

# Inspection of Pipeline

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The reliability of a pipeline is dependent on the design. A design is defective when materials are selected improperly or the system is constructed falsely. In other situations, the design can become flawed from unexpected conditions such as natural disasters. Therefore, a pipeline must be regularly and carefully checked. Pipelines are often located underground or are extended for long distances in remote areas where no paved roads reach. Traditionally, operators will inspect these pipelines on foot or by land vehicles. However, as stated earlier a decent part of pipelines are usually extended in areas where there is no easily accessible road. Therefore, not only is this process time consuming but also might prove impractical in most situations. An alternative is to use aerial vehicles such as helicopters and even satellites. With helicopters, the cost is high and the altitude must be relatively high which could compromise the ability to obtain a clear image of the pipeline and the terrain around it. Likewise, satellites can also be financially unfeasible to use regularly and the images taken in most cases are not detailed enough for inspection. This is where a UAV (also known as a drone) is an elegant yet smart solution to use. A UAV can provide detailed images for the entire length of the pipeline. In addition, it can provide a live video feed that can be used to get an immediate overview of the pipeline condition and identify any defects.

## Fahud Pipeline

The SIGMAX team decided to display this application on a pipeline originated from the Fahud Oil field. The images supplied by the drone reveal a greater amount of detail of the terrain around the pipeline and of the pipeline itself.

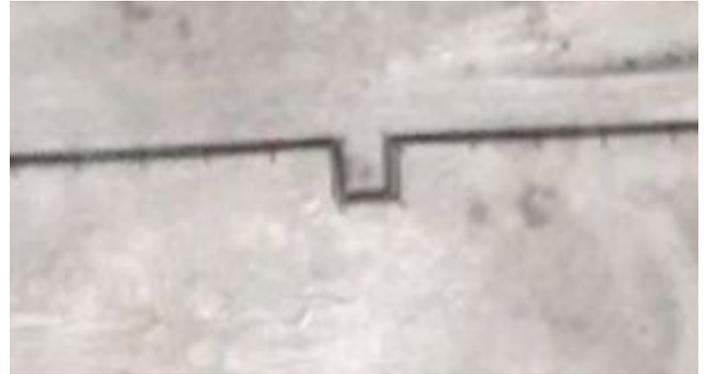


*Figure1. An Overview of The Mapped Pipeline*

A comparison between figure 2 and 3 shows how much more detail a drone can provide in comparison to a satellite. In figure 2 we can see the pipeline crosses a small wadi (valley). As a result, it is possible to see what obstacles the pipeline goes through. Also, unlike the satellite the image from the drone reveals drastically more information about the base of the pipeline and its condition.



*Figure 2. Zoomed view from the Drone*



*Figure 5. A zoomed image of the same section captured by the Satellite.*



*Figure 3. Zoomed view from the Satellite of the same location.*



*Figure 4. Another zoomed image of a section of the pipeline captured by the Drone.*

Figures 4 and 5 show another comparison of the accuracy and difference in resolution between imagery from a satellite and a drone. It's also worth noting that the resolution of the drone imagery is 2.6 cm/pixel and it's easily possible to improve the resolution of the imagery. We can provide a resolution of less than 1 cm/pixel which is suitable to perform accurate pipelines inspection. On the other hand, the resolution of the Satellite is around 15 m/pixel.

## Implementation of Artificial Intelligence

Implementing Artificial Intelligence algorithms with the developed map can speed up the inspection process and reveal insights that are usually hard to be revealed by the naked eye. Artificial Intelligence algorithms are able to detect almost any kind of obstacles that are affecting or might affect the pipelines and the base in a matter of minutes. Such algorithms

are able to detect rocks, plants, water, and sand that might have an effect on the pipeline. Another implementation of Artificial Intelligence algorithms on inspection tasks is to automatically detect any changes occurred on the area of interest over a period of time. This is done by comparing two different maps of the same area, one taken earlier and the other one on a later date. This is really helpful in identifying the effects of nature and human activities on the pipeline over a period of time.

Implementing Artificial Intelligence on drone imagery is definitely a game-changing technology that is changing the way Oil and Gas companies look at inspection. We are working on developing and bringing these algorithms to life and start integrating them with our inspection projects.

## Conclusion

The experiment on the Fahud pipeline strengthens the argument that drones are the most ideal tool to use in pipeline inspection. A drone can provide clear and detailed images at a reasonably low price. It can be deployed at almost any time and is perfect for regular use. It will save time, money and provide practical data.