

# DSIAC TECHNICAL INQUIRY (TI) RESPONSE REPORT

## Unmanned Aerial Vehicles Equipped With Ultraviolet-C Lighting for Disinfection

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A chief service of the DoD IACs is free technical inquiry (TI) research, limited to 4 research hours per inquiry. This TI response report summarizes the research findings of one such inquiry jointly conducted by DSIAC.

## ABSTRACT

The Defense Systems Information Analysis Center (DSIAC) was asked to identify if there is available research related to the use of unmanned aerial vehicles (UAVs) equipped with ultraviolet (UV) lighting for antimicrobial or decontamination activities in support of emergency medical or counterbiological warfare response to man-made biologic threats. Considering the COVID-19 virus, companies and researchers are aiming to create ways to decontaminate surfaces using UV light, specifically ultraviolet-C (UVC) light, by using UAVs to eliminate exposure to humans. Recent solutions from researchers include UAVs equipped with UVC lights to autonomously decontaminate and disinfect surfaces without harming humans. The potential uses for this technology could be extended to man-made biological threats in the future.

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## 1.0 TI Request

### 1.1 INQUIRY

Is there research or technology available related to the use of unmanned aerial vehicles (UAVs) equipped with ultraviolet (UV) lighting for antimicrobial or decontamination activities?

### 1.2 DESCRIPTION

The inquirer is interested in UAVs equipped with UV light that autonomously participate in decontamination activities in support of emergency medical, disaster, or counterbiological warfare response to man-made biologic threats. Recent solutions from researchers include UAVs equipped with ultraviolet-C (UVC) lights to autonomously decontaminate and disinfect surfaces without harming humans. The potential uses for this technology could be extended to man-made biological threats in the future.

## 2.0 TI Response

The Defense Systems Information Analysis Center (DSIAC) searched open-source documents to identify research and technology related to the use of UAVs equipped with UVC light for decontamination and disinfection. Various researchers and companies are in the process of developing, testing, and offering completed UAVs to aid in disinfecting surfaces without causing human harm from harmful UVC light exposure.

It is also interesting to note that any UAV that can carry the payload of UVC lights can be used for decontamination efforts. Determining the size, weight, and power of the lights can allow researchers to determine which payloads are a good fit for current UAVs.

### 2.1 AERTOS 120-UVC

Digital Aerolus recently developed a drone named the Aertos 120-UVC as an upgrade to their Aertos UAV. This drone, equipped to navigate interior spaces without GPS or other external aids, is a quadcopter equipped with 36 light-emitting diodes (LEDs) that shine 36 potent UVC lights at 265 nm. It must fly 6 ft above a surface for 5 min to provide a disinfection rate greater than 99%. Batteries will need to be changed out during the process to ensure the UAV holds a proper charge [1].

### 2.2 UNIVERSITY OF CALIFORNIA SAN DIEGO (UCSD)

Researchers at UCSD have been experimenting with the Parrot Beebop drone for use in disinfecting COVID-19. The drone has been retrofitted with strips of LEDs that emit UV light in

the UVC frequency range. The idea is that the drone would be placed in a room and then piloted remotely by using the drone's camera to navigate. UCSD's goal is to design a kit that anyone can adapt to retrofit their own drones, thus allowing disinfection capabilities to more people. The team is currently testing the prototype to see how effective it is at killing pathogens, effective defined as a 99% pathogens kill rate [2].

## 2.3 AERONÁUTICA SDLE AND GRUPO RÍAS

Spanish companies Aeronáutica SDLE and Grupo Rías are developing a microdrone emitting UVC to disinfect surfaces as well as indoor and outdoor areas. The microdrone works with sensors that allow it to perform its function remotely inside buildings and avoid human exposure to infection. It is prepared for UVC radiation and will have 15 min of endurance [3].

## 2.4 HEALTH INNOVATION VIA ENGINEERING LAB (HIVE)

Researchers from Galway, Ireland's HIVE have developed the UVCDrone, which uses UV light to sterilize surfaces. The UVCDrone uses UVC light when the public space is unoccupied, such as at nighttime. The drone is programmed to autonomously fly around public space using a bespoke artificial intelligence algorithm and land again for recharging [4].

## 2.5 INDIAN ARMY CORPS OF ELECTRONICS AND MECHANICAL ENGINEERS (EMES)

Drones to help battle COVID-19 have been developed by the Corps of EMEs, an arms and service branch of the Indian Army. The current products are completely in-house designed and developed and have been user-validated, according to a senior Army officer. The UV-light sanitizer has been developed by the 509 Army Base Workshop in Agra, India. The drone uses UV germicidal irradiation for disinfection by directing the light toward a surface from ~6 inches. The surface will be fully sanitized in 20 s [5].

## 2.6 GHOST DRONE

Korean designers at Off Garage Studio created the GHOST drone, a UV LED integrated drone, as a "space care system" to provide autonomous sterilization services. The drone is equipped with sensors and UVC LEDs and flies around subway and train stations to clean the germs on surfaces as well as purify the air.

The drone has a front vision sensor, a driving camera, a bottom vision sensor, a side vision sensor, and an ultrasonic sensor to ensure the safety of the flight. Front and bottom LEDs light up in the dark, so when the station closes, the drone can float around to provide hygienic services [6].

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## BIOGRAPHY

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