# TechNote

UAVs for Emergency Response

Background

A UAV (unmanned aerial vehicle) is a powered aircraft with no pilot onboard. UAVs can be piloted remotely by the operator at the ground control station or flown autonomously, following a preprogrammed flight plan configured by the operator at the ground control station.

Traditionally, UAVs have been used for intelligence, surveillance, and reconnaissance roles in military settings. UAVs, however, can also be used in civilian settings. Monitoring the United States' land borders is an example of civilian use of this technology. UAVs that can be stored in the trunk of a vehicle have been developed and can be used for emergency response operations. These UAVs are launched within minutes, provide up to two hours of flight time, and are generally less expensive in price and operating costs than the military models.

UAV System Components and Operations

A UAV system is typically comprised of three key components: the aircraft, a payload, and a ground control station. The aircraft typically consists of a durable, modular air vehicle with a fuselage, wings, a rotor/propeller, a tail, an engine, communications equipment, and a flight control system. The communications equipment enables the transfer of information between the UAV and the ground control station. The flight control system controls the aircraft according to its manual or preprogrammed flight plan.
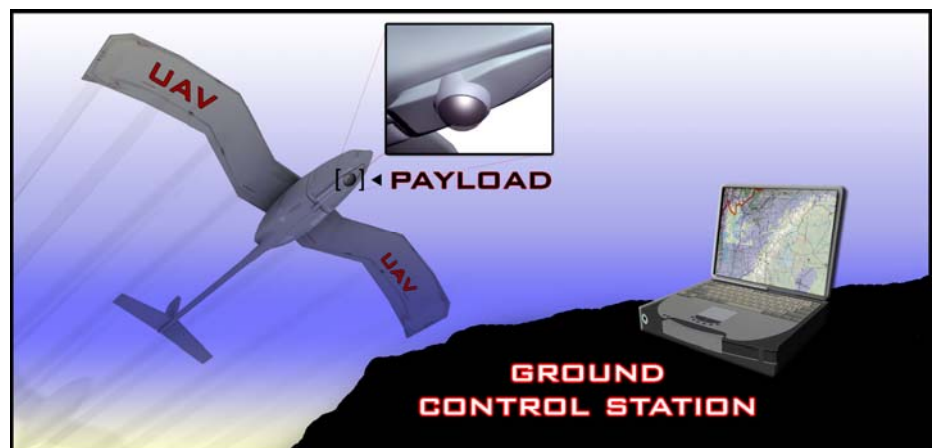
UAV System Components

The second key UAV component is the "payload." The payload refers to the intelligence, surveillance, and/or reconnaissance equipment being carried by the UAV. Typical payloads consist of sensors, such as a thermal imager, radar, or video or still camera. The payload is limited by the available physical mounting area and the lifting capability of the UAV. The payload is usually located on the underside of the nose, tail, or fuselage.

The third key UAV component is the ground control station. Ground control stations use uplink/downlink communications equipment, global positioning system (GPS) navigation equipment, and mission management software to control the UAV and its payload. The uplink transmits command and control information from the ground control station to the UAV, while the downlink provides status information from the UAV to the ground control station for display to the operator. The GPS navigation equipment (part of the flight control system) and mission management software allows the user to program flight coordinates and monitor vehicle position and speed.

A UAV system typically operates in the following manner:

- The UAV is launched by the operator to support a task such as ground surveillance.
- Information captured by the payload sensor/camera is relayed from the UAV to the ground control station via the communications link for live viewing or storage.
- The information is processed and displayed at the ground control station for operator interpretation and/or stored for later retrieval.
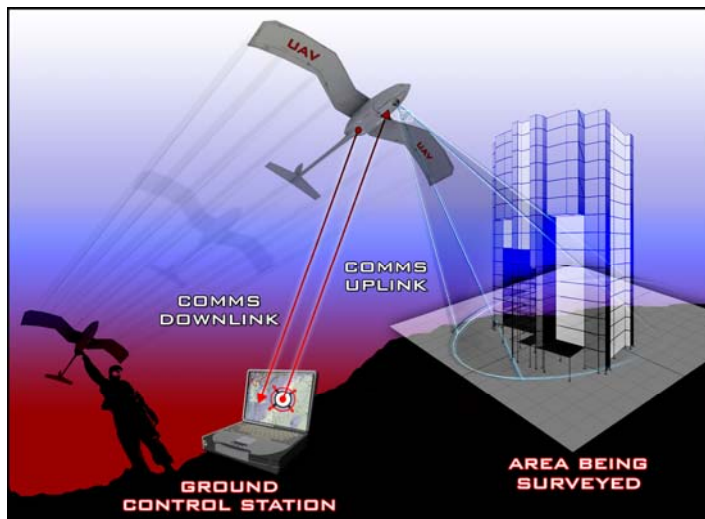
UAV System Operations

Applications

UAV systems can be used to:

- Conduct surveillance of illegal activities.
- Gather visual intelligence.
- Collect evidence.
- Monitor large special events (e.g., sporting events, protests).
- Monitor traffic.
- Monitor search and rescue operations.
- Monitor or detect incidents involving hazardous materials.

Usage Considerations

One of the greatest challenges to responder agencies in the use of UAV systems is obtaining the appropriate certification to fly the UAV. For public agency operation, the Federal Aviation Administration (FAA) issues a Certificate of Authorization (COA) to federal, state, and local government agencies that operate UAV systems. The FAA works with its applicants to develop conditions and limitations for UAV operations to ensure that they do not jeopardize the safety of other aviation operations. A COA permits agencies to operate a particular UAV, for a particular purpose, in a particular area. A COA is usually valid for one year. Usually, the FAA will provide a formal response within 60 days from the time a completed application is submitted. COAs often contain additional restrictions, such as limiting flight time to daylight hours, prohibiting flight near heavily populated areas, and/or requiring that the aircraft be observed, either by someone in a manned aircraft or a ground observer who can keep visual contact with the airborne UAV at all times.

Additional information regarding the COA process is available from the FAA's air traffic organization, (ATO-R), Office of Systems Operation and Safety, System Safety and Procedures.

Emerging Developments

Micro-aerial vehicles (MAV) that will be capable of taking off and landing in the palm of their operator's hands are under development and will likely be available in the near future. Vendors are working to develop MAVs for use in a wide range of applications.

Resources

FAA Unmanned Aircraft System Group: http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/aaim/organizations/uas/

UAV Forum: http://www.uavforum.com

UAV Market Space: http://www.uavm.com