Flying UAV Laboratory

Drone-based CBRN detection and air sampling

Taking CBRN technology to new heights

Features

- Usable from -40°C to 70°C: no fluids
- Bio/radioaerosol sampling: Air flow to 300 LPM
- User-specified automated protocols
- Wireless control option
- Stand-alone modules or with UAV platform
- Easy decontamination
- Compact and lightweight

Application Areas

- Counter-terrorism
- Public health
- Environmental monitoring
- National security
- Agriculture

The Flying UAV Laboratory II comprises several lightweight UAV stand-alone sensor modules for applications such as counterterrorism, public health, and nuclear safety. The modules may be used as-is or integrated onto one of two Research International quadcopter UAV platforms. Modules available include:

Aerosol sampling The aerosol sampler module uses electret filter technology. Two filter styles are available: A 300 liter/minute version with a 0.5 micron 50% particle size cut-off and a HEPA version that has 95% or better collection down to 0.3 microns. The sampler can be turned on and off using RI's quadcopter ground controller. With a separate Research International wireless link, all sampling procedures can be modified in-flight. The module weighs 451 grams and consumes 10 watts of power.

Radiation detection/identification The gamma ray detector module incorporates CsI scintillator technology with isotopic identification capability over an energy range of 0.05 to 3.0 MeV. The module also includes an electret filter for collection of radioactive aerosol samples on ground station demand. The module weighs less than 1.2 kg and consumes a maximum of 15 watts of electric power.

Aerosol monitoring This module provides both biological aerosol detection and sample collection. It is based on Research International's industry-leading portable photon counting biodetector, the Tac-7C, and aerosol sampler, the SASS 3100. The module weighs 1.5 kg and consumes 6 watts of power in detection mode and 16 watts with simultaneous 300 LPM collection.

CWA and TICs (late 2024) Two IMS modules are available. A small module (0.8kg, ~1 watt of power) can monitor 10-12 chemical vapors, while a larger module (5 kg, 30 watts) can monitor for up to 24 chemical vapors.

Wireless Communication A wireless communication module is available that enables ground-based PC control and monitoring of the sensors and sampler over a range of up to 3 km.

Quadcopter Platforms Customers who do not have their own UAV platform may be interested in the quadcopter used by RI during module qualification. It provides up to 30 minutes flight time unloaded, maximum payload capacity 3.7 kg, with a range of 1.5 km.

All modules will operate on DC UAV supplies of 15 to 32 volts. Alternatively, a separate battery pack can be provided. See other RI brochures for details on RF links.

Sampling Module: Collection & Decontamination Specifications

Operating Principle	Collection by electret dry filter media.	
Air Collection Rate	With standard (bioaerosol) electret filter: With HEPA-style (radiological) electret filter:	User adjustable 50 LPM to 300 LPM. User adjustable 10 LPM to 49 LPM.
Filter Collection Efficiency	With standard (bioaerosol) electret filter: With HEPA-style (radiological) electret filter:	50% at 0.5 micron diameter. More than 95% for > 0.3 μm diameter.
Filter Mass and Composition	Standard (bioaerosol) electret filter: HEPA-style (radiological) electret filter:	12 mg/cm^2. Polypropylene electret microfiber. 2.2 mg/cm^2 for active media; 8.6 mg/cm^2 including backing scrim. Polypropylene electret microfiber.
Filter Media Size	4.4 cm active diameter filter, mounted in 6.0 cm diameter injection-molded polypropylene holder.	
Decontamination	Water-tight design allows decontamination with 1 to 5% bleach solution. Fan shell and motor/rotor assembly may be removed for decontamination.	

Sampling Module: Physical Specifications

Dimensions	Not to exceed 15cm Dia. x 9.5cm H (6 x 3.74 inches)
Weight	451g (1 lb.)
Package	IP67 sealed polymer shell+ demountable rain shield
Sound Level	45-61 dB (A) at 1 meter; peak value at exhaust port.
Temp. Range	-40° to 70°C for both storage and operation.
Humidity Range	Rain shield prevents wetting of filter during rainy conditions or debris deposition on takeoff/landing.
Drive Fan	High efficiency centrifugal fan with electronically commutated drive motor. Fan life is 30,000-40,000 operating hours.
Power Source	Requires 10 watts at 15-32VDC. 100–240 VAC/50–60 Hz; lump-in-cord 28 VDC power supply provided.
Power consumption	< 10 watts

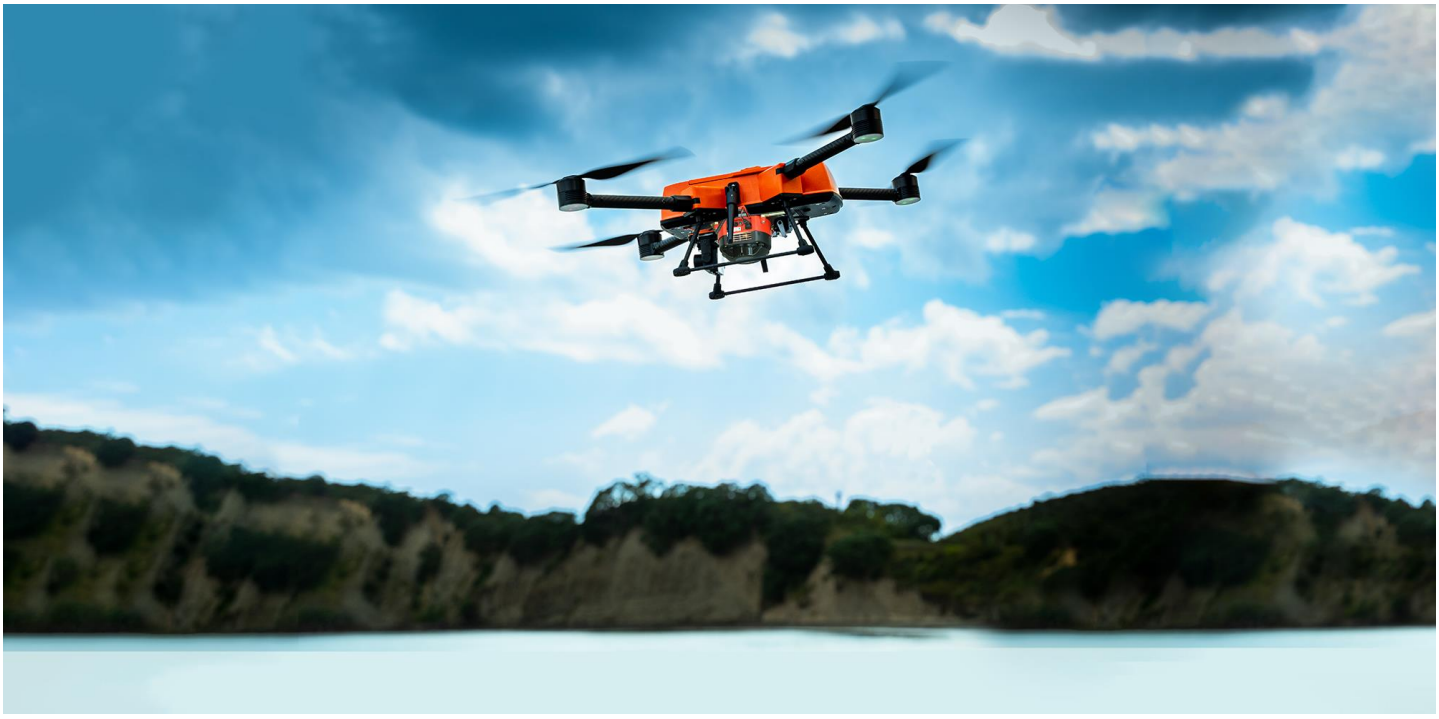
Research International air sampler mounted beneath drone

Sampling Module: Software, Accessories, & Consumables

System Controls	PC-based software monitors sampler operation and is used to control sampling rate and air flow rate. Sampler may also be turned on and off remotely with RI's UAV ground controller.
PC Software Requirements	OS: Windows; processor: 400 MHz Pentium or equivalent (min.); RAM: 96 MB (min.), 256 MB (recommended); hard disk: 1.2 MB available space; USB port or CD-ROM.
Communications	Can be turned On/Off via UAV ground controller. Hermetic DB9 RS232 serial output on module can be used for connection to a wireless data transmission link or PC. Compatible 2km wireless link available from RI.
Optional Accessories	Carrying case, rechargeable battery pack, charger.
Consumables	Electret filters in four styles: Standard /welded, standard/removable, HEPA/welded, HEPA/removable

Aerosol Fluorescence Detector Specifications

Operating Principle	Dual-channel aerosol particle counter. Fluorescent and diffractive-scattered photons are monitored on a particle-by-particle basis and particles are binned based on optical response.
Excitation wavelength	UV-C excitation: 280 nm LED
Particle size range	Respirable particle range
Threat identification	Aerosolized bacteria, spores, viruses, toxins, and several drugs of abuse.
Detection limit	100 ACPLA, typical. AI-type 5-parameter algorithm used to identify unusual aerosol events
Data output rate	15 second update rate; 15 minute historical data profile used as a moving baseline for alarm protocols
Sampling Rate	1.2 liter per minute nominal
Weight	1.5 kg (3.3 lbs.)
Power consumption	6 watts in monitoring mode, 16 watts when sampling
Alarms	Custom 5-parameter algorithm issues an alert when an unusual aerosol event occurs. Sampler is slaved to detector to auto-collect a sample. Historical data can be analyzed with an AI-style software package to optimize alarm settings for the user's environment.
Communications	Particle size distribution, fluorescence intensity, background aerosol levels and GPS location can be monitored in real-time from ground station using Research International wireless link.
Continuous Operating Time	Powered by UAV. Fully operational while UAV is in flight.
Operating temperature range	-30 °C to 50 °C; up to 60C for 1000 hours.
Humidity	0 to 95% non-condensing
Consumables	None



Toxic Gas Detector Specifications - Option 1

Operating Principle	Second generation Ion Mobility Spectrometry (IMS)
Ionization method	Corona discharge- nonradioactive
Nerve agents detected/identified	Up to 12, including GA, GB, GD, GF, VX, HD, L, phosgene, nitrogen mustard, hydrogen cyanide
Toxic Industrial Chemicals	Up to 16 toxic industrial gases currently available
Maximum single library size	A combination of 24 CWAs and TICs.
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	10-30 secs typ. 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.
Communications	Chemical response data and GPS location can be monitored in real-time from ground station using Research International wireless link.
Field Self-calibration	Yes. Atmospheric water vapor used to auto-calibrate
Continuous Operating Time	Powered by UAV. Fully operational while UAV is in flight
Operating temperature range	-30 °C to 60 °C
Weight	5 kg (11 lbs.)
Power consumption	30 watts
Humidity	0 to 95% non-condensing
Consumables	A gas scrubber cartridge needs to be replaced after 40 hours of continuous operation

Toxic Gas Detector Specifications - Option 2

Operating Principle	Advanced, non-radioactive Ion Mobility Spectrometry
Agents Detected	Nerve, blood, blister, choking, and a selected library of and TICs
Operating temperature range	-32°C to 49°C (-25.6°F to 120°F)
Operating humidity range	0 to 100% RH
Modes of operation:	1) CWAs and TICs (chemical warfare agents and toxic industrial chemicals) 2) CWAs only
Weight	.8 kg (1.8 lbs.) including batteries
Dimensions	10.6 x 18.0 x 4.65 cm (4.17 x 7.08 x 1.83 in)
Power	9VDC; 110/240V ac using power supply unit
Batteries	4 x AA lithium iron disulphide or 4 x AA alkaline manganese dioxide (rechargeable NiMH AA batteries can be used)

Radiation Detector Module Specifications

Operating Principles	Scintillation-type spectrometer and Geiger tube
Scintillation material	CsI (Tl) crystal
Energy range/sensitivity	0.05 to 3.0 MeV/Scintillation detector: 0.01 to 50 uSv/hr; Geiger tube is 50-10^6 uSv/hr
Counts/uSv/hr (^{137}Cs)	200 CPS
Spectral channels	1024. Identification of common radioisotopes in real-time
Update rate	One measurement set per second
Data handling	Onboard storage plus limited data in real-time
Communications	Dose rate, spectral information and GPS location can be monitored in real-time from ground station using Research International wireless link.
Continuous Operating Time	Powered by UAV. Fully operational while UAV is in flight.
Operating temperature range	-30 °C to 60 °C
Weight	1.2 kg (2.65 lbs.)
Power consumption	5 watts in monitoring mode and 15 watts in sampling mode
Optional add-on capability	300 liter/min radioaerosol sampler (see sampling module specifications)
Humidity	0 to 95% non-condensing

UAV Features

Research International offers the UAV described below. Customers may use their own UAV if longer flight time or larger payload is required.

Module control	Capable of turning Module on/off	
Max payload capacity	3.7 kg/8 lbs	
Flight time	Up to 30 mins (no wind & no load)	
Max wind speed resistance	18 m/s/40mph	
Max flight altitude	1,500 m / 1 mile	
Max flight distance	1.5 km	
Max flight speed	ATTI 20 m/s; GPS 10 m/s	
Max image transmission	1 km	
Waterproof rating	IP67	
Satellite positioning system	GPS/Galileo	
Working temperature	-10°C – 40°C	
Transmitter power (EIRP)	<33 dBm (FCC), <20 dBm (CE)	
Operating frequency	2.405-2.475 GHz/5.725-5.825 GHz	
Drone Battery	99 Whr/ 22.2V	
Dimensions (no propeller)	Unfolded: 522 x 522 x 192 mm (20 x 20 x 7.5 inches)	Folded: 306 x 266 x 192 mm (12 x 10.5 x 7.5 inches)
Certifications	CE / FCC / ROHS / RCM	

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