



# UAVs Offer Sensor Solutions to the OIL & GAS Industries

White Paper

# Abstract

As public awareness grows about the effectiveness of unmanned aerial vehicles (UAVs) so does the exploitation of UAVs in civil and commercial ventures. The sensors that were once deployed on costly manned helicopters or by foot are now sufficiently compact and light that they can fit on fast and slender UAVs. This paper focuses on what sensors are soon to be feasible in UAVs such as the ScanEagle or the Integrator.

# Keywords

UAV, civil, commercial, sensor,



## Introduction

UAVs (unmanned aerial vehicles) are autonomous drones that are capable of making mid-air maneuvers without human control. They come in all shapes and sizes: from tiny, insect-inspired, indoor UAVs to giant hundred-million-dollar monstrosities. UAVs have the vast benefit that they do not require a human pilot in dangerous, boring, or repetitive conditions.

Technology has progressed such that sensors that once required a human to operate can be placed on a UAV, which saves on fuel and increases efficiency. Robots do not require sleep.

UAVs that are small to mini are perfect for such exploits as pipeline supervision, mineral exploration, and environmental monitoring. They are easily deployable, use less fuel than larger UAVs, and are still large enough to carry targeted sensors to surpass at their chosen task.

## Oil and Gas Industries

UAVs can be fitted with many sensors that draw a picture of what is happening on the ground. All of which have applications in the O&G Industries. Detecting leaks in pipes and watching over offshore installations are traditional applications but UAVs can also be used for environmental monitoring, protecting tankers from pirates, and counter-terrorism measures.

### Extraction

After the widely publicized oil rig explosion and following environmental disaster in spring 2010, safety and reliability on oil rigs has been put in the spot light.

Sabotage and piracy are significant concerns to the safe functioning of rigs. An infrared camera installed on a UAV can simultaneously detect unauthorized boats approaching from any direction. An infrared camera works just as well after dark as during the day and warmth of even one body on a skiff lights up like lighthouse against the cool water.

The ever-present danger of fire on rigs is a threat to the lives on board as well as a potentially catastrophic environmental disaster. A UAV with a visible light camera and an infrared camera can send real-time information to the crew to give warning about anomalies.



Figure 1: ScanEagle UAV

## Pipelines

Leaks in pipelines are a significant source of financial loss and environmental damage. Leaks in above-ground and below-ground pipes can be seen using a hyperspectral camera. Environmental laws outline the length of time that a leak can pour out undetected. With kilometers of pipeline to check for the location of the pressure drop it can be next to impossible to locate the leak in time without an eye in the sky.

Natural gas leaks can cause large pockets of gas that with a spark will cause a huge explosion. Methane monitors on UAVs could detect ppb of methane. This saves having to monitor the entire pipeline by hand.

## Tankers

Oil tankers are left largely unprotected as they carry their thousands of tonnes of oil to refineries or to market. As piracy becomes a more common occurrence, security of tankers has become an issue. Even a small vessel has the potential threat to an oil tanker, as is demonstrated by the French tanker the Limburg which leaked 90,000 barrels of oil.<sup>[1]</sup> It is now thought that the Limburg was rammed by a small boat noticed shortly before the blast occurred.<sup>[1]</sup>



Figure 2: Integrator UAV

A UAV equipped with an infrared camera can recognize the presence of even a small vessel well before it can get close enough to become a threat. Having a visible light camera also attached would provide identification of the potential threat. A loudspeaker on the UAV would give the craft warning to turn around and avoid confrontation.

## Refining

Oil refineries release into the atmosphere such chemicals as benzene, sulfur dioxide, carbon monoxide, and methane. The concentrations of such pollutants are carefully measured inside of smokestacks but once the gases have left it is difficult to gage the dispersal of pollutants. A UAV set up with a Raman spectrometer can paint an accurate picture of pollution patterns around a refinery.

Table 1: Size Weight and Power of Various Sensors

Sensor	Detects	Passive/Active	Weight (kg)	Power (W)	Dimensions (mm)
SAR	Reflected microwaves	Active	0.9	15	157 x 191 x 114 [2]
Night camera (IR)	Infrared	Passive	2.9	18	300 x 200 x 200 [3]
Electro-Optical camera	HD video	Passive	1.0	7	180 x 180 x 180 [4]
LIDAR	Reflected Laser Light	Active	11.5	65	345 x 180 x 180 [5]
Hyperspectral camera	Hyperspectral pictures	Passive	1	<10	110 x 93 x 50 [6]
Multispectral camera	Multispectral pictures	Passive/Active	1.25	10	92 x 112 x 122 [7]
Chemical warfare sensor	Nerve gases, Blister agents	Passive	0.016	0.5	150 x 150 x 150 [8]
Metal Oxide sensor	Ozone	Passive	0.7	1	135 x 225 x 260 [9]
Cell Spotter	Communication Signals	Passive/Active	1.1	7	40 x 208 x 141 [10]

## Conclusion

The sensors that were once deployed on costly manned helicopters or by foot are now sufficiently compact and light that they can fit on small to mini UAVs. Sensor solutions include an infrared camera, visible light camera, hyperspectral camera, multispectral camera, methane monitor, loudspeaker, Raman spectrometer, magnetometer, gravimeter, synthetic-aperture radar, and ground-penetrating radar. As public awareness grows about the usefulness of unmanned aerial vehicles (UAVs) so does the exploitation of UAVs in civil and commercial ventures.

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