

**SCENTROID**

[ FUTURE OF  
SENSORY  
TECHNOLOGY ]

**DR1000  
FLYING  
LABORATORY**

Reference List



# DR1000 FLYING LABORATORY APPLICATION OVERVIEW



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## Drone-Based Emission Monitoring

Applications:

Wastewater treatment, landfill, greenhouse gas monitoring, oil & gas, pipeline, petrochemical, well sites, mining, construction sites, smart cities, urban areas

# DR1000 Flying Laboratory

The DR1000 is an intelligent chemical analyzer designed to be mounted to a drone for aerial air quality measurement. The DR1000 measures gases using up to 6 sensors selected based on application from a list of more than 40 possible sensors. These sensors can detect pollutants such as H<sub>2</sub>S, NO<sub>2</sub>, SO<sub>2</sub>, VOC, CL<sub>2</sub>, PM1-10, and many other compounds. The drone analyzes data continuously while in flight at a rate of more than 100 samples per second, while sending data back to the ground station using long range radio transmission (LORA) and the dedicated cloud server over 3G wireless network. The data is automatically stamped with GPS position, latitude, time, date, ambient humidity, and temperature. This data can be used for numerous applications using DR1000s GIS software or any other mapping software such as ArcGIS.

## What is Included:

- DR 1000 Analyzer
- Ground Station Receiver
- Ground Station (Laptop)
- Carbon Fibre Probe
- GPS, GSM, and LORA antennas
- Charge adaptor
- Extra batteries and wall charger (optional)



### Operating Time

Maximum 2.5 hours  
with full battery



### Sampling Rate

500 samples/second,  
filling a bag every 5 seconds



### Transmission Rate

8 Seconds



### Maximum # of Sensors

6 Chemical Sensors + PM1-10  
+ Radiation detection



### Other Sensors Included

Temperature, humidity, GPS  
position, latitude



### Dimensions/Weight

26 x 16 x 18 cm, 3.2kg



### Communication

3G/4G, LoRa



### Height Capabilities

The DR1000 can travel 150 meters  
above ground level



### Cloud Access

Unit can be accessed on location  
or remotely using encrypted cloud  
based hosting

# APPLICATION: OIL & GAS



## Gas to be monitored:

CH<sub>4</sub>, CH<sub>2</sub>O, SO<sub>2</sub>, VOCs, NH<sub>3</sub>

## Challenge

Monitor oil and gas site emissions, health and safety, time and cost of monitoring

## How Scentroid helped:

In 2016, Eni conducted a field test of the DR1000 in collaboration with a local company to conduct simultaneous drone measurement with summa canisters of hazardous gases released during excavation of an industrial land fill. The objective was to provide operators with a way to monitor the gases over the large area without having to be exposed to the actual pollutants. The gases measured were Hydrogen Chloride, Hydrogen Cyanide, Formaldehyde, ammonia, and hydrogen sulfide.

The study was a great success showing extremely close correlation between the DR1000 and laboratory readings. Furthermore, combining multiple technologies such as Lidar and thermal imaging with the chemical detection capabilities of DR1000 the group was able to calculate exactly where each gas was released from and in exact quantities in a reconstructed 3D map of the landfill. The success of the project has led to numerous long-term use of the DR1000 for hazardous waste excavation.

## Client: Eni Energy Company, Italy

Eni is an Italian multinational oil and gas company headquartered in Rome. Considered one of the global supermajors, it has operations in 79 countries, and is currently world's 11th largest industrial company.

## Other features that can be used:

Thermal Camera, LIDAR, drone Camera for inspection

# APPLICATION: PIPELINE LEAK DETECTION



## Client: Sky4APPS, Italy & Aerostar Drone, Canada

Sky4APPS provides state of the art solutions for quality of air analysis, site surveys and mapping, antenna 3d modeling, solar panel validation, disaster mapping, safety, security and precision agriculture.

### Gas to be monitored:

CH<sub>4</sub>, CH<sub>2</sub>O, SO<sub>2</sub>, VOCs, NH<sub>3</sub>

### Challenge

Monitor oil and gas pipeline for leak detection, time and cost of monitoring

### How Scentroid helped:

One sector that actively deploys Scentroid DR1000 technology is oil and gas industry. Drones equipped with DR1000 can make offshore oil and gas operations safer and more efficient. In one project Scentroid provided DR1000 for monitoring of gas emissions from leaks in the pipe line, storage tanks and even stacks. To accomplish this the DR1000 was equipped with a fast response PID, H<sub>2</sub>S, NMHC, and SO<sub>2</sub> sensors. The DR1000 allowed the operators to stay safely away from hazardous areas especially flare stacks and open holding tanks. Aerial inspection can also result in early detection of leak, damage to structural abnormalities, piping and other external and internal inconsistencies.

New technology and innovation for drones is making them more accessible than ever. And the oil and natural gas industry has embraced this innovation, to help their efforts as good stewards of the environment. With drone operating costs dropping as technology improves, this tech is rising as the new eye in the sky for oil and natural gas producers.

### Other features that can be used:

Thermal Camera, drone Camera for inspection

# APPLICATION: MINING, CONSTRUCTION SITES



## Gas to be monitored:

NO<sub>x</sub>, SO<sub>x</sub>, PM 2.5, PM10, Dust, CO, CO<sub>2</sub>, CH<sub>4</sub>

## Challenge

Blasting is an integral part of large-scale open cut mining that often occurs in close proximity to population centers and often results in the emission of particulate material and gases potentially hazardous to health. On other cases, underground coal fires start naturally or as a result of human activities. Burning coal seams emit carbon dioxide, carbon monoxide, sulfur oxide and methane, and is a leading cause of smog, acid rain, global warming, and air toxins.

## How Scentroid helped:

Drones equipped with DR1000 are becoming an integral tool in replacing manual inspections in the most mining areas and collecting critical information, while drastically reducing the time and manpower. World's largest mining companies are investing immense resources in finding technological solutions to increase efficiency, improve safety and streamline operations. DR1000 flying lab provides air quality data including SO<sub>x</sub>, NO<sub>x</sub>, Methane, CO, CO<sub>2</sub>, PM1-10, TSP information and new levels of insight. This autonomous technology, streamlines operations, increases efficiency and offers immediate, easy access to the air quality data.

Clients: SI Analytics: South Africa  
ECO Monitoring: Poland  
Saengvith Science: Thailand

## Other features that can be used:

drone Camera for inspection, thermal camera

# APPLICATION: URBAN AMBIENT AIR QUALITY MONITORING

**Client: Katowice  
Police Force**



## Gas to be monitored:

O3, NO2, CO, PM2.5 and PM10

## Challenge

The country of Poland has a problem with burning of illegal fuel materials in households and commercial buildings. A problem that is partly responsible for the air pollution problems present in some parts of the country. According to a report by the World Health Organisation (WHO), out of the 50 European cities most affected by smog, 33 are in Poland. The WHO estimates that around 50,000 Poles die every year due to illness caused by air pollution.

## How Scentroid helped:

The southern Polish mining city of Katowice has started using Scentroid DR1000 attached to police drones to pinpoint offenders who break anti-smog rules. The DR1000, can analyse the chemical composition of smoke emitted from the chimneys of individual houses. The police use the drone to detect increase in tracer gases such as HCL and Fermaldehyde. This increase will trigger a sample collection using DR1000 which is further analyzed by an accredited laboratory if the need arises. If the police task force detects any of these chemicals, they conduct a visual inspection of the building to determine if in fact illegal fuels are used.

After the first hour of testing the DR1000 the city patrol force identified a possible offender and after inspection of the furnace issued a PLN 500 (EUR 120, USD 150). Local authorities hope that the eye in the sky will prove an effective tool for detecting sources of air pollution and deter illegal contributors.

## Other features that can be used:

drone Camera for inspection, thermal camera

# APPLICATION: SMART CITIES, URBAN AREAS, INDUSTRIAL PARKS



**Client: South Korea  
Ministry of Environment,  
National Institute of  
Environmental Research**

## Gas to be monitored:

VOCs, O3, NO2, CO, PM2.5 and PM10, NO, SOx

## Challenge

In South Korea, there are more than 57,500 businesses registered as air pollution facilities nationwide. Of these, there are only 5,500 large-scale business sites with real-time measuring devices. According to the National Institute of Environmental Research (KERI) in 2014, the dust emissions of small businesses account for about 30% of the total workplaces.

## How Scentroid helped:

Department of Atmospheric Environment Engineering, National Institute of Environmental Research, under the Ministry of Environment, started using DR1000 to investigate industrial parks and small businesses areas to find polluters and small business which are suspected of exceeding emissions.

Ministry of Environment conducted a drone crackdown in the concentrated area of Pocheon small business site on December 2017. The National Institute of Environmental Research analyzed the concentration of VOCs in the area and found 56% of VOCs reduction immediately after the crackdown.

When drone was flying in that area, air quality data from the drones Scentroidre immediately transferred to the ground station and the cloud based DRIMS software. Park Jung-min, a researcher carefully monitored the chemical gases graph on the DR1000 ground station. Park, a researcher, said, "As soon as a violation of the standard is suspected, the cracking team will be dispatched to the site."

## Other features that can be used:

Thermal Camera, drone Camera for inspection



# APPLICATION: UNIVERSITIES, RESEARCH CENTERS



## Gas to be monitored:

To be selected from list of available sensors (+30 sensors)

## Challenge

Assessment of air quality has been traditionally conducted by ground-based monitoring, and more recently by manned aircrafts and satellites. However, performing fast, comprehensive data collection near pollution sources is not always feasible due to the complexity of sites, moving sources or physical barriers.

## How Scentroid helped:

Small Unmanned Aerial Vehicles (UAVs) equipped with Scentroid DR1000 with different sensors have been introduced for air quality monitoring, as they can offer new approaches and research opportunities in air pollution and emission monitoring, as well as for studying atmospheric trends, such as climate change, while ensuring urban and industrial air safety. Some of our recent clients including Sait Polytechnic institute of Canada deployed DR1000 to monitor methane and greenhouse gases.

## Other features that can be used:

Thermal camera, Photogrammetry and Lidar Mapping

Clients: University of Texas USA, University of California-Berkleye USA, University of Mainz Germany, Marche Polytechnic University Italy, Sait Polytechnic institute Canada





# APPLICATION: WASTEWATER TREATMENT PLANT

( TAILING POND, LAGOON,  
POND / LAKE CONTAMINATION  
INSPECTION )

**Client: Avetin  
Engineering - USA**

## Gas to be monitored:

H<sub>2</sub>S, NH<sub>3</sub>, VOCs, SO<sub>2</sub>, Odour

## Challenge

Waste Water Treatment Plants emit a wide array of pollutants that must be monitored. By their very design, processes involved in sewage treatment produce and use a number of highly toxic and explosive gases, requiring waste water monitoring to ensure the safety of both employees and the environment.

## How Scentroid helped:

Recent advances in UAV / Drone Technology combined with sensory innovation for Environment and Forestry industries allow ground-breaking opportunities. UAVs offer eco-friendly data collection with accurate and usable information over large tracts of land for a fraction of the cost of a traditional sampling and analysis campaign. Unmanned aerial vehicles (UAVs) offer new opportunities to monitor pollution and provide valuable information to support remediation. Scentroid's DR1000 has been used by several companies for drone monitoring of wastewater treatment plant emissions. DR1000 is providing direct aerial sampling and inspection of hard to reach areas. Drone can collect pond and other source emissions for analysis by GC laboratory. Possibility for in-air analysis for H<sub>2</sub>S, Total VOC, SO<sub>2</sub>, Ammonia and others.

## Other features that can be used:

Thermal imaging, GIS mapping, elevation reports

# APPLICATION: FOREST FIRES



**Client: University of  
California - Berkeley**

## Gas to be monitored:

CO, CO<sub>2</sub>, O<sub>3</sub>, NO<sub>2</sub>, NO, PM<sub>2.5</sub>, PM<sub>10</sub>, PM<sub>100</sub>

## Challenge

Forest fires can negatively affect the air quality over thousands of square kilometers. Pollutants such as particulate can be easy to detect but the affect of other pollutants such as CO<sub>2</sub> require precise measurement.

## How Scentroid helped:

In the event of a wildfire or a controlled burn, information is critical for fire management and suppression. Drone equipped with a Scentroid DR1000 is a powerful tool to collect information both during and after a fire, helping the decision makers direct the firefighting activities. Scentroid's DR1000 has been used by several companies and universities, including University of California, Berkeley to monitor emissions from forest fires. These emissions can help create better models to predict the impact of the fire on air quality both locally and globally. The data can also be used to predict ground level impact up to 48 hours in the future to ensure proper measures such are taken to protect the safety of the public.

## Other features that can be used:

Infrared camera, LIDAR

An aerial photograph of a landfill site. A yellow truck is parked on a path of dirt and trash. The ground is covered with a dense layer of waste, including black plastic bags, colorful plastic bottles, and other debris. The scene is brightly lit, suggesting a sunny day.

# APPLICATION: LANDFILLS, COMPOSTING FACILITIES, ANIMAL FARMS

## Gas to be monitored:

NH<sub>3</sub>, H<sub>2</sub>S, CH<sub>4</sub>, CO, PM<sub>2.5</sub> and 10

## Challenge

Monitoring environmental areas is vital for any landfill. At any moment, you may need to prove that a “no-go zone” has never been affected by your operation, or you may need to know and be able to communicate where contaminated waste has been stored.

## How Scentroid helped:

The use of Scentroid DR1000 Flying Lab could prove invaluable in the solid waste industry. Emission monitoring, using UAVs equipped with DR1000 can make landfill gas monitoring much simpler, faster, and more efficient. Drone environmental monitoring allow users to save money and time compared to traditional monitoring methods, while also increasing data resolution. Landfills are important emitters of methane, a green house gas. Drone with DR1000 is particularly well suited for large scale methane release inspection. In Shongweni landfill, inspectors have programmed drones to conduct automated methane release inspection of all active cells on a weekly basis without any manpower.

## Client: Shongweni Landfill, South Africa

A waste management company who's goal is to tackle some of the most intractable waste management issues in South Africa. Their mission evolves with society's needs, habits, and awareness of health and environmental prosperity.

## Other features that can be used:

Thermal camera

# APPLICATION: VOLCANOES



**Client: Japan  
Meteorological Agency**

**Gas to be monitored:**  
SO<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>S, HF, HCL, PM<sub>2.5-10</sub>

## Challenge:

Volcanos has affected the environment of our planet for millions of years. Their impact can be both locally and globally lasting from <1 year to 100s of millions of years. Continuous and abrupt emission of CO<sub>2</sub> levels can lead to global warming. Other gases such as SO<sub>2</sub>, H<sub>2</sub>S, HF, and HCL can have localized impact and are good indicators to create early warning systems. Current methods of manual measurements or satellite-based measurements are either unsafe or not accurate enough to provide all the dimensionality required to create precise models of impact. Therefore, a more safe and accurate methodology is required to measure these gases directly from a volcano before or after eruption.

## How Scentroid helped:

DR1000 is used by several agencies to take direct samples from an active volcano. The drone can fly close enough to the volcano to not only make measurement but also collect air samples using the DR1000's built in sampling pump and bring it back for further analysis. All this is done with the operator being safely kilometers away from the volcano. The drone can even be used during the eruption to measure all gases and particulate being emitted from the volcano without ever putting the operator at risk.

## Other features that can be used:

Thermal imaging

# APPLICATION: FIRST RESPONDERS

( EMERGENCY DRONES, RESCUE )

Client: EuroChem,  
Switzerland/Russia

## Gas to be monitored:

SO<sub>2</sub>, NO<sub>2</sub>, VOC, HF, HCL, Radiation, O<sub>3</sub>,  
CO, CO<sub>2</sub>, NO

## Challenge

First responder drones can be used in disaster situations like: monitoring catastrophes, surveying area to assess if safe for responders to enter, fire scene inspections, post-disaster relief operations and monitoring plane crashes debris areas.

## How Scentroid helped:

Drones are starting to become a common piece of technology used in emergency situations and this is due to the various benefits they provide. Operators fly drones equipped with a Scentroid DR000 into an active area when they have the go-ahead from the Incident Commander to monitor hazardous gases from catastrophes. This allows first responders to have a complete picture of the entire affected area, a list of possible hazardous gases to be able to make informed decisions on actions to be taken and proper protective equipment to be used. The data can also be used to determine the areas that need to be evacuated and the urgency of the evacuation.

## Other features that can be used:

Thermal Camera

# SCENTROID CLIENTS



Australian Government



...Plus many more!



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