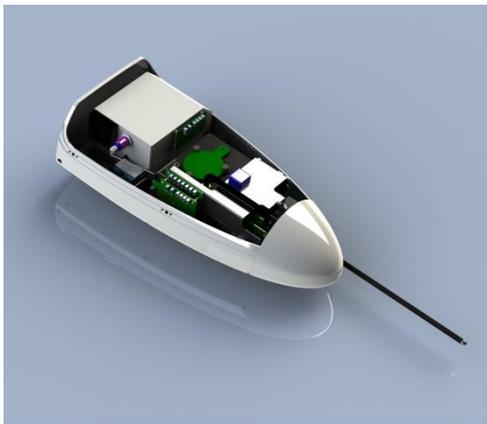




Flying UAV Laboratory

Complete Off-The-Shelf System

Multi-Functional CBRN Solutions



CBRN payload mounted in UAV

The FLYING LABORATORY

is a pioneering UAV-based product with full CBRN monitoring capabilities developed by Research International. A second-generation ion mobility spectrometer (IMS) is mounted onboard to provide toxic gas detection. Up to 20 chemical warfare agents and toxic industrial gases can be detected at part per billion to part per million concentrations. A UV particle fluorometer is used to detect any unusually high biological aerosol levels, and a gamma spectrometer is used in

combination with two Geiger counters to detect and identify nuclear materials and monitor radiation levels. One of the Geiger tubes is used for monitoring general background radiation levels, while the second, capable of detecting either alpha, beta or gamma radiation, is mounted so that it monitors radiation emitted from particulates captured by an aerosol sampling filter included in the payload.

An on-board air sampling circuit can grab a biological or radiological aerosol sample if the biological or radiological sensors detect unusual conditions. This sample is collected onto a compact 44 mm diameter high-flow electret filter with a 50% collection point of 0.5 microns, or with a lower flow electret filter with 99+% efficiency at 0.3 microns. The latter is favored for radiological sampling.

A video or continuously recording IR camera can also be provided in a gyroscopically stabilized gimbal mount. Camera video can be either streamed to a base station when within telemetry range, or stored onboard for later examination. A single-board computer is used to combine, analyze and store digital data created by the various CBRN sensors. Sensor data, along with GPS coordinates and time, is stored on a 32GB SD memory card for post-flight analysis.

The UAV can be operated in a “manual” control mode when within wireless telemetry range or can be programmed for fully autonomous operation to meet applications involving longer flight distances. Special electronics and software allows automated landing by unskilled personnel and the UAVs have state-of-the-art mufflers to reduce propulsion system noise. Air residence times can be up to 15 hours depending on atmospheric conditions and the payload.

FEATURES

- Complete CBRN Sensor suite
- Turn-key or payload only
- Fixed wing UAVs
- Multi-rotor helicopters
- Respirable bioaerosols
- Aerosol sample collection
- Optional IR/video
- Downlink or store data onboard
- Custom packages

APPLICATION AREAS

- Agriculture
- Public health
- Environmental protection
- Homeland security
- Military
- Public event security

System detectors typically respond in 1 to 2 seconds. The gas detector has the largest latency period, about 4 seconds, which corresponds to less than ± 45 meters uncertainty in position at cruising speed, or about ± 26 meters at the lowest possible (stall) speed. All system components are capable of operation between -30°C and $+60^{\circ}\text{C}$. Specifications for the various subsystems are provided below but custom detection suites are also possible.

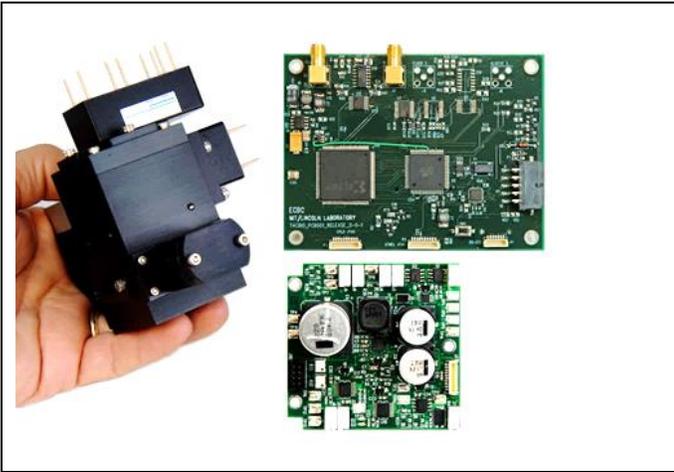


Figure 1: Biodetector hardware based on ultraviolet-stimulated biofluorescence.

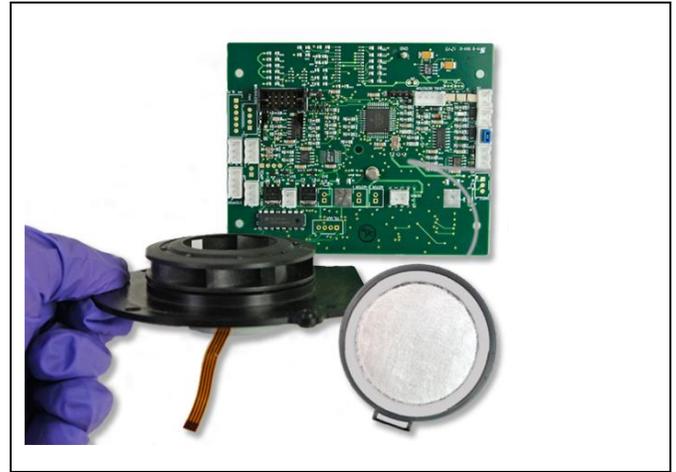


Figure 2: 300 liter/minute aerosol sample collector components.



Figure 3: Radiation detector subsystem shown in a previous application, mounted in a cylindrical enclosure to the underside of a miniature UAV helicopter.



Figure 4: Vibration stabilized camera mount and IR camera.

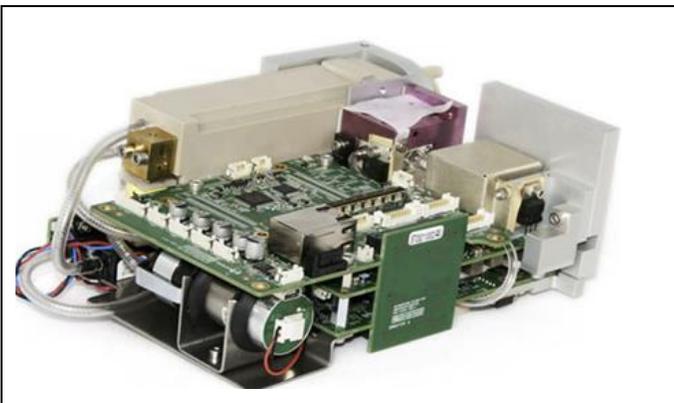


Figure 5: Second-generation IMS gas detector.

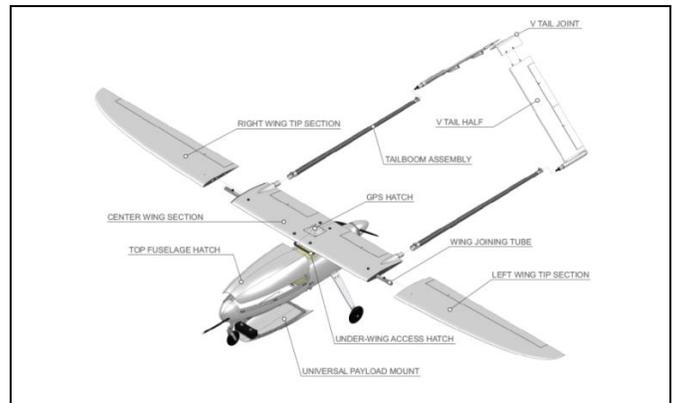


Figure 6: UAV airframe views.

BioAerosol Detector Specifications (See Figure 1 above)

PARAMETER	DESCRIPTION
Operating Principle	Aerosol particle counter with UV biofluorescence signature detection
Excitation wavelength	360 um
Particle size range	Respirable particle range
Threat identification	Aerosolized bacteria, spores, viruses, toxins.
Detection limit	100 to 300 ACPLA, depending on threat
Data output rate	2 sec. and 1 minute update rates. 30 minute historical data profile used as a moving baseline for alarm protocols
Sampling Rate	1 liter per minute nominal
Alarms	Electronic digital alarm; software adjustable alarm criteria
Continuous Operating Time	Essentially unlimited if power is maintained
Operating temperature range	-30°C to 60°C
Humidity	0 to 95% non-condensing
Consumables	None

Aerosol Sample Collector Specifications (See Figure 2 above)

PARAMETER	DESCRIPTION
Operating Principle	Electret dry filter media with high efficiency centrifugal fan.
Air Collection Rate	User adjustable 50 LPM to 300 LPM typical
Collection Efficiency	With bioaerosol filter: 0.5 um dia: 50%; 1.0 um dia: 75%; >2.0 um dia: 90% With radioactive aerosol filter: >99% for all particles greater than 0.3 microns
Operating Temp. Range	-40°C to 70°C
Filter media physical size	4.4 cm diameter active filter in 6.0 cm diameter holder.
System Controls	Microprocessor controlled. Operating characteristics addressable over RS-232 serial data link.

Radiation Detector Specifications (See Figure 3 above)

PARAMETER	DESCRIPTION
Operating Principles	Scintillation-type spectrometer and 2 Geiger tubes. One Geiger tube is for gamma monitoring of surroundings, second for detection of alpha, beta and gamma radiations emitted by aerosols captured on the electret sampling filters.
Scintillation material	Sodium iodide crystal scintillator
Energy range	0.05 to 3.0 MeV
Spectral channels	238
Update rate	One measurement set per second
Data handling	Onboard storage plus limited data in real-time
Continuous Operating Time	Essentially unlimited if powered externally
Operating temperature range	-30°C to 60°C
Humidity	0 to 95% non-condensing

Thermal Camera/Gimbal Mount Specification (See Figure 4 above)

PARAMETER	DESCRIPTION
Display formats, analog output	PAL, NTSC; switchable
Pixel pitch	25 um
Resolution	324 x 256
Spectral band	8 – 14 um
Exportable frame rate	7.5/8.3 Hz
Sensitivity (NETD)	0.05 Kelvin
Size	45 x 45 x 30 mm
Lens Specification	35 mm f/1.2 lens. Horizontal field of view: 13 degrees. Vertical field of view: 10 degrees.
Detection limits	1.8mx0.5m man shape at 800m; 4mx1.5m vehicle shape at 2250m
Operating temperature range	-40°C to 80°C

Thermal Camera/Gimbal Mount Specification (continued)

Gimbal System	
Stabilization method	2-axis gyro stabilized fully integrated direct drive gimbal
Stabilization	Better than 250 μ rad
Temperature	-40°C to 50°C operational

Gas Detector Specifications (See Figure 5 above)

PARAMETER	DESCRIPTION
Operating Principle	Second generation Ion Mobility Spectrometry (IMS)
Ionization method	Corona discharge- nonradioactive
Nerve agents detected	GA, GB, GD, GF, VX, HD, L, phosgene, nitrogen mustard, hydrogen cyanide
Toxic Industrial Chemicals	10 toxic industrial gases simultaneously detected with nerve agents above
Air sampling rate	400 ml/min sensor flow
Sensitivity	Typically 1% of IDLH for GA, GB, GD, and GF nerve agents. PPB or PPM typical sensitivity levels for various toxic industrial vapors and gases
Time to detect	4 secs worst case to detect a foreign trace gas. Detailed scans can then be run and the data stored for later depot-level analysis at the flight center after the UAV returns.
Continuous Operating Time	Essentially unlimited if powered externally.
Operating temperature range	-30°C to 60°C
Humidity	0 to 95% non-condensing
Consumables	Two gas scrubber cartridges need to be replaced after every 125 hours of continuous operation

UAV Specifications (See Figure 6 above)

PARAMETER	DESCRIPTION
Maximum payload	10.0 kg
Payload volume	20 liters
Range	Typical: 250 km with 3.5 liter fuel tank; 500 km with 7.5 liter fuel tank
Ceiling	5000 m
Flight time	Up to 18 hours with 7.5 liter fuel tank
Stall speed	47 km/hr
Maximum speed	130 km/hr
Cruise speed	79 km/hr
Wing span	3.3 m
Overall Length	2.27 m
Sound level	<60 dB @ 30 m
Nondetectability range	700 m
Takeoff and landing	Catapult or runway
Avionics	Piccolo TASE200 autopilot with auto-landing capability; -40°C to 80°C
Platform weight	10.0 kg

Research International reserves the right to change specifications without prior notice.

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