TacBioHawk™

Detect • Collect • Identify

Multi-Functional CBRN Solutions

The TacBioHawk™ combines particle detection and bioidentification capability

The TacBioHawk™ is an integration of Research International's TacBio biological particle detector and BioHawk aerosol collector and bioidentifier into a single package. It is designed for continuous outdoor monitoring of biothreat agents over a wide range of environmental conditions.

The biological particle detector uses ultraviolet (UV) excited fluorescence to monitor biological particle levels in the air, and elastic scattering to monitor other types of particles. This particle detection portion of the TacBioHawk is extremely useful for tracking background levels of airborne materials and providing an alarm if there is an unusual increase in biological aerosol levels. However, it does not identify the type of biological material detected, and for that reason it is correctly characterized as a 'trigger.' The BioHawk portion of the system provides identification in the event of a TacBio alarm.

When the BioHawk is triggered into operation by the TacBio, an aerosol sample is automatically collected and an 8-agent wet sandwich-style antibody-based assay is performed. The entire process can be completed with no human intervention within a 20 to 30 minute period.

FEATURES

- Detection plus bioidentification
- Up to 8 simultaneous agent identifications
- Fast assays
- Reusable coupons
- Continuous outdoor monitoring
- -32°C to 60°C
- Remotely controllable in real time
- Communicates wirelessly or via RS-232 link

APPLICATION AREAS

- Environmental
- Air quality
- Agriculture
- Public Health
- Military

TACBIO BIODETECTOR MODULE

The aerosol biodetector's mode of operation is based on the well-known fact that non-biological materials primarily absorb and scatter impinging UV light, whereas biological materials fluoresce as well as scatter UV light. With the recent development of GaN semiconductor Light Emitting Diodes (LEDs), high brightness UV sources have become available that are energy efficient and more reliable and temperature-tolerant than current UV lasers (<400nm wavelength). In addition, very high-speed analog electronics are used to count the individual photons emitted by each particle, providing a "Geiger counter" operating mode that eliminates most of the drift and aging problems seen with analog

optoelectronics. The TacBio requires little maintenance and no consumables, and is an ideal first line of defense for monitoring areas that cannot be accessed regularly.

Although aerosol data can be transferred to a remote location for analysis and storage using the TacBioHawk's serial RS-232 data line, it is also stored internally on a removable SD memory card within the unit. This card can store up to 5 years of aerosol alarm data.

BIOHAWK MODULE

The BioHawk® is a portable 8-channel bioassay system with automated sample collection capability that is suitable for high-sensitivity monitoring of live agents and protein toxins. Once activated by the TacBio, the BioHawk samples surrounding air for aerosol threats with its wetted wall cyclone air sampler, and automatically transfers the concentrated sample from the air sampler to a wet bioassay module. This module performs automated sandwich-style antibody assays in eight separate detection channels over a period of 15-20 minutes, after which results are communicated to users through a Touch Screen LCD display and by wireless or RS-232 link to personnel at a remote location. System operation may also be remotely controlled in real time with virtually every fluid or air handling function being capable of remote manipulation.

The bio-identification portion of the instrument can also analyze fluids from other sample collection systems or from liquid samples loaded into the instrument through a manual sample port. A built-in microcomputer provides unparalleled operating flexibility and sophistication.

Bioassays are performed within a disposable, credit card-sized, plastic assay coupon. Unlike other technologies on the market that are based on a "use once and discard" philosophy, this coupon and the reagents stored within it may be used for 10 assay procedures before being discarded. Since the coupon can execute up to eight different assays simultaneously, a total of 80 individual assays may be performed before the coupon is discarded. This capability can substantially reduce life cycle cost.

While possessing a high level of function and great versatility, the unit is still very easy to use. Most global functions such as air sampling and bio-identification are performed using multi-step protocols (recipes) developed by Research International and stored in the system's computer memory. The unsophisticated user needs only the most fundamental level of training since the internal processes and steps are preset through the built-in computerized recipes. For more sophisticated users, bundled Windows-based software allows the development of customized sample collection and detection protocols.

The system is designed to be operated over a very wide temperature range, from -32°C to 60°C. In low temperature environments sampled air is preheated to above freezing before entering the wetted wall cyclone sampler. At high ambient temperatures, cooling fans circulate air into the transport case to prevent overheating. Bioassay reagents are maintained in a very stable lyophilized (freeze-dried) form until they are needed and are only rehydrated when a bioassay is to be performed, greatly extending the assay coupon's useful life. Once hydrated, reagents are useable for a period of up to 48 hours.

TacBioHawk Specifications

General Specifications

PARAMETER	DESCRIPTION
Basic Function	An unusual increase in the bi-aerosol background triggers aerosol sampling and a wet bioassay analysis for selected threat agents.
Start-up time	1 minute.
Time to alarm	1 minute or less. A 30 minute historical baseline is used for alarm protocols
Air sampling rate	40 liters/min of ambient air nominal
Communication	NATO ATP-45D : RS-232 or wireless BioLink
Bioassay time	20 to 30 minutes typical, including collecting an air sample.
Number of simultaneous agent identifications	Up to 8 agents
Geographic locating	Internal GPS determines position of equipment.
Power	Idle condition (1, 2): 0.84 amperes; 21.8 watts. Wet sampling (1, 3): 1.24 amperes; 32.2 watts. All systems operating (1, 4): 5.0 amperes; 130 watts.
Duty cycle	Continuous 24 hours per day operation
Operating temperature range	-32 °C to 60°C. Operation between 50 and 60°C is permitted up to a total time of 1000 hours.
Humidity	0 to 95% non-condensing
Consumables	Distilled water, buffer water, and bioassay coupons
Sound level	78 dB (A) maximum at 1 meter.
Survivability	MILSPEC 810; MTBF of about 30,000 hours is determined by air sampler fan
Size	633.7 cm H x 590.1 cm W x 335.1 cm D without air stacks attached. 793.7 cm H x 590.1 cm W x 335.1 cm D with air stacks attached.
Weight	30 kg dry weight

Notes:

1. 26 volts DC input power.
2. No heaters on, no wet sampling. Bio-aerosol detection ongoing.
3. No heaters on, bio-aerosol detection and wet sampling ongoing.
4. Both interior and wet sampler air heaters on, plus all analytical equipment.

TacBio Bioaerosol Detector Specifications

PARAMETER	DESCRIPTION
Operating Principle	Aerosol particle counter with UV fluorescence signature detection
Particle size range	Respirable particle range
Threat identification	Aerosolized bacteria, spores, viruses, toxins.
Interferents	Interferent resistant to diesel smoke, pollen, silica dust.
Start-up time	1 minute.
Time to alarm	1 minute or less. A 30 minute historical baseline is used for alarm protocols
Sampling Volume	1.2 liter per min of ambient air nominal
Communication	RS-232 or wireless BioLink
Data storage	Collected data is stored on a removable SD-type data card. A 1.0 GB card will store more than 5 years of aerosol data.
Alarms	Electronic digital alarm.
Consumables	None

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

BioHawk Sampler/Bioanalyzer Specifications	
PARAMETER	**DESCRIPTION**
Collection principle	Multi-stage wetted-wall cyclone with enhanced particulate collection.
Assay method	Disposable assay coupon, re-useable up to 10 times. Up to eight simultaneous antibody-based assays per assay cycle. Coupon reseals on removal for archival storage.
Fluid Handling	Fluids manipulated under microprocessor control using peristaltic and syringe pumps; sample may be oscillated to lower assay time; reagent is recovered for reuse.
Consumables	Distilled water, buffer water, and bioassay coupons
Fluids storage	Clean water: 1 liter; Buffer: 200 ml; Waste: 500ml
Human interface	Day/night Touchscreen LCD display, usable in MOPP gear.
Operating/storage	Once hydrated, long term operation above about 40C will deteriorate reagents and reduce assay coupon life.
Data storage	Flash memory retains raw/processed data for over 6000 assays.
Alarm	Software data link.
Decontamination	Auto-flush protocols using onboard water, or manual flush with detergent and/or disinfectant. High-performance pull-through centrifugal sampling fan may be removed and discarded.
Outer shell	Heavy-duty hard-shell transport case with wheels.
Bioassay Specifications	
Analyte range	Toxins, viruses, bacteria, spores, fungi, multi-cellular pathogens
Sensitivity	Analyte dependent, 1 to 10 ppb typical for toxins, 10,000 to 100,000 CFU/ml for bacteria.
Assay time	Dependent on assay; 20 minutes typical.
Reagent storage	Reagent stored onboard assay coupon; may be reused more than 10 times depending on assay protocol.
Confirmatory sample	Confirmatory sample may be stored in assay coupon or sample vial.
Air Sampling Specifications	
Operating principle	Multi-stage wetted-wall cyclone with spray-enhanced particulate collection.
Air collection rate	40 LPM, nominal.
Particulates collection range	1-10 µm
Concentration ratio	40,000/min., nominal.
Liquid inventory	1 cc typical. Factory set but adjustable under computer control. Patented control process maintains a constant liquid volume in the sampler, independent of collection time, temperature, or humidity; useful for concentrating trace airborne analytes.
Air inlet and outlet	External ports on TacBioHawk case
Sample transfer	On-board 12 cc/min peristaltic pump from sampler to bioanalyzer. Vial filling also supported. Air sampling may continue during bioanalysis.
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