Problem Chosen	2021 MCM/ICM Summary Sheet	Team Control Number
B		2100079

Our Thesis for 2021 MCM Problem B

Summary

Keywords: keyword1; keyword2

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Contents

1 Overview

1.1 Background

The wildfires in Australia recently has drawn great focus. Frequent wildfires bring fire extinguishing system great pressure, thus the assistance of automatic devices, like Unmanned Aerial Vehicle(UAV), radio and unmanned reconnaissance, should be taken into considerition.

1.2 Restatement of the Problem

To help the firefighting system in East Victoria State, we are required to solve several problems. The unmanned devices to respond to the bushfires can be divided to two kinds, the SSA Thermal Imaging system and the Radio Repaeters, with each UAV carrying one of them. To gurantee that the Safty Cofficient meets the satandard, we should balance the number of SSA and RR carried by UAVs, in order to acquire best economic benifits.
Moreover, the prediction of the bushfires in the next decade in East Victotia is required we will explain how to apply our model to respond to the bushfires.We are also required to point out where the UAVs with Radio Repaeters should be.

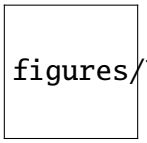

Figure 1: Topographical Map of Eastern Victoria

2 Notations

- **Unmanned Aerial Vehicle** $\rightarrow$ UAV
- **Radio Repeater** $\rightarrow$ RR
- **Rapid Bushfire Response** $\rightarrow$ RBR
- **Surveillance and Situational Awareness** $\rightarrow$ SSA
- **The total number of SSA and RR**$\rightarrow$ m
- **The firespot**$\rightarrow$ x
- **The fireregion**$\rightarrow$ y
- **Vector (x,y)**$\rightarrow \alpha$
- **Danger Cofficient**$\rightarrow$ d

3 Hypothesis and Justifications

1. **The EOC will be set near the fire and will not move**
2. **The Radio Repaeters'(RR) flights are always at their highest speed and will keep their location at the fires**
3. **The wildfires are considered as discrete dots(Firepoints)**
4. **The UAV with SSA system must work within 5Km from the firepoint**
5. **Ignore the side effects like Doppler Effecet and the influence of the winds**

4 Model Overview

4.1 Optimal numbers Model

To design a purchasing configuration for SSA and RR, we need to introduce a **Danger Cofficient** to evaluate whether the number of devices can gurantee that the firefightres are safe enough to work at the firespots. Due to various kinds of goods in the problem, this is a threedimensional heterogeneous container loading problem. We use the Three Space Division Method and Monte Carlo Simulation to solve it.

4.2 Programming on Routes of UAVs

5 Model Theory

6 Model Implementation and Results

7 Disscussion

8 Conclusion

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