage California's



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transportation system, Caltrans needs ubiquitous and effective communications. Rural locations sometimes have little or no cellular coverage, and often no other means of communications. In some rural sites, Caltrans radios are also ineffective. There is a need to expand communications coverage, without the significant expenditure for satellite communications equipment and service.

## WHAT ARE WE DOING?

The purpose of this research effort is to evaluate the potential of extending the range of existing wireless communications infrastructure for a variety of remote communications use cases in existing rural projects (Handheld Terminal, Responder, etc.).

This research will investigate the possibilities for use of unmanned aerial platform to provide an aerial cellular and Wi-Fi communications repeater capabilities to expand Caltrans communications coverage in rural areas. The system may also act as a general-purpose Wi-Fi hotspot.

## WHAT IS OUR GOAL?

The goal of this research will be to significantly improve rural communications for Caltrans, without the added cost of satellite communications equipment and service. This will enable more efficient and safer maintenance and incident response for Caltrans' rural districts.

## WHAT IS THE BENEFIT?

This research is expected to lead to enhanced wireless network coverage using existing cellular infrastructure without reliance on satellite communications services. This would provide significant benefit in rural areas with more challenging cellular communications.

The system should also provide benefits in urban applications, including the general-purpose Wi-Fi hotspot.

Research on an aerial cellular and Wi-Fi repeater will yield substantial benefits, including:

- Improved daily rural maintenance operations
- Improved maintenance incident response
- Improved ability to dispatch the correct equipment for a given situation based on facts from the field
- Increased safety of the traveling public
- Increased mobility of the traveling public

## WHAT IS THE PROGRESS TO DATE?

A no-cost, time-extension was approved. This was needed primarily due to COVID-19 delays and access restrictions to the development labs.

Task 2 – Concept of Operations has been completed and approved by the Technical Advisory Panel (TAP). This task focused on understanding how a UAS could be used in transportation settings.

Task 3 – Literature and Product Search has been completed and approved by the TAP. This task conducted a search for best practices in State transportation departments and the application of UAS devices.

Task 4 – System Requirements is being reviewed by the TAP. The task develops system requirements to bridge the understanding between the concept of operations (task 2) and the detailed system design (task 5)

Task 5 – Detailed System Design is currently underway and is expected first quarter 2022.