



COUNTY OF LOS ANGELES

FIRE DEPARTMENT

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TO: EACH SUPERVISOR

FROM: DARYL L. OSBY, FIRE CHIEF

MITCHELL H. KATZ, MD, DIRECTOR

SUBJECT: DELFT UNIVERSITY PROTOTYPE AMBULANCE DRONE REPORT

On January 26, 2016, your Honorable Board directed the County of Los Angeles Fire Department (Department) and the Emergency Medical Services (EMS) Agency to provide a report on the status of drone technology and how it could be used as a component of the emergency response system.

In consideration of the Board's request, we have jointly researched the status of Delft University's "ambulance drone" and the published article. You may access the article by clicking on the following link: <http://www.io.tudelft.nl/onderzoek/delft-design-labs/applied-labs/ambulance-drone/>.

This is a very interesting combination of currently available technology to address a critical public health issue. Currently, the ambulance drone exists only as a prototype and the developers have been seeking sponsors to allow further research to be done. There are some specific issues which would make development of a program like this especially challenging in Los Angeles County. Specifically, Costs, Indoor/Outdoor Accessibility and Federal Aviation Administration Regulations and Safety Concerns currently do not support the use of drones in Los Angeles County for EMS purposes.

Size of Los Angeles County

Each ambulance drone is designed to cover 14 square kilometers (5.4 square miles). Los Angeles County is made up of approximately 4,000 square miles. In order to cover this large land mass, ocean excluded, it would take more than 1,000 ambulance drones (this includes providing double coverage in high density areas and reserve ambulance drones).

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ROLLING HILLS ESTATES
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SANTA CLARITA

SIGNAL HILL
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SOUTH GATE
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WEST HOLLYWOOD
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WHITTIER

Cost

Assuming their cost projections are accurate, each ambulance drone would cost approximately \$20,000. With the average automatic external defibrillator (AED) costing \$1,200-\$1,500, anywhere from 13 to 16 public access defibrillators could be added to the community for the same cost. Unlike public access defibrillators, the ambulance drone would also require other significant start-up and training costs to our public safety agencies.

Indoor/Outdoor Accessibility

At best, the ambulance drone could deliver the AED to the doorstep, but not inside a home or building. Available research for homes showed that training family members in Cardio Pulmonary Resuscitation (CPR) was equally efficacious in improving survival when compared to home AEDs in targeted cardiac patients. Thus, delivering an AED by ambulance drone would not be expected to improve survival compared with CPR training and standard 9-1-1 resource response to a patient's home. The best value of AEDs has been demonstrated in public gathering places and an ambulance drone would only be able to reach outdoor gatherings. As the cost per unit for a standard AED comes down, reducing the gathering size in which an AED is required could have the same effect at a lower cost.

In their article, Delft University suggests that the survival from out-of-hospital cardiac arrest could be increased from eight percent to 80 percent. This data is inaccurate and is based on multiple assumptions. AED use can only apply to a specific subset of cardiac arrest patients: ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT). These are the only cardiac arrest patients that benefit from defibrillation. This also assumes that the ambulance drone would be able to reach the patient in one minute and that there is a ten percent absolute improvement for every one minute of time saved. While it has been shown that early defibrillation improves outcomes, and there is an approximate ten percent drop in survival for each minute of delay, these data cannot necessarily be used conversely and have not been prospectively validated in this novel model of cardiac arrest resuscitation.

Is this the best approach to reducing out-of-hospital sudden cardiac death (SCD)? Currently, only 33 percent of SCD patients in the United States receive bystander CPR, and only three percent receive defibrillation from a public access defibrillator. Over the past few years both Departments have promoted Sidewalk CPR Day, which has trained more than 100,000 people in "hands-only CPR." We also continue to provide Emergency Medical Dispatch with CPR instructions and we are reviewing our data to evaluate new approaches to increase the rate of bystander CPR. Additional public education is essential to improve outcomes from SCD. Continuing to increase the availability of public access defibrillators is an increasingly cost-effective approach as the price point of defibrillators continues to drop.

Federal Aviation Administration Regulations and Safety Concerns

The skies over Los Angeles are already crowded and Delft University has not addressed the risks and regulations necessary to ensure the safety of this number of drones in our airspace. The busy air space and air traffic will be impacted by drone usage.

At the present time, the Federal Aviation Administration (FAA) has strict guidelines for Public Aircraft Operations in regard to Unmanned Aircraft Systems (UAS) to operate within United States (U.S.) airspace:

“Public Aircraft Operations are limited by federal statute to certain government operations within U.S. airspace. Title 49 U.S.C. § 40102(a)(41) provides the definition of “Public Aircraft” and § 40125 provides the qualifications for public aircraft status. Whether an operation qualifies as a public aircraft operation is determined on a flight-by-flight basis, under the terms of the statute. The considerations when making this determination are aircraft ownership, the operator, the purpose of the flight, and the persons on board the aircraft.

For public aircraft operations, the FAA issues a [Certificate of Waiver or Authorization \(COA\)](#) that permits public agencies and organizations to operate a particular aircraft, for a particular purpose, in a particular area. The COA allows an operator to use a defined block of airspace and includes special safety provisions unique to the proposed operation. COAs usually are issued for a specific period – up to two years in many cases.

The FAA works with these organizations to develop conditions and limitations for UAS operations to ensure they do not jeopardize the safety of other aviation operations. The objective is to issue a COA with parameters that ensure a level of safety equivalent to manned aircraft. Usually, this entails making sure that the UAS does not operate in a populated area and that the aircraft is observed, either by someone in a manned aircraft or someone on the ground to ensure separation from other aircraft in accordance with right-of-way rules.”

Clearly, this would defeat the purpose of the ambulance drone; however, we feel that it is worth monitoring the evolution of the drone technology for uses within the Department and EMS. In the future, as the number of drones and use expand, we anticipate current regulations, liability, mechanical issues, protocols for collision avoidance, and malfunction will be further addressed.

Conclusion

For all the reasons previously stated, ambulance drones are not appropriate for introduction into the system at the current time. We anticipate that technological advances will continue to transform the EMS system to the benefit of our patients. For example, several EMS systems have begun deploying extracorporeal membrane oxygenation into the field to treat patients with out-of-hospital cardiac arrest. This machine replaces the vital functions of the heart and lungs, oxygenating the blood and perfusing the body, thus allowing more time for advanced interventions at the hospital to restore the patient's spontaneous circulation. These "early adaptor" systems are increasing cardiac arrest survival in the communities they serve and successfully resuscitating patients who, without this technology, would not survive. However, new technologies require scrutiny to ensure that they are both safe and efficacious. Early adapters take on the risk, but may also be the first to see the benefits allowing others to follow. Most importantly, innovation requires a foundation of excellent care. As a system, we should ensure we meet and exceed current standards of care and are constantly ready to adapt to new innovations that will take us, and our patients, into the future.

If you have any questions, please contact me at (323) 881-6180, or you may contact Dr. Katz at (213) 240-8101.

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