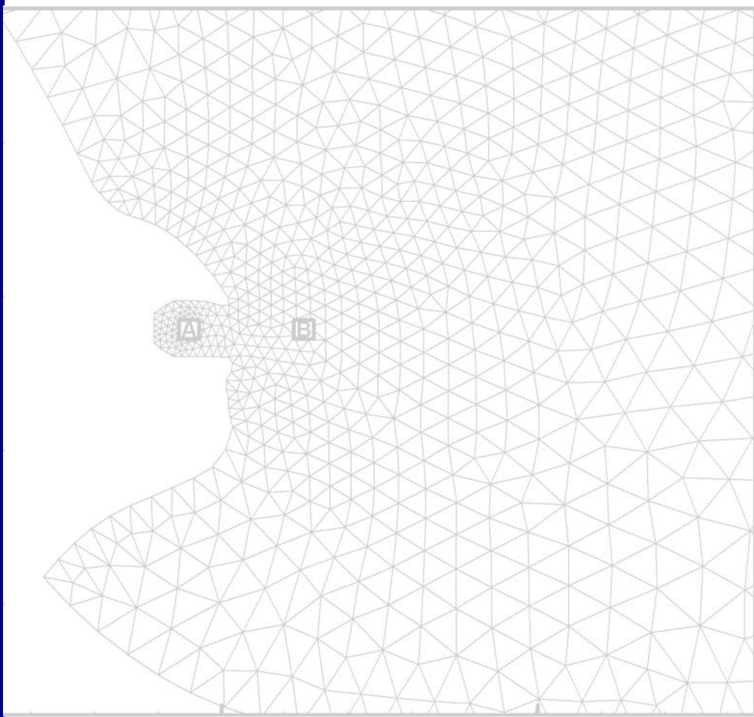
DETAILED PROJECT REPORT FOR RECLAMATION WORK FOR THE DEVELOPMENT OF LAND FOR INDUSTRIAL ACTIVITIES AT PARADIP



First Interim Report

Topographical Survey Report

Client

Dredging Corporation of India Limited

Consultants

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1 Introduction

The combination of Differential Global Positioning System (DGPS) and drones has changed how we map land. DGPS improves GPS accuracy by correcting errors, while drones take quick, detailed pictures from the sky. Together, they make surveying faster and more precise, especially over large or hard-to-reach areas. This teamwork saves time and money, and the data they collect can easily be used in mapping software. This report explains how DGPS, and drones work together and shows how they're making land surveying easier and better for everyone.

2 Aim

Conducting a detailed topographical survey of Indian Oil Corporation Limited - Pradip Site, Odisha, using Drone and DGPS for precise mapping.

3 Study Area

Figure 1 Study Area of IOCL – Pradip Site

Table 1 Project Summary

Name of the Project	Implementation of Topographic Survey at Odisha For IOCL Pradip Site
DGPS Instrument	Spectra SP85
UAV Model	Model V & DJI Mavic 3 Enterprise
Sensor	Daylight RGB camera (24.3 megapixels)
Flying Height	80 meters Above Ground Level (AGL)
Ground Sample Distance	2 cm per pixel
UAV Image Processing Software	Agisoft, Bentley Context Capture, Auto CAD, Google Earth, and Global Mapper.
Deliverables	Project Report

4 Project Workflow

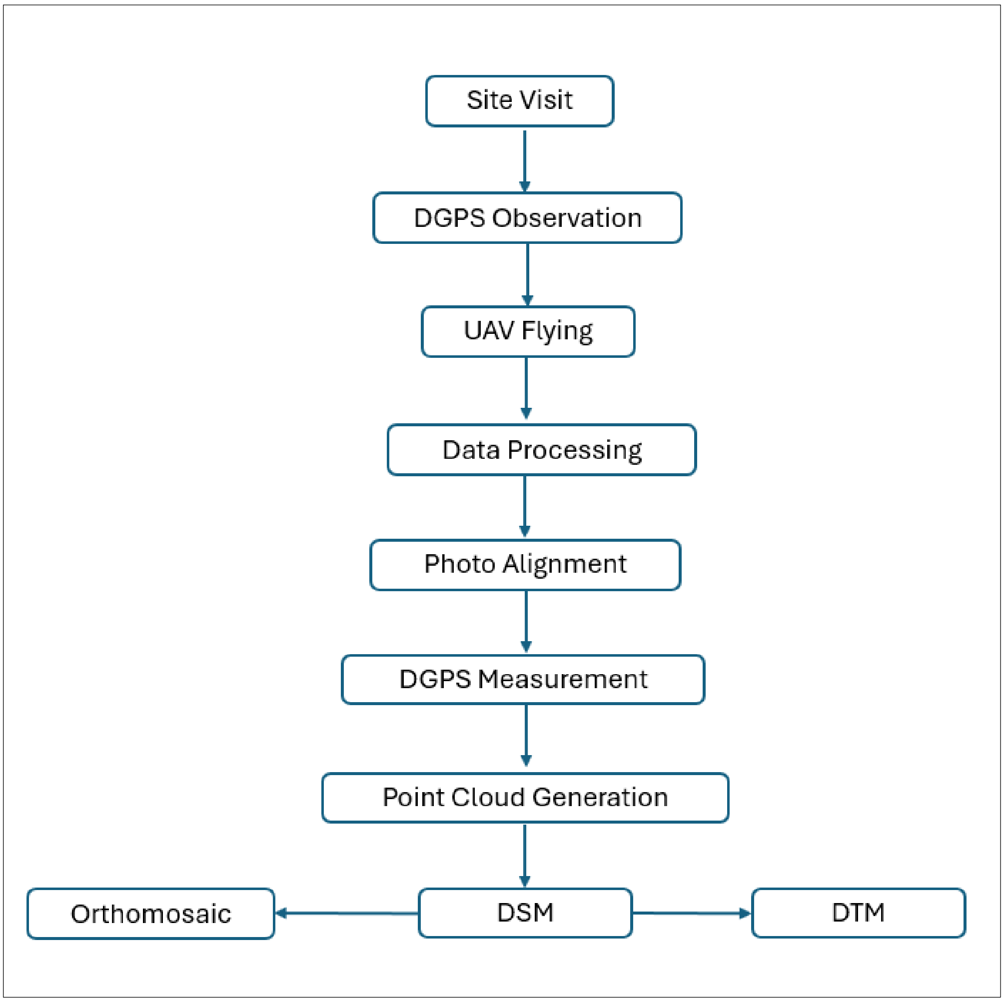

Figure 2 Project Workflow

5 DGPS Survey

DGPS (Differential Global Positioning System) is a satellite-based navigation technology that boosts GPS accuracy by correcting for signal errors. It works by comparing GPS signals received from satellites with signals from fixed ground reference stations. These corrections, transmitted to DGPS receivers, refine position calculations, achieving high accuracy levels ranging from sub-meter to centimetre precision. Widely applied in surveying, agriculture, marine, and aviation, DGPS enhances efficiency and reliability in navigation tasks. When integrated with drone surveying, it improves aerial mapping accuracy. As technology advances, DGPS systems are expected to further evolve, promising even greater precision and reliability in various applications.

6 DGPS Data Processing

GCP are reference points on the ground with known global coordinates established and it is used for accurately geo-referencing the UAV images during processing. All the observed GCP points were processed with base point using DGPS Post Processing software and the processed coordinates were used for image alignment to improve the positional accuracy of the UAV data product i.e., Orthomosaic, DSM, DTM and 3-Model.

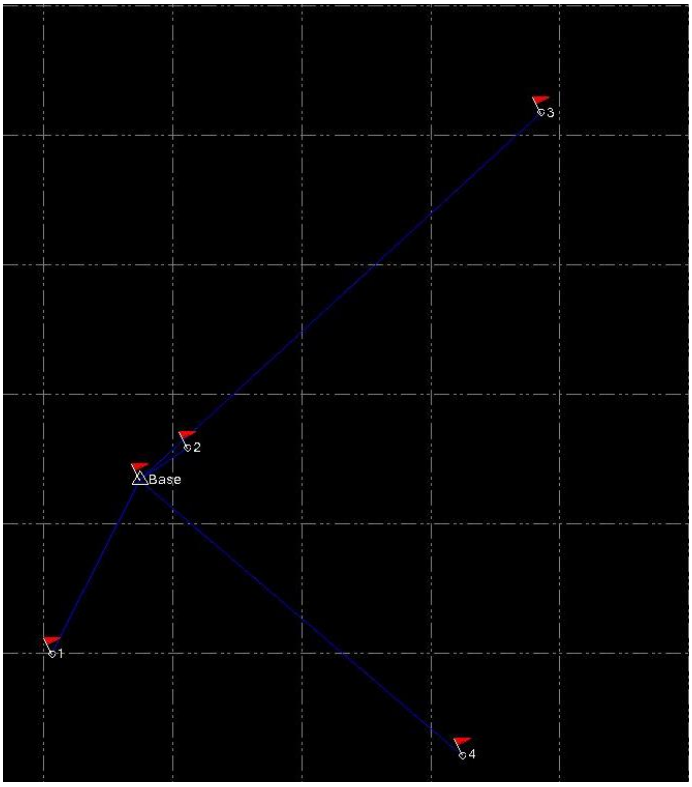

Figure 3 DGPS Data Processing

7 UAV/Drone Survey

The selection of UAV has been varied depends on the application and terrain. For example, Land Use and Land Cover (LU/ LC) mapping for a plain terrain fixed-wing UAV are most suitable for capture the nadir image in a short time. At the same time, the mapping area is located in a hilly region, multi-copter is most suitable to capture the nadir images, but it will take additional time compared to the fixed wing. For small AOI, multi-copter UAV with low endurance will be sufficient.

8 Ground Control Station (GCS)

A GCS is a land-based control Centre for UAV and payloads. It is used to configure, monitor, and control the flight parameters of UAV in real-time. The major role of the GCS software is used to plan the flying pattern. It provides a map screen where the user can define a home location, waypoints for the flight, setting camera overlaps, setting flying height, battery level monitoring and see the progress of the mission. The real-time location of the UAV is monitored using a mobile phone with the help of a location finder path and track the location of the UAV even at the failure of radio communication. Figure 7 shows the GCS display of UAV Nadir photo acquisition of the mining site. The flight pattern is created in two directions North-South and East-West respectively.

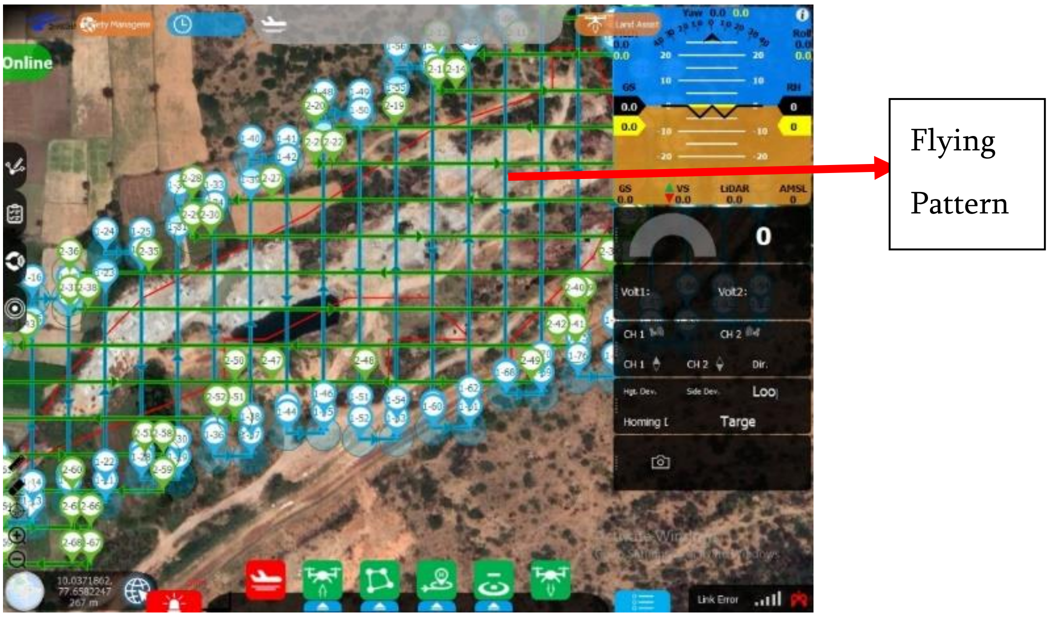

Figure 4 Flying patern for current project

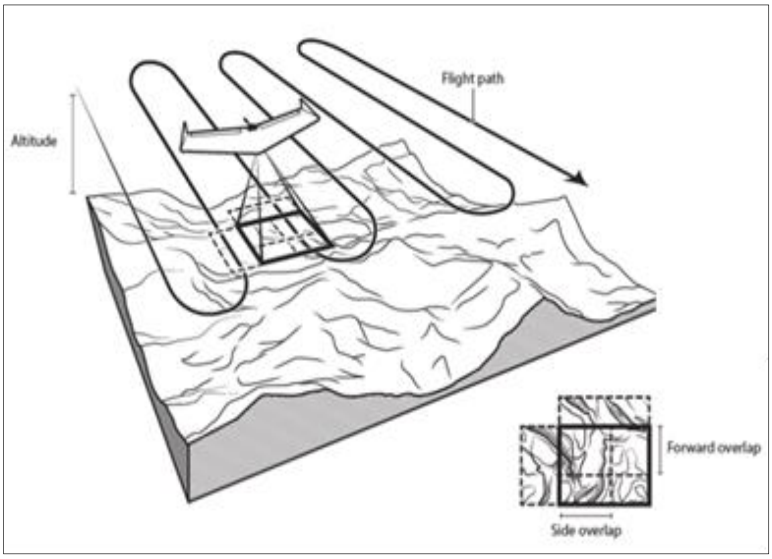

Figure 5 Typical image for Flying patern

9 UAV Image Processing

UAV (Unmanned Aerial Vehicle) image processing involves analysing aerial images captured by drones for various applications. Drones equipped with cameras capture images, which undergo pre-processing steps like correction and enhancement. Algorithms extract features like buildings and vegetation for analysis, aiding tasks such as land use classification and change detection. Applications include agriculture, environmental monitoring, and disaster management, offering rapid data acquisition and cost-effectiveness. Challenges include processing complexity and regulatory constraints. Advancements in technology promise to enhance capabilities, paving the way for improved analysis and decision-making in diverse fields.

i. Image Geo-tagging

The nadir images do not have any GPS information details such as Latitude, Longitude and Altitude. All the acquired nadir images are geo-tagged (combining positional information (POS) to the corresponding images) using an open-source python script. The POS with corresponding images is verified using the Google Earth Pro open-source software. After the Geo-tagging, GPS information was added in the image properties details.

ii. Ground Control Points (GCP) Optimization

UAV acquired high-resolution aerial images along with GPS location. To obtain the survey-grade positional accuracy of the end product, the pre-defined GCP points were placed on the permanent structure on the ground. These locations were surveyed using a DGPS instrument and accurate position details are derived in X, Y and Z format before the UAV survey. Reconstruct the aligned UAV images through the GCP to provide precise horizontal and vertical positional accuracy.

iii. Digital Surface Model (DSM)

A Digital Surface Model (DSM) is a detailed representation of the Earth's surface, capturing its topography, terrain features, and elevation data. It provides a digital representation of the Earth's surface, including natural and man-made structures like buildings, trees, and mountains. DSMs are commonly used in various applications such as urban planning, environmental assessment, and infrastructure development. By accurately depicting the Earth's surface in digital form, DSMs help analysts and planners make informed decisions about land use, flood risk management, and transportation planning. They are generated using remote sensing technologies like LiDAR (Light Detection and Ranging) or photogrammetry.

Figure 6 Digital Surface Model

iv. Digital Terrain Model (DTM)

A Digital Terrain Model (DTM) is a digital representation of the bare Earth's surface, devoid of any above-ground features such as buildings, vegetation, or infrastructure. It provides detailed elevation data, depicting the natural landscape including valleys, hills, and other terrain features. DTMs are essential in various fields such as geology, hydrology, and civil engineering for tasks like slope analysis, drainage modeling, and site suitability assessments. Like DSMs, DTMs are created using remote sensing technologies such as LiDAR or photogrammetry, enabling accurate depiction of ground elevation. By providing precise elevation information, DTMs facilitate informed decision-making in land management, environmental planning, and infrastructure design.

Figure 7 Digital Terrain Model

v. **Ortho mosaic Image**

An orthophoto, short for orthorectified photograph, is a georeferenced aerial or satellite image that has been corrected for distortion caused by terrain relief, sensor perspective, and camera tilt. Unlike regular aerial photographs, orthophotos have uniform scale and true geometric properties, making them suitable for accurate measurements and mapping applications. They are widely used in fields such as urban planning, agriculture, forestry, and environmental monitoring. Orthophotos are created by combining aerial or satellite imagery with digital elevation models (DEMs) or Digital Terrain Models (DTMs) to remove perspective distortions and ensure consistent scale across the entire image. This correction process enables precise interpretation and analysis of features on the Earth's surface.

Figure 8 Ortho mosaic Map

10 Conclusion

In conclusion, our topographical survey at the Pradip site in Odisha, employing drone and DGPS surveys, has furnished precise and detailed data crucial for future planning and development. Overcoming terrain challenges, we ensured accuracy and reliability in our findings. This project showcases our commitment to leveraging advanced technologies for efficient surveying. The outcomes will inform decision-making and set a standard for similar projects. Moving forward, we aim to maintain our dedication to delivering high-quality surveying solutions to meet industry demands.

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