

# Can Unmanned Aerial Vehicles Supplement Services Provided by Traditional First Responders?

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\*Funding: This study was funded by a grant provided through Wayne State University's Undergraduate Research Opportunities Program.



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## Introduction

- Opioid overdoses claimed 47,600 American lives in 2017, yet a highly effective reversal agent (naloxone) is readily available.<sup>1</sup>
- Naloxone's efficacy is time-dependent, so minimizing the time required to reach patients is critically important.
- Drone delivery of naloxone (prior first responder arrival) may result in expedited resuscitation and improved patient outcomes.
- Data on travel times for drones compared to medical first responders (MFRs) are lacking.
- This study analyzes the time required for a drone carrying naloxone to traverse various distances in order to simulate the time required for drones to reach the scene of opioid overdoses and compare these results with real-world MFR transit data.

## Methods

- 50 total flight trials were conducted using a customized DJI Inspire 2 drone (Fig 1) across seven different straight-line distances corresponding to common distances found in our MFR reference dataset.
- Total time required for the drone to take-off, ascend to its "cruising altitude", and then travel the horizontal distance in question was recorded as the UAV-T variable. (Table 1)
- 200 Detroit-based MFR runs to suspected or actual opioid overdoses were used for comparison; time elapsed between MFR dispatch and arrival on scene was recorded as the MFR-T variable (Table 1).
- MFR-T was compared with UAV-T across different distances in order to identify disparities in travel times (I.e. between dispatch and arrival-on-scene) for the MFRs versus the drone at each discrete distance. (Fig 2)

## Results

- These data show with greater than 95% certainty that drone travel times are better than ambulance arrival times at distances of 0.5 km, 1.0 km, 1.5 km, 2.0 km, and 3.0 km.
- At the remaining distances, we were unable to draw statistically significant conclusions due to an insufficient quantity of first responder data (I.e. fewer than 5 data points).

## Figures



Figure 1: Customized DJI Inspire 2 drone used for this study.

Straight-Line Distance (km)	MFR-T (sec)	UAV-T (sec)	Drone's Arrival Time Improvement over MFR (sec)
0.5	215 +/- 25	26 +/- 2	189 +/- 25
1.0	276 +/- 34	54 +/- 5	222 +/- 34
1.5	308 +/- 47	86 +/- 3	223 +/- 47
2.0	305 +/- 28	112 +/- 3	194 +/- 28
2.5	314 +/- 43	--	--
3.0	420 +/- 67	165 +/- 2	255 +/- 67
3.5	427 +/- 73	--	--
5.0	--	269 +/- 3	--

Table 1: Mean Time Between Dispatch and Arrival for MFR (MFR-T) Versus Drone (UAV-T) Across Various Distances

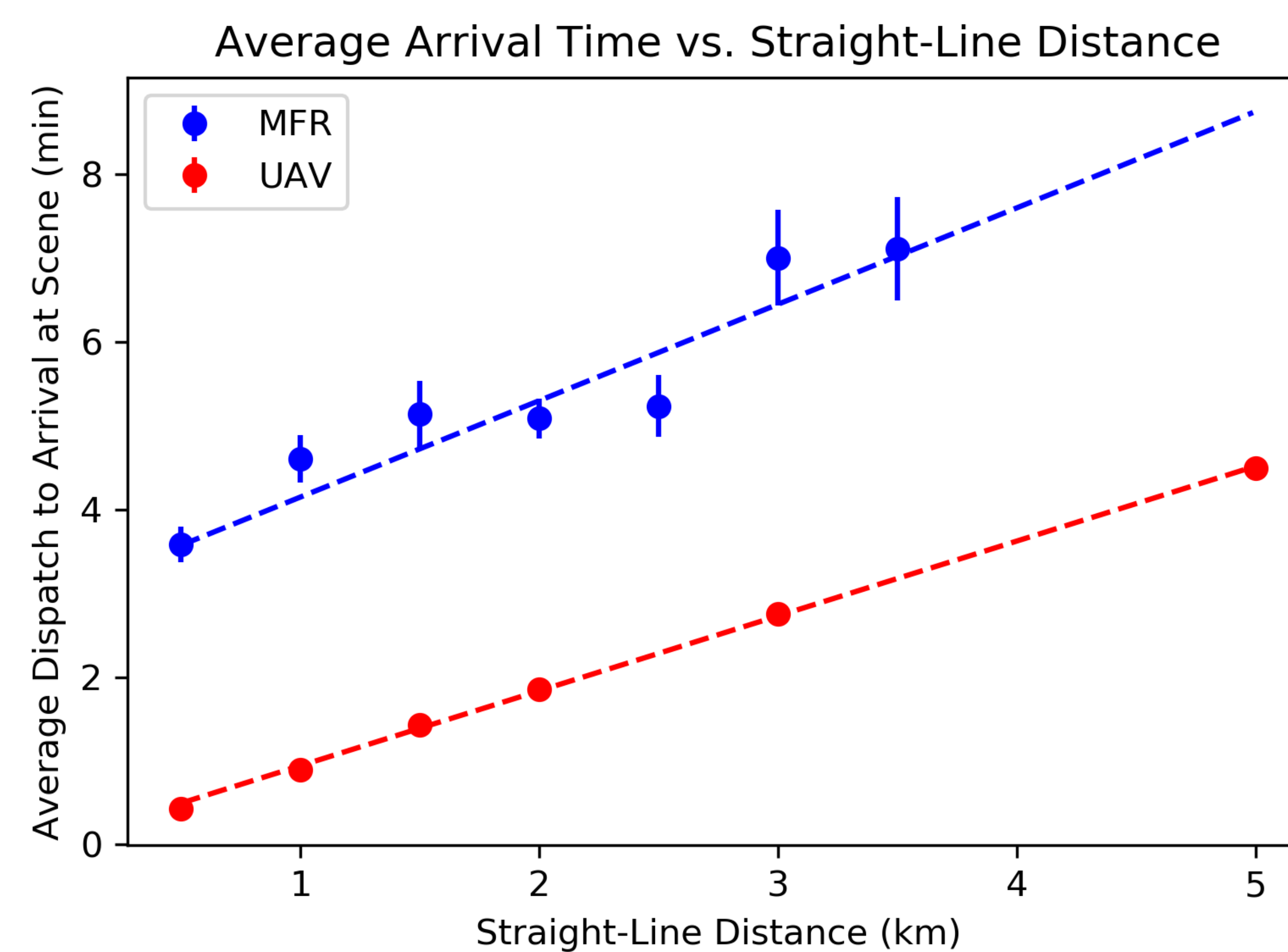


Figure 2: Average drone response time (UAV-T) versus average ambulance response time (MFR-T) across various distances

## Discussion

- We have shown that a drone is capable of traveling faster across several straight-line distances than an ambulance responding to opioid overdoses the same distances away.
- UAVs are a platform technology and may be used to deliver urgent medical supplies (E.g. epi-pens, anti-convulsant medications and AEDs) in acute medical emergencies.<sup>2</sup>
- Many technological, economic, and regulatory considerations must be explored before attempts to integrate these platforms into municipal emergency response infrastructure are made.
- Limitations of this investigation include: limited MFR response reference dataset, restricted number of flight trials, and conducting tests exclusively in optimal weather conditions.

## Use of Drones During COVID-19

- COVID-19 has brought about new opportunities to practically evaluate and actually implement drone-based healthcare delivery.
- The primary domains of drone use during COVID-19 include:
  - Crowd Monitoring & Temperature Checks** => Surveying public spaces to identify high-risk individuals based on detectable vital signs (E.g. temperature, heart rate, cough).<sup>3</sup>
  - Disseminating Public Health Messages** => Broadcasting social distancing announcements and reminding passersby about the importance of wearing masks.<sup>4</sup>
  - Delivery of critical medical supplies** => Collaborative efforts to establish hospital delivery networks for rapid transport of time and temperature sensitive medications, PPE, and other key supplies needed to treat COVID-19 patients and protect front-line workers.<sup>5</sup>
  - Disinfection** => Repurposing agricultural drones to sanitize high-traffic communal spaces and venues.<sup>6</sup>
- Recent use of drones during the COVID-19 pandemic has yielded mixed responses and has contributed to concerns about how this technology might impact personal privacy and other civil liberties.<sup>7</sup>

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