

Oil Exploration 4.0, Fueled by Earth Observation, Satellite Imagery, and Smart Maps

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Abstract

A picture is worth more than 1000 words; this phrase is nothing new for Geoscientists. We get very excited to see the high-resolution images of fluvial systems desert landforms, structural geology at planet scale. The oil industry has entered a new era, with digital transformation. Earth Observation is a new name for using satellite imagery qualitatively and quantitatively. The new state-of-the-art imagery from modern satellites has a 0.30m of minimum resolution. Coupled with added capabilities from frequencies beyond the optical range into Infra-Red, Radio and Gamma-ray, satellite imagery provides sophisticated maps and precise digital models to the upstream, to 24/7 monitoring of processing plants, which are the basis for predictive analytics and ensuring safe operations. These satellites operate in stable orbits about 500km above. The new commercial Synthetic Aperture Radar (SAR) sensors see through the cloud cover and thick canopies, providing very clear images of natural and man-made features allowing precise mapping for surface geology, monitoring of construction projects, and planning logistics. This presentation is about the innovative use of multi-spectral imagery from satellites and drones in the energy industry. The new breed of “Shoe-box” or “Tabletop” satellites are 1/100 of the conventional satellites in size and allow the deployment of multiple satellites, Satellite Constellations, into desired orbits. These satellites are synced to provide images, with one-hour repeat times! The data stream in real-time requires the use of Machine Learning (ML) and Artificial Intelligence (AI) technologies to detect very subtle changes in the successive images several times a day. Working together, these satellites cover the whole area of the size of Brazil in one day. The ability to steer, precisely define the area of interest, define times of days, and durations provide the basis

for innovative business models in every industry, including oil and gas, renewables, and midstream operations. Permian Basin and Eagle Ford operations are immensely benefited by the use of satellite-based imagery and big-data analytics, in monitoring operational trends, reducing the transportation times by logistics planning, and sourcing water and frac sands. These operational efficiencies have proved to be critical for the success of shale operations. Drone acquired videos provide the highest resolution images of few centimeters. LiDAR mapping using Drones has proved immensely successful in creating virtual field trips and accomplishing detailed scaled mapping. Technology startups are growing every day to arm Drones with sensors for precise monitoring of pipelines for leak detection, assurance of the Right of the way (RoW) and sniffing chemicals. In the age of the Internet of Things (IoT) getting the ground truth from up and above is serving more than a pretty picture!