An Emergency Response UAV Surveillance System
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A system using Unmanned Air Vehicles (UAVs), equipped for real time telemetry of video imagery, sensor support data, and GPS/INS navigation, is being developed to provide situational awareness (SA) to the central command of mass casualty incident response. UAVs provide an inexpensive and safe means of acquiring video surveillance in chaotic disaster scenes, while being durable and non-intrusive. The system provides autonomous surveillance of defined perimeters, video tracking and active following of targets of interest, and real time cueing to other imaging UAVs.

BACKGROUND
In a disaster response, incident commanders must function to effectively coordinate personnel and resources, often with delayed and inaccurate information on the hazards and evolving conditions at the scene. Therefore, real time SA is critical to the central commander since a delay in the received information could have catastrophic outcomes. Current emergency response practices use ground video surveillance of the disaster scene to obtain SA. Ground video surveillance is limited because: 1) its field of view is limited and not responsive to emerging events, 2) many ground cameras are needed to provide images of the entire scene, and 3) it requires manual installation by the already overburdened responders. Coordinated autonomous UAVs address these problems by rapidly providing simultaneous views of the scene at different resolutions (Figure 1) using fewer cameras. They also have the ability to traverse into sites that are unreachable or too dangerous for first responders.

UAV SYSTEM HARDWARE
The UAV Surveillance System is composed of multiple instrumented Zagi planes made by Procerus Technologies, with the following specifications:
- Size: 48” Wide, Weight: 24 oz
- Flight speed: 35-45 mph
- Flight AGL altitude: 100-400 ft
- Max range from station: 3 miles
- Comms: 900MHz (Telemetry) & 2.4GHz (Video)

They are equipped for real time telemetry of video imagery, sensor support data, and GPS/INS navigation data. They autonomously take-off (hand launched), land and fly waypoint routes and loiter plans.

IMPLEMENTATION
The system uses a high flying UAV to provide video of the entire disaster scene. Other low flying UAVs are used to provide higher-resolution video of specific areas. The video images of all UAVs and additional ground cameras, if desired, are received in a single laptop for processing (Figure 2). Developed algorithms and software are used to obtain geodetic (i.e., GPS) locations of areas of interest by directly clicking in the received images, enabling rapid coordination among responders. The low flying UAVs can also be autonomously redirected to locations of interest selected in the high flying UAV images by the user. Video and GPS coordinates can be sent through a network to other responders in the area.