

# **Pipeline Vandalisation and Oil Spillage Monitoring using Remote Sensing : A Case for Nigeria\***

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## **Abstract**

Oil pipeline vandalisation and oil spillage are common issue in Nigeria Niger Delta region where the country produces all her crude oil for now that puts the nation on top five large oil exporting country. The Niger Delta is consists of the shoreline, mangrove, and thick rain forest predominant areas of Nigeria. Also oil pipeline stretches across these areas to the savannah grass land region of the country in the north. Oil spill is global but pipeline vandal attack is peculiar to Nigeria and now in Iraq for obvious reasons. The main thrust of this contribution is to sting the nation and professionals to be proactive in considering, investigating and deploying remote sensing technologies that is most suitable for Nigeria ecological environment. This does not discount the scio-economic and political alternatives to douse the contributing vandal causative factor of oil spill in Nigeria. The paper looks at the contemporary techniques and technological achievement so far and present sieving model for Nigeria to pitch her approach without re-inventing the wheel or adopting non-applicable technologies in our environment.

## **1.0 Introduction**

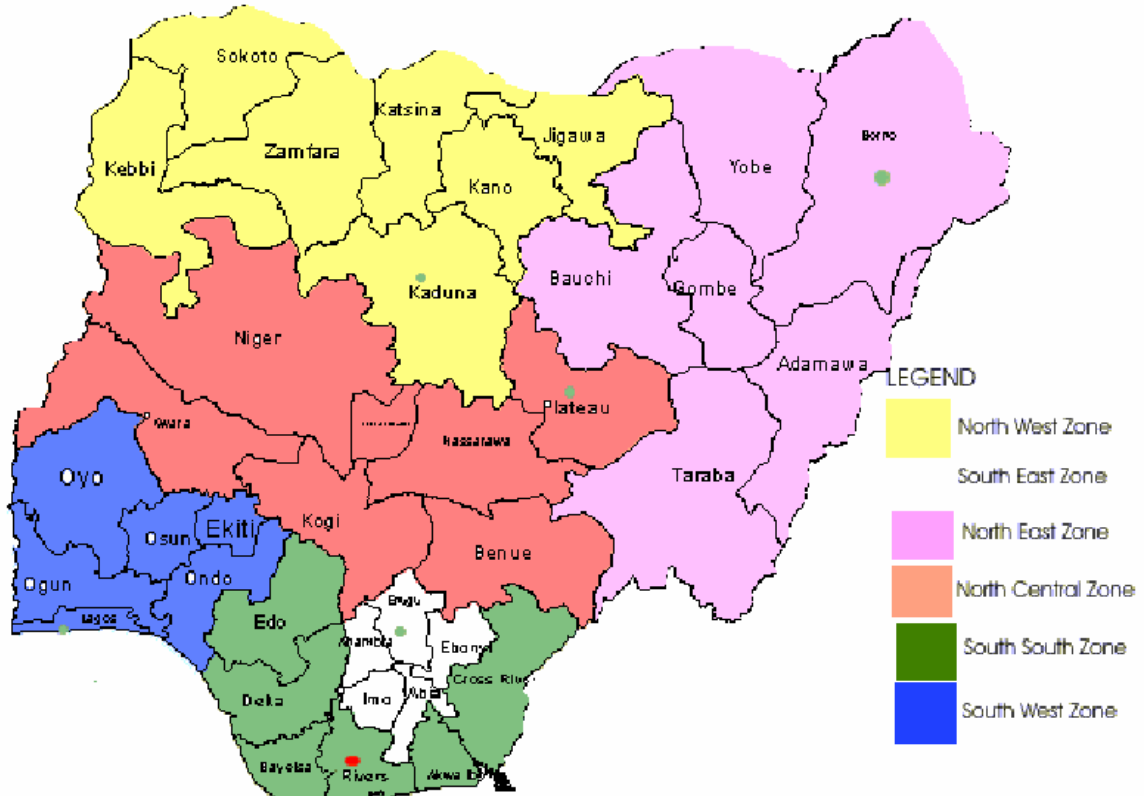
Oil pipe line vandalisation is sine qua non to oil spill in Nigeria. Literature reviews show that less than 70% of the causative factors would have been monitoring targets if vandal attacks are off the list. The major issues would having been monitoring and controlling spill due to oil pipe, conveyor and equipment failure, and safety measures negligence on part of oil operators in Nigeria<sup>1</sup> The case of Nigeria oil spill and vandal attacks on oil installation incidents like the case of Iraq which is recent, no doubt requires more of socio-economic and political control measure than technological which the paper focuses. Nigeria no doubt is waking up to her responsibilities in the recent, government withdrawal from production is a new jingo which is welcome if well implemented. Also, Nigeria government as she implode in from active production should realise the need to explode actions not only in policy making but in research like in the area monitoring and controlling oil spill as they spontaneously occur no matter the causative factor.

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The economics of the consequences are more to be given a passive attention, more so when quantum of life have been severally been lost and the environment endangered by oil spill consequences.

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Nonetheless it is commendable to mention here that the Nigerian government has put in place institution to monitor and response to disasters, the National Emergency Management Agency (NEMA). Also, Niger Delta Development Commission (NDDC) to provide socio-economic infrastructure to improve life and solve agitations which has make oil installation vandalism phenomenon in that part of the country, and National Aero Space Research & Development Agency (NASRDA) is in place. Oil spill is one of the list items in the emergency response agenda of NEMA<sup>2</sup> and in other agencies' programmes mentioned, which is believed, is by the mention and requires more proactive effort to put in place a monitoring and intervention programme in place using all inclusive party approach. The technology and policy issues in Nigeria for a workable programme need to be thoughtful to make the desired deliverables, mitigating wastes of funds and efforts on mundane and inadaptable technologies or re-inventing the wheels as the case may be if effort are haphazard.

## 2.0 The Issues of Oil Spill Remote Sensing Technology

There is no doubt man has used remote sensing technology to solve some of her environmental challenges especially in topological surveying. Today remote sensing is considered the viable option in oil spill monitoring and control programmes world over. It is statement of fact that the use of modern remote sensing instrumentation can



Figure 1 Oil Spill Sea & Coastal<sup>7</sup>

be employed to monitor oil spill on the open ocean on quasi or continuous real time basis as seen in figure1. The question is what about oil spill in the mangroves and dense forestry areas which characterized Nigeria oil producing areas? Even though sensors design and electronics are becoming increasingly sophisticated and much less expensive, the operational use of remote sensing equipment lags behind the technology. In remote sensing, a sensor, other than the eye or conventional photography, is used to detect the target of interest at a distance. The most common forms of oil spill surveillance and mapping are done with simple still or video photography. Remote sensing from an aircraft is still the most common form of oil spill tracking. Attempts to use satellite remote sensing for oil spills continue, although success is not necessarily as claimed and is generally limited to identifying features at sites where known oil spills have occurred. Several general reviews of

oil spill remote sensing have been prepared. These reviews show that there is progress in oil spill remote sensing, however that this progress is slow. Furthermore these reviews show that specialized sensors offer advantages to oil spill remote sensing. Generic, off-the-shelf sensors have very limited application to oil spills.<sup>3</sup>

The technology of remote sensing not withstanding the platform rests so much on the sensors and much work have been carried out in this respect although focus on oil spill in environment that share little similarities with Nigeria oil producing areas. Some of the sensors and their applicability are shown in tables 1. The operability of the various sensor technologies are shown table 2.<sup>3,4,5,6</sup>

The application of satellites as means of remote sensing in monitoring of oil spill is not yet foregone conclusion no doubt images from GEOS, LANDSAT, SPOT, ERS1-2, RADASAT and JERS-1 have been used for insights studies and documentation which are far from real time adaptation, hence the search continues.<sup>8,9</sup>

Table 1. Platforms and Sensor Technologies

Remote Platform	Sensor Technologies	Applications	Techniques
Air borne	Thermal & Mid Infrared	Focal plan detective cameras	Differential reflection of oil
Air borne	Visible Camera	Camera	Electromagnetic spectrum
Air borne	Visible Video	Global Position System	Electromagnetic spectrum 400-700nm
Air borne	Ultra Violet	Cameras	Reflectivity of UV <math><0.01\mu</math>
Air borne	Laser Fluoresensor	Laser	Fluorescent intensities & spatial signatures
Air borne/ Flight	Radar	Synthetic Aperture Radar (SAR)	X-band radar preferred to L & C radar
Air borne	Passive Microwave	Microwave radiometer	Microwave energy emissivity factor/ Radiometry
Satellite	Satellite visible	GEOS, LANDSAT, SPOT	
Satellite	Satellite Radar	ERS-1, ERS-2, Radarsat, JERS-1	
Satellite/Air borne	Thickness Sensor	Laser and Interferometer	

Table 2

**Operational Utility of Oil Spill Sensors**

USE	Sensor										
	Thermal IR	Mid IR	Visible Camera	Visible Video	UV	Laser Fluorosensor	Radar	Passive Microwave	Satellite Visible	Satellite Radar	Thickness sensor
Detect oil on water	3	2	2	2	2	4	2	2	2	2	1
Detect oil on land/shore	1	1	2	2	1	4	1	1	1	1	1
Map oil on water	3	2	3	3	3	2	3	2	2	2	1
Map oil on land/shore	1	1	2	2	1	2	1	1	1	1	1
Tactical water cleanup support	3	2	1	3	2	3	2	2	1	1	2
Tactical support land/shore	1	1	1	3	1	3	1	1	1	1	1
Thickness/volume measure	2	1	2	2	2	2	1	2	1	1	4
Legal and prosecution	2	2	3	3	2	4	2	2	1	1	1
General documentation	2	2	4	4	2	2	2	1	2	2	1
Pipeline surveillance	1	1	2	3	1	4	1	1	1	1	1
Long-range surveillance	2	1	2	2	2	1	4	2	2	3	1
Night/fog work	2	2	1	1	1	2	4	2	1	3	1
Experiments at sea	3	2	2	2	2	3	2	1	1	1	4
Detection in weeds/ on ice	1	1	1	1	1	4	1	1	1	1	1
Cheap operational support	3	4	2	4	2	1	1	1	1	1	1

<p><i>Legend</i> 4 = fully operational and works well  3 = functions, interferences may be a problem  2 = works marginally or needs development  1 = does not work or needs complete development</p>
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### 3.0 Methodological Approach for National Programme on Oil Spill Monitoring and Control

It is obvious that the application of remote sensing on oil installation vandalism and oil spill monitoring and control is a technical possibility with varying degrees of technology and use which mostly on icy and open view lands exotic to Nigeria rain forest area. Hence, there is need for a national concerted and well planned approach for effectiveness of effort and funds application. Internationally efforts are grid like the current efforts to expand oil spill remote sensing capabilities, the Minerals Management Service working with the U.S. Coast Guard, Environment Canada, private industry and academia, are engaged in basic and applied research which are related to the application of airborne remote sensing technology focusing on detection, definition and tracking of oil spills in the marine environment.<sup>7</sup> The opined stratagem depicted in figure 2.0 is expected to follow a proven schema that would provide the required results given.

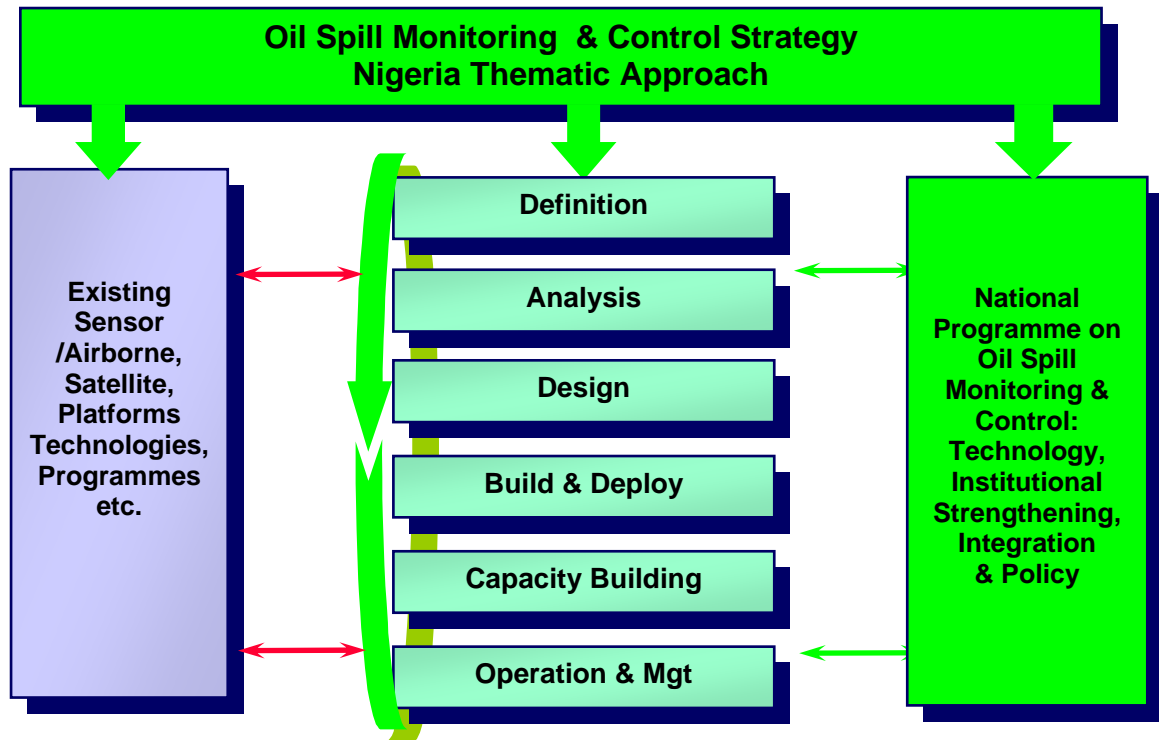


Figure 2.0 Evolution Approach to National Programme on Oil Spill Monitoring & Control

It is quite indicative that Nigeria is not going to isolate her programme from available technologies and programmes in this effort, but shall thoroughly examine all the options to evolve Nigeria oil spill monitoring and control that is thematic to her environment. The process shall predominately involve study and research that include the government agencies <sup>1</sup>, academia, and stake holding enterprises.

The thematic approach shall help the country on pedestal of emerging technologies support technical centres, in oil spill technologies research definition, study and analysis, design and building, deployment and operation with emphasis on policy, capacity building sustainable basis. In this case emerging sensors technologies, real-time displays, printers and high altitude platforms integration can be envisaged features solving our peculiar problems.

#### 4.0 Conclusion

The case of oil pipeline and other equipment vandalism, and oil spillage monitoring using remote sensing technology in Nigeria is a possibility, the government and professionals today should not wait till the consequences becomes a greater emergence. Lives have been lost coupled to investments and the environment is under siege, and shall continue if no proactive effort is done that constructively too. Nigeria need to join in the search for solution than a plug and play approach and off-shelves that are not fitting to Nigerian environment. The time to act is now.

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