Unmanned Aerial Vehicle Non-Line-of-Sight Chemical Detection

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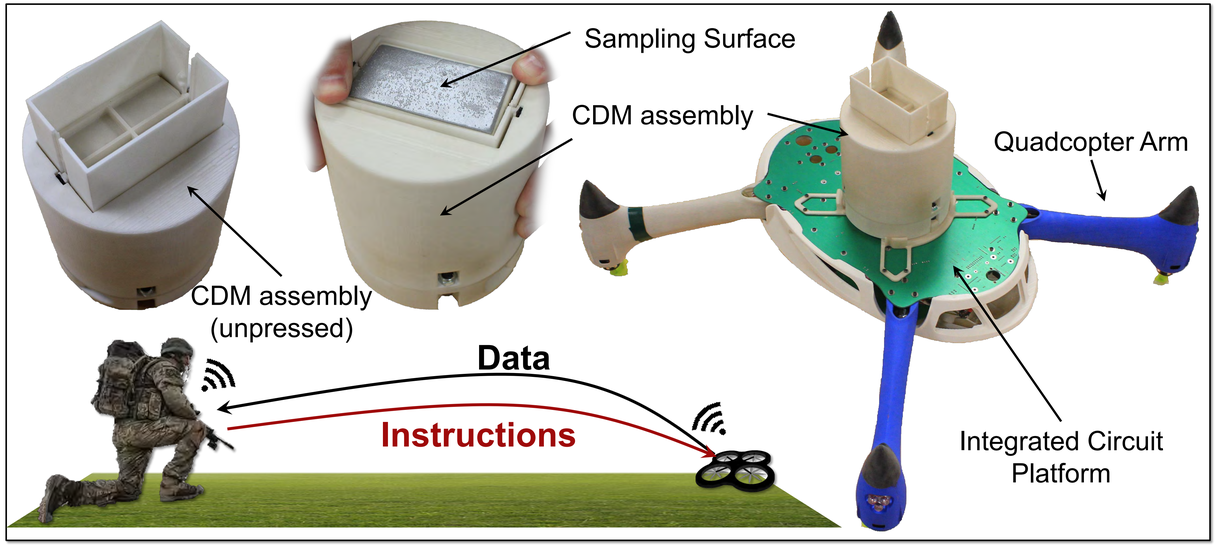
Background

Currently fielded and explored technological solutions are not capable of efficient non-line-of-sight (NLoS) threat detection at distances greater than a few meters. An innovative solution to **reconceptualize remote detection** combines the point and proximal detection benefits with Warfighter hazard mitigation. Unmanned aerial vehicles (UAVs) and ground based robots operate at stand-off distances using wired or wireless controls and communication; however, **only UAVs offer NLoS detection**. Any direct threat to the user is minimized while the sample collection occurs with highest quality level.

Approach

ECBC's Advanced Design and Manufacturing (ADM) has designed a quadcopter UAV platform with a payload capacity of 5-7 lbs and a range of a few kilometers.

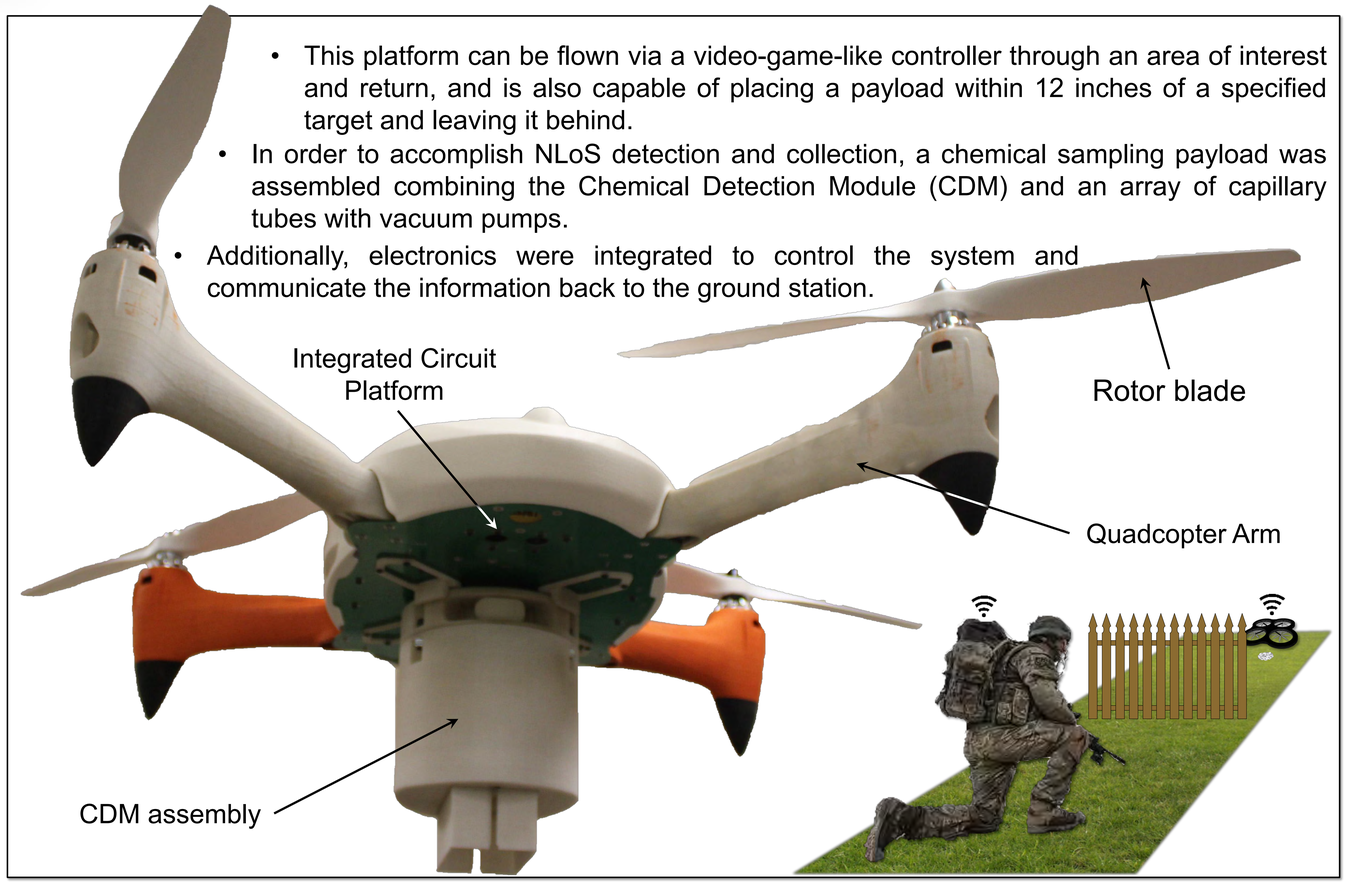


Potential for Leverage

Current DoD organizations such as the **Night Vision and Electronic Sensors Directorate (NVESD)** are interested in the development of NLoS detection techniques, and are actively looking into such solutions to possibly feed into programs of record. Examples of acquisition programs that would utilize this technology would be:

- **Forward Reconnaissance and Explosive Hazard Detection (FREHD)**
- **Common Analytical Laboratory System (CALS)**
- **Next Generation Chemical Detector (NGCD)**

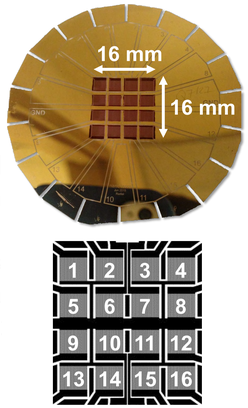
- This platform can be flown via a video-game-like controller through an area of interest and return, and is also capable of placing a payload within 12 inches of a specified target and leaving it behind.
- In order to accomplish NLoS detection and collection, a chemical sampling payload was assembled combining the Chemical Detection Module (CDM) and an array of capillary tubes with vacuum pumps.
- Additionally, electronics were integrated to control the system and communicate the information back to the ground station.



Commercial Collaboration

Nano Terra
George Whitesides

Colorimetric and electrical response sensors are also used in industrial real-time gas monitoring. Sensors from companies such as **George Whitesides' Nano Terra** (right) offer COTS products that could easily be included in payload and/or material construction.



Future Directions

Future developments include:

- Chemically agnostic *in-situ* identifying payload
- Colorimetric sensor integration to allow UAV to act as its own sensor, as well as inform user what kind of threat was encountered
- GPS linked sampling to allow for threat mapping and monitoring

Data can either be transmitted back to the Warfighter as observed or uploaded after the UAV returns. This project would position ECBC at the forefront of NLoS stand-off detection.

Approved for Public Release