IIC TECHNOLOGIES

High Resolution Aerial Photography for Effective Land & Property Management

by

N V Kumar

www.iictechnologies.com

Agenda

IIC TECHNOLOGIES

- Company Introduction
- Our Aerial Assets
- Our Experience in Cadastral Surveys
- Intro to AP Resurvey Project
- Aerial Photography and Mapping Process

Company Introduction

Introduction to IIC Technologies

IIC TECHNOLOGIES

- Established in 1994
- Focus on Geospatial Sciences
  - Marine (hydrographic, charting)
  - Terrestrial (aerial & satellite mapping, lidar, heritage mapping)
  - Geosurveys (cadastral survey, seismic, bathymetry)
  - Software (geospatial, digital analysis, database management)
  - IIC Academy (capacity building, land surveying, hydrography, data processing)
- Capacity: 1500+ employees
- Global: Offices & Strategic Partners
- Experience: Surveying, Digital Mapping, Software in Marine & Terrestrial domains
- Quality: ISO 9001: 2015
- Branded: Recognized quality, service, cooperation

Introduction to IIC Technologies

IIC TECHNOLOGIES

- Geospatial Engineering and Consultancy
  - DPR / Engineering Consultancy
  - System Integration
- Defence, Aerospace and Geophysics
- Ports and Water Resources
- Infrastructure and Government
- Heritage

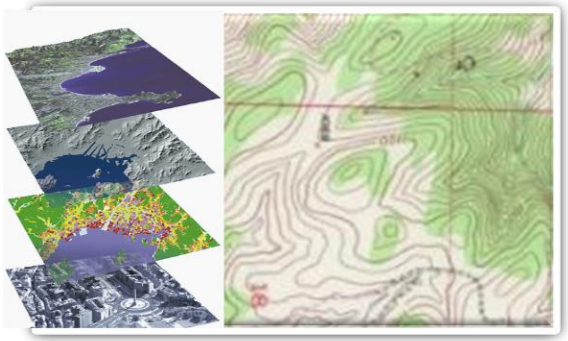
IIC a one stop for End-to-End Solutions

IIC TECHNOLOGIES

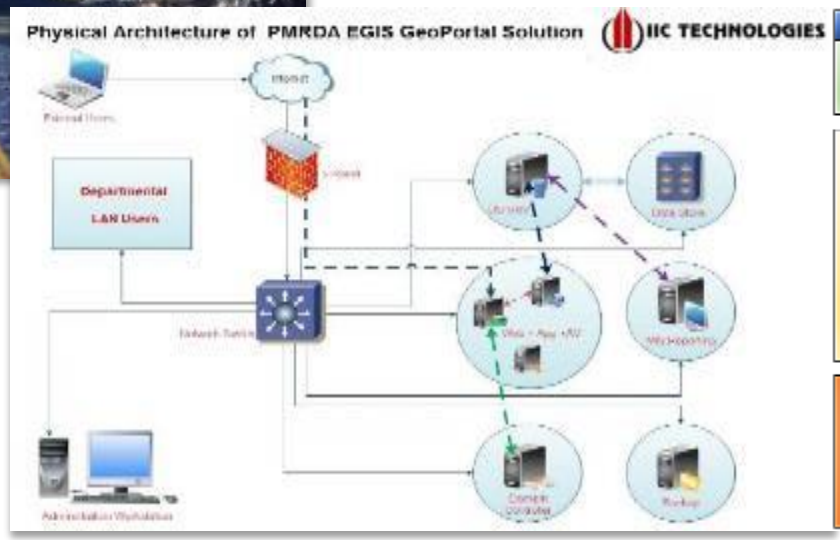
1. Data Acquisition & Processing

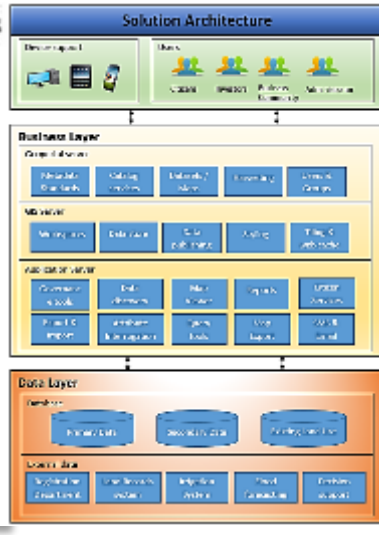
- **Airborne**
  - ✓ Imagery
  - ✓ LiDAR
- **Topographic**
  - ✓ DGPS
  - ✓ Total Stations
  - ✓ Auto-levels
- **Hydrographic & Bathymetric**
- **Global mapping standards**

2. Database Management & Modeling



3. Software Development & SI





Quality Certifications

IIC TECHNOLOGIES

ISO 27001:2013: Information Security

CERTIFICATE OF REGISTRATION

GMS INTERCERT SERVICES has assessed and certified the Information Security Management System of

IIC TECHNOLOGIES

IIC TECHNOLOGIES PRIVATE LIMITED

8-2-350/5/B-22, Rd. No. 3, Banjara Hills, Hyderabad - 500 034, India.

(hereinafter called the organization) and hereby declares that organization is in conformance with

ISO/IEC 27001:2022

Information Security Management System

This registration is in respect to the following scope:

The Management of Information Security Systems in Marine, GIS, Terrestrial & Allied Services, Software and IT Services

(Statement of Applicability - V1.0 dtd 24 April, 2023)

Initial Registration Date	: July 10, 2017
Issued Date	: July 25, 2023
1st Surveillance on or before	: June 25, 2024
2nd Surveillance on or before	: June 25, 2025
Valid until	: July 24, 2026

MABLI GRETCHEN
Certification Manager

AIAO-BAR ACCREDITED

Certificate Number : ISMS2023038

GMS INTERCERT SERVICES

Accreditation by American International Accreditation Organization, Inc. and Bureau of accredited Registrars (AIAO-BAR)

1165 Main Street P.O. Box 156 West Barnstable, MA 02668-9998

Certificate Verification: Please check the validity of certificate at http://gmsintercert.com/verify/search.php or www.gmsintercert.com at Verify Certificate. email: info@gmsintercert.com

BUREAU VERITAS Certification

IIC TECHNOLOGIES LIMITED

IIC TECHNOLOGIES

CORPORATE OFFICE:
8-2-350/5/B-22, ROAD NO. 3, BANJARA HILLS, HYDERABAD – 500 034, INDIA.

This is a multi-site certificate, additional site details are listed in the appendix to this certificate

Bureau Veritas Certification Holding SAS – UK Branch certifies that the Management System of the above organization has been audited and found to be in accordance with the requirements of the management system standard detailed below:

Standard

ISO 9001:2015

Scope of certification

A. PROVISION OF MARINE SERVICES & SOLUTIONS INCLUDING PRODUCTION OF ELECTRONIC NAVIGATIONAL CHARTS (ENC), CHART COMPILATION, OTHER ALLIED PRODUCTS & HYDROGRAPHIC DATA PROCESSING.
B. PROVISION OF TERRESTRIAL SERVICES & SOLUTIONS INCLUDING PHOTOGRAMMETRY, LIDAR AND ORTHOPHOTO.
C. PROVISION OF TECHNICAL PUBLICATION SERVICES &SOLUTIONS INCLUDING WIRING DIAGRAMS & TECHNICAL ILLUSTRATIONS.
D. DESIGN, DEVELOPMENT, ANALYSIS, TESTING, INSTALLATION, CUSTOMIZATION, DISTRIBUTION & MAINTENANCE OF INNOVATIVE SOFTWARE PRODUCTS & SERVICES.

Original cycle start date:	20 December 1999
Expiry date of previous cycle:	06 August 2018
Recertification Audit date:	26 July 2018
Recertification cycle start date:	08 August 2018

Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on: 06 August 2021

Certificate No. IND18.7456U/Q Version: 1 Revision date: 08 August 2018

Signed on behalf of BVCH SAS UK Branch
Ramesh KOREGAVE
Director, CERTIFICATION
South Asia Region

UKAS 0008

Certification body address: *5th Floor, 66 Prescot Street, London, E1 8HG, United Kingdom.*

Local office: *Bureau Veritas (India) Private Limited (Certification Business) 72 Business Park, Mand Industrial Area, MIDC Cross Road "C", Andheri (East), Mumbai – 400 093, India.*

Pg 1 of 2

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization. To check this certificate validity please call +91 22 6274 2000.

ISO 9001:2015 certification

ISO 20000-1:2018: Management of IT Services

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ISO/IEC 20000-1:2018

IT Service Management System

This registration is in respect to the following scope:

The Management of IT Services in Marine, GIS, Terrestrial & Allied Services and Software

(This is in Accordance with the Service Catalogue - V1.1 of December 01, 2021)

Initial Registration Date	: July 10, 2017
Issued Date	: July 25, 2023
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Global Footprint

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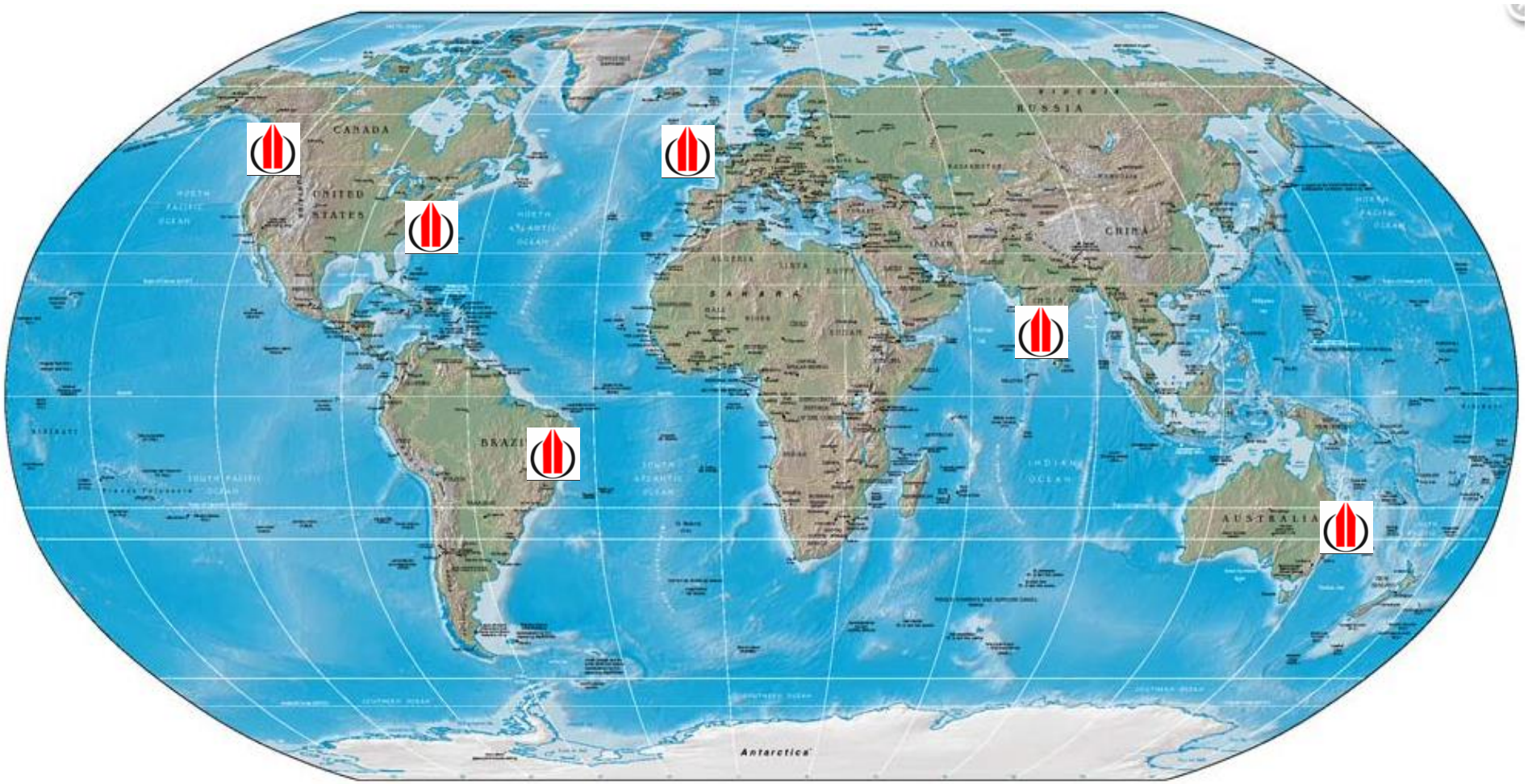

Indian Customer References

IIC TECHNOLOGIES

DEFENCE RESEARCH & DEVELOPMENT ORGANISATION
Ministry of Defence, Govt. of India

सेटलमेन्ट कमिशनर અને
જમીન રેકર્ડ નિયામકશ્રી - મહેસૂલ વિભાગ
(ગુજરાત સરકાર)

सेंटर फॉर आर्टिफिशियल इंटेलिजेंस एंड रोबोटिक्स
Centre for Artificial Intelligence and Robotics
डीआरडीओ | DRDO

Government of India
Ministry of Environment & Forests

इसरो ISRO

NUCLEAR POWER CORPORATION OF INDIA LIMITED
A Government of India Enterprise
एनपीसीआईएल NPCIL

वाप्कोस
WAPCOS

GREATER VISAKHAPATNAM MUNICIPAL CORPORATION
GVMC
City of Destiny

CENTRAL WATER COMMISSION
केन्द्रीय जल आयोग
आपो ज्योति रसोऽमृतम्

भारत इलेक्ट्रॉनिक्स
BHARAT ELECTRONICS

भारतीय भूवैज्ञानिक सर्वेक्षण
GEOLOGICAL SURVEY OF INDIA
सत्यमेव जयते
1851

रेलटेल
RAILTEL

INTEGRATED COASTAL MANAGEMENT SOCIETY
SICOM

भाऊजप्रा
iWAI

RITES
THE INFRASTRUCTURE PEOPLE

Chief Commissioner Of Land Administration
Government Of Andhra Pradesh

NATIONAL TECHNICAL RESEARCH ORGANISATION
GOVERNMENT OF INDIA

HYDERABAD
ON MISSION TOMORROW

PMRDA

Our Aerial Assets

Aircraft

Regd. No: VT – IIC

Regd. No: VT – ASU

Regd. No: N650 CA

S. No.	Make & Model	Registration Number (Call Sign)
1	CESSNA CARAVAN 208B	VT-IIC
2	CESSNA CARAVAN 208B	VT-ASU
3	CESSNA CARAVAN T206H	N650CA

Aerial Sensors & Cameras

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Sl	Sensor/Camera	Model	Description
1	LiDAR Sensors	Leica ALS70-HP / ALS80-HP / Riegl VQ-1560i / Riegl Q780i	High-end Aerial Lidar Sensors-4
2	Optical Cameras	DMC II 230, Intergraph	Large Format Camera-1
3		Leica RCD 30 – 2 No.s / PhaseOne IXU-RS1000 – 2 No.s	Medium Format Cameras-4

Our Experiences in Cadastral Surveys

Land Resurvey – Cadastral Mapping

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S. No	State/ Union Territory	Area in Sq. Km	Technology used
1	Gujarat	**44,486**	**DGPS/ETS Based Survey**
2	Bihar	**37,578**	**Aerial Photography Survey**
3	Odisha	**28,056**	**Aerial Photography Survey**
4	Rajasthan	**22,720**	**HRSI**
5	Andhra Pradesh	**8,000**	**Aerial Photography Survey**
6	Andaman	**95**	**DGPS/ETS based Survey**
	Total	**1,40,935**	

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AP Resurvey Project

AP Resurvey

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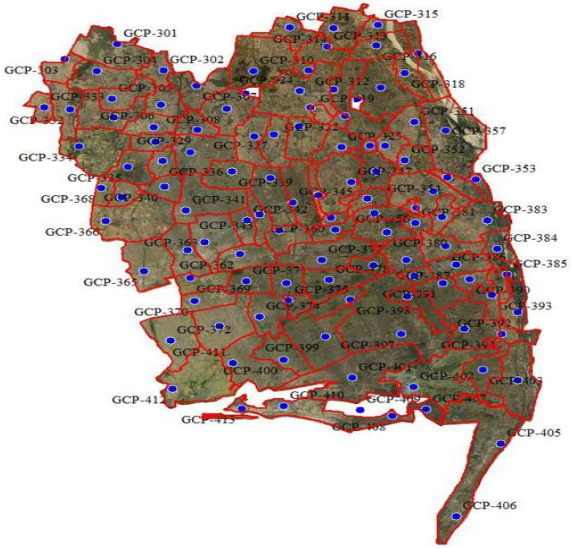
- **AP Resurvey Project:** Aerial Photography Acquisition, Ortho Rectified Images for Large Scale Mapping (Agricultural Land and Habitations, Area)
- **Scheme Name**: YSR Jagananna Shaswata Bhu Hakku mariyu Bhu Raksha Pathakam
  - ✓ Beneficiaries: Agricultural lands and Residential property owners
  - ✓ Benefit: Entitlement of land ownership
- **Major Objectives**:
  - ✓ To remove the irregularities and bring transparency
  - ✓ Aims to reducing disputes in villages over property issues
  - ✓ Land titling card will be a proof of ownership and enable the holder to get loan

Aerial Photography and Mapping Process

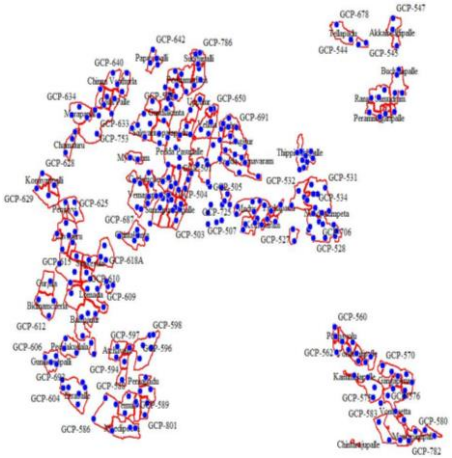
Activities

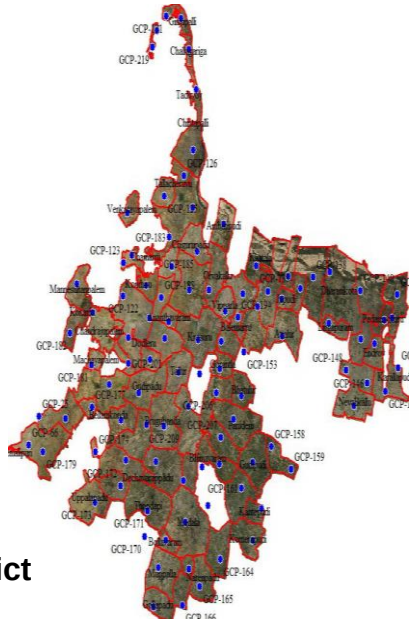
- Ground Control Survey
- Mission & Flight Planning
- Aerial Data Acquisition
- Data Processing
- Supply of ORI & Habitational Area Maps



Bapatla District

Kadapa District





Palnadu District

Ground Control Survey

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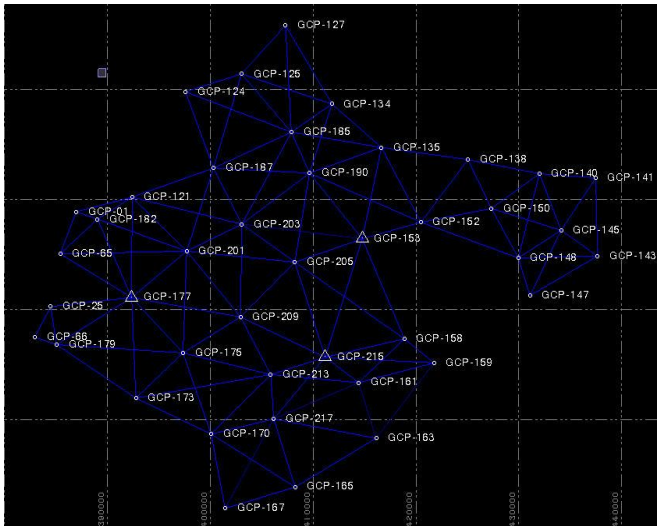
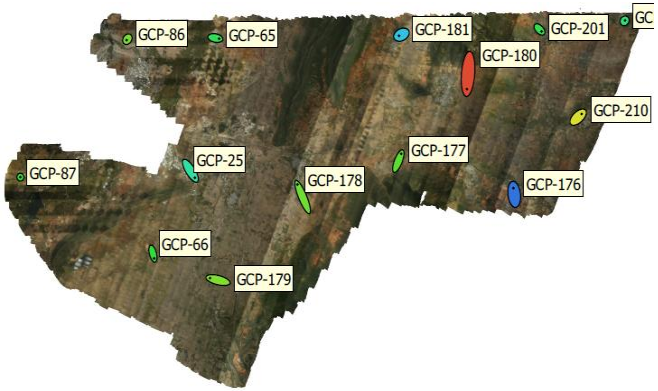
- ✓ CORS station data as input by Govt. of AP
- ✓ Ground Control Points and well distributed check points
- ✓ Base Control Points for Aerial flying
- ✓ Check Points with reference to CORS for validation
- ✓ Pre-targets painted for clear visibility on Aerial Photograph



Ground Control Network

- ❑ Trimble R12 instruments
- ❑ UTM grid, WGS 84 datum
- ❑ Clear visibility of sky above 20°
- ❑ Observations with minimum 4 satellites
- ❑ PDOP < 4

Base Station Observation



GCP's with Check Points

Mission & Flight Planning

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- ✓ Fight path cover cross flight lines to eliminate shadowing, leaning, perspective and radial distortions.
- ✓ Flight line forward & side overlap is 60% & 30%. No data gaps are observed between usable portions of the swaths.
- ✓ Data collections in high relief terrain have greater overlap.

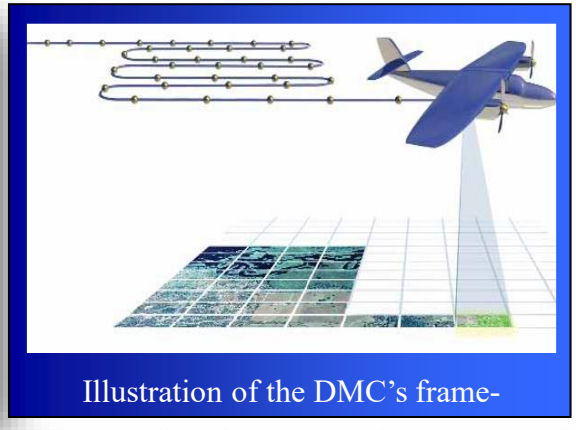
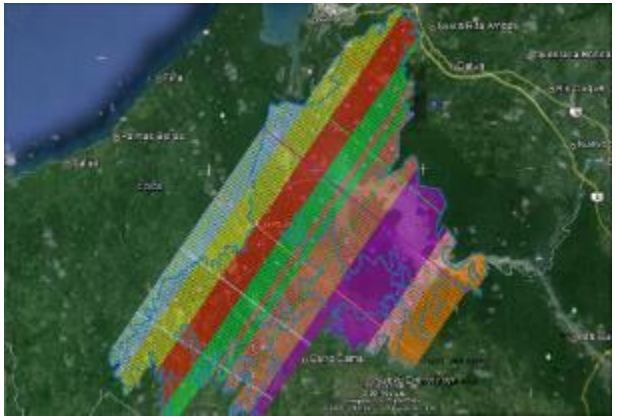
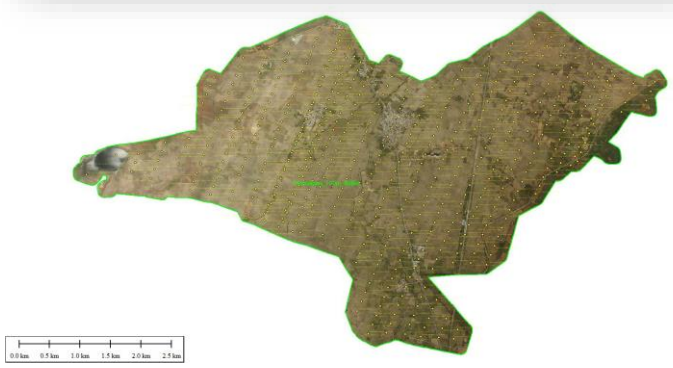


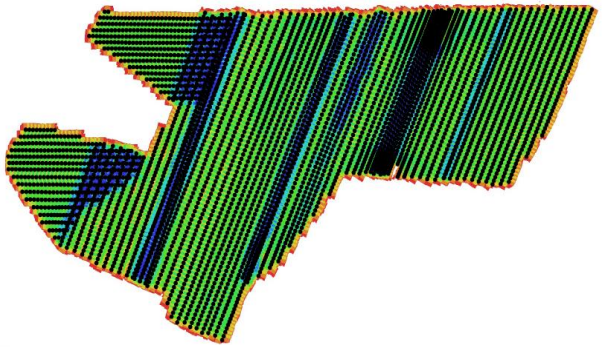
Illustration of the DMC's frame-based image capture





Nemalipuri Village - (AOI)

Flight Plans



Actual Flight Lines

Aerial Data Acquisition

- Ground Control established by GOVT. OF AP CORS shall be used for base stations for Aerial Flying activities
- Aerial Photography using Fixed Wing Aircraft
  - Technology: Imagery Data Acquisition System
  - DMC – The Digital Sensor Technology of Z/I Imaging

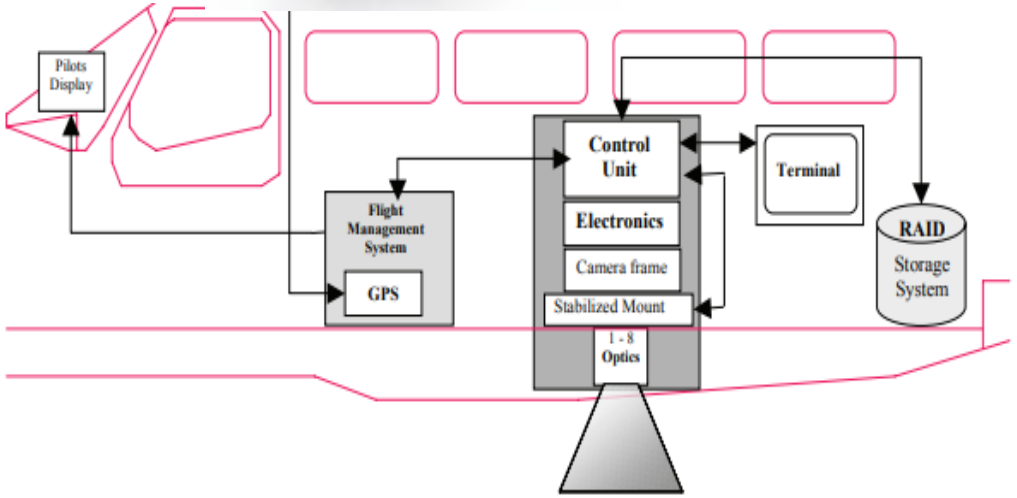
DMC II 230

RCD 30

Aerial Take off

Sensors Installation

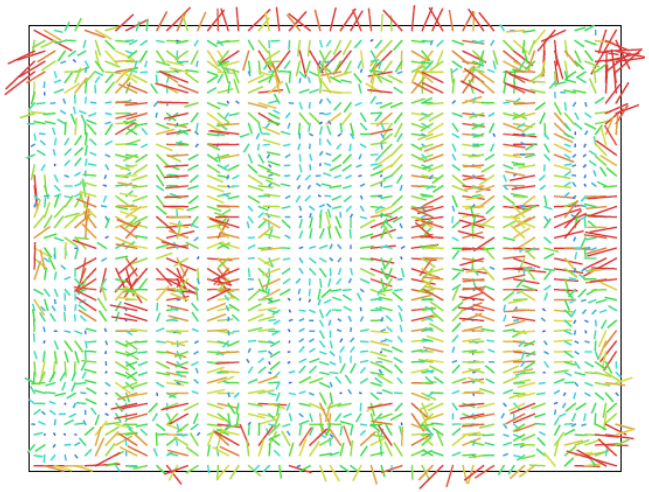
Landing



DMC Airborne configuration

Aerial Triangulation (AT)

- ✓ To densify horizontal and vertical control from relatively few GCPs.
- ✓ Reduce amount of field survey by extending control to stereo-models
- ✓ AT is simultaneous space resection of image rays projected and recorded at one source
- ✓ These image rays intersect at corresponding ground location to determine 3D coordinates
- ✓ They fit to known ground survey control in simultaneous 3D least squares adjustment
- ✓ ‘unknown’ ground points are derived by intersection of adjusted image points



Camera Calibration

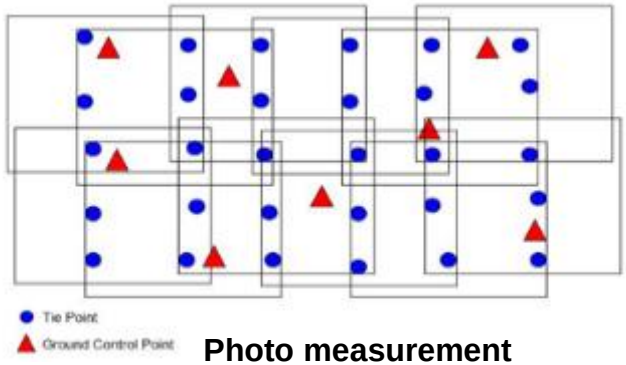
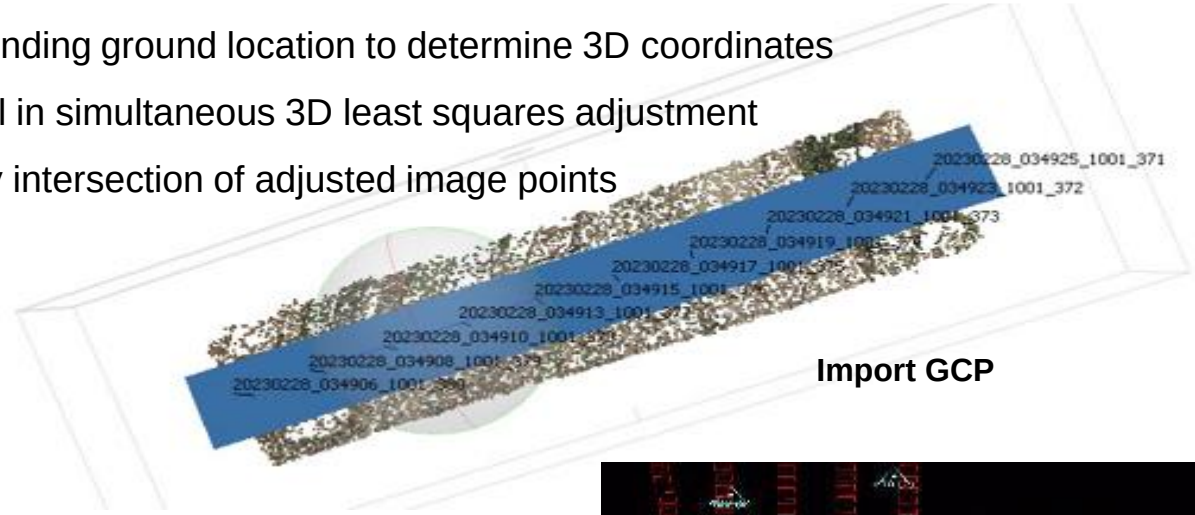
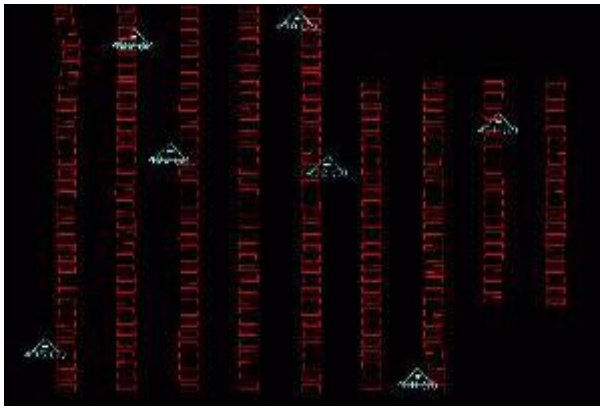


Photo measurement



Import GCP

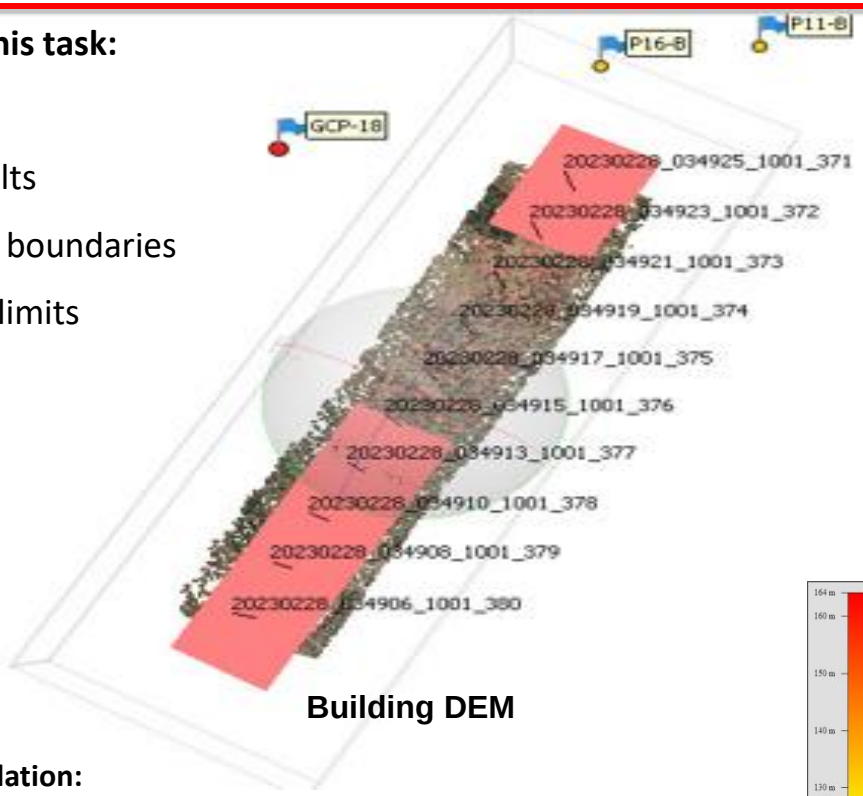


Pass points measurement

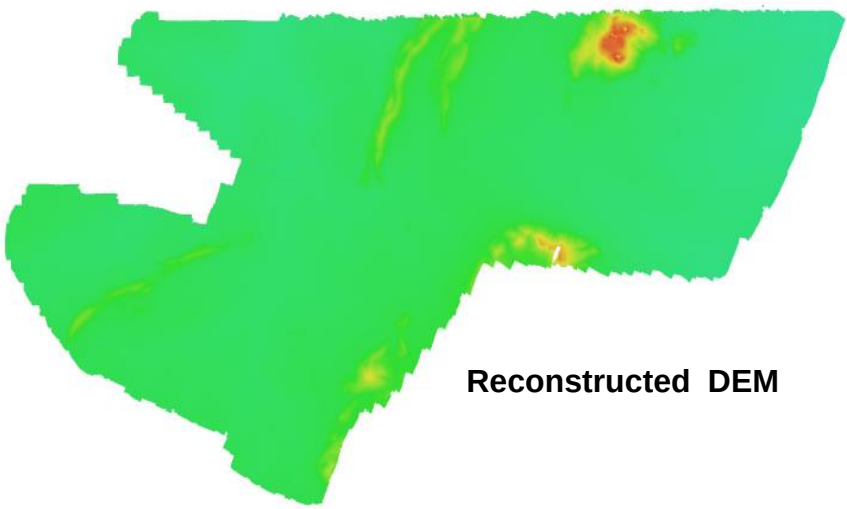
DEM Compilation

Inputs for this task:

- ✓ Scans
- ✓ AT results
- ✓ Project boundaries
- ✓ Model limits



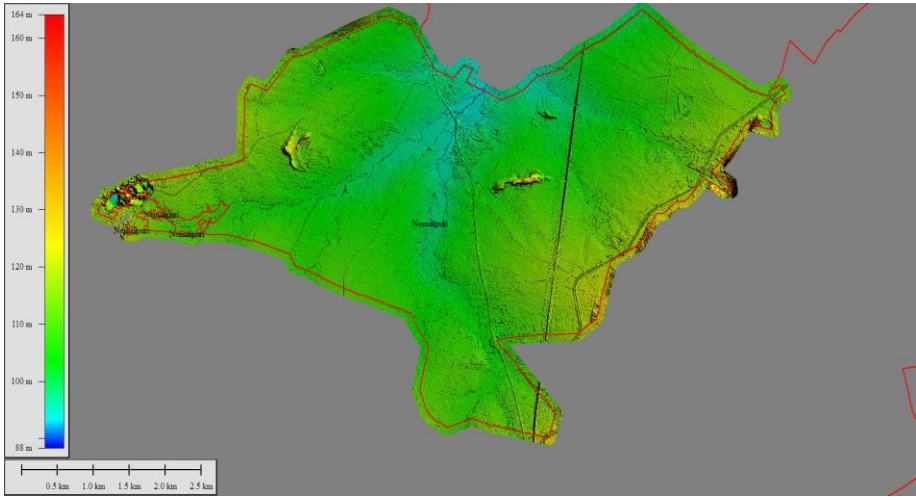
Building DEM



Reconstructed DEM

Stereo Compilation:

- ✓ DEM consisting of mass points and break lines will be collected.
- ✓ Mass Points collected at predetermined locations along a grid.
- ✓ Breaklines will be captured along significant linear terrain breaks
- ✓ Each model is evaluated for the type of terrain and features



Final DEM of AOI

DSM, Orthophoto

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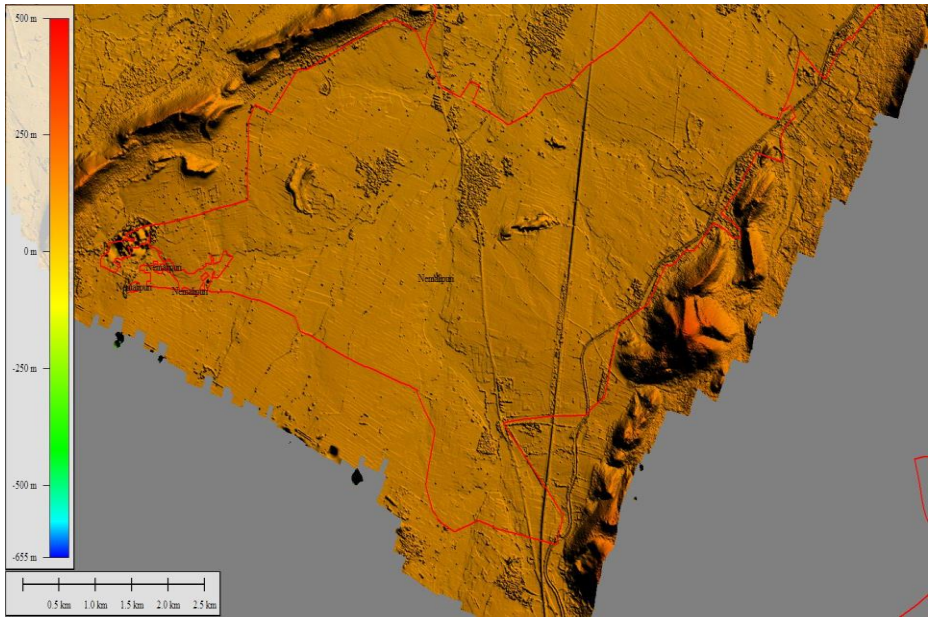
- ✓ Agisoft Photoscan Pro software was used for 3D data processing
- ✓ Both image alignment and 3D model reconstruction are fully automated

DEM

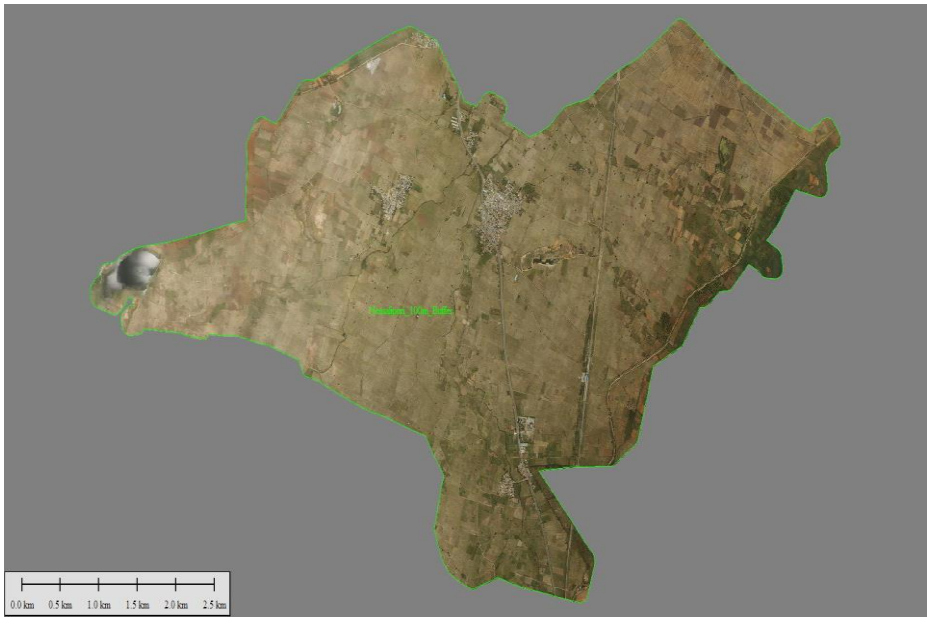
Size	24,357 x 13,541
Coordinate system	WGS 84 / UTM zone 44N (EPSG::32644)
File size	785.68 MB

Orthomosaic

Size	487,120 x 261,980
Coordinate system	WGS 84 / UTM zone 44N (EPSG::32644)
Colors	3 bands, uint8



DSM of the AOI



Orthophoto of the AOI

Feature Extraction/ Database Creation - Abadi (Village site/ Habitation) areas

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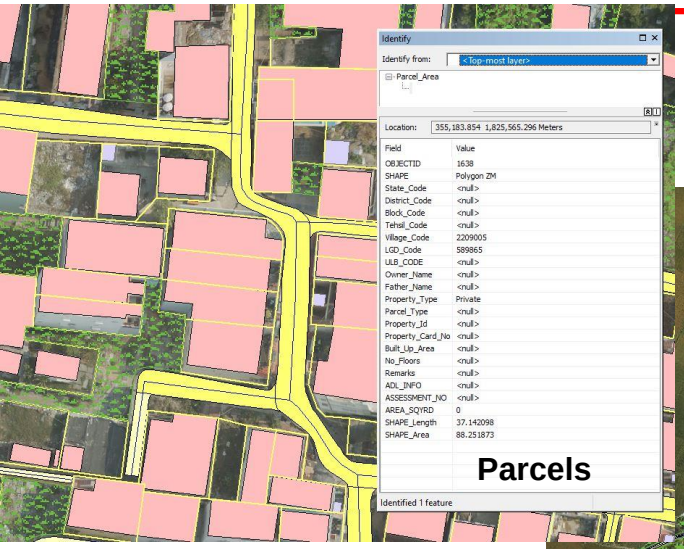
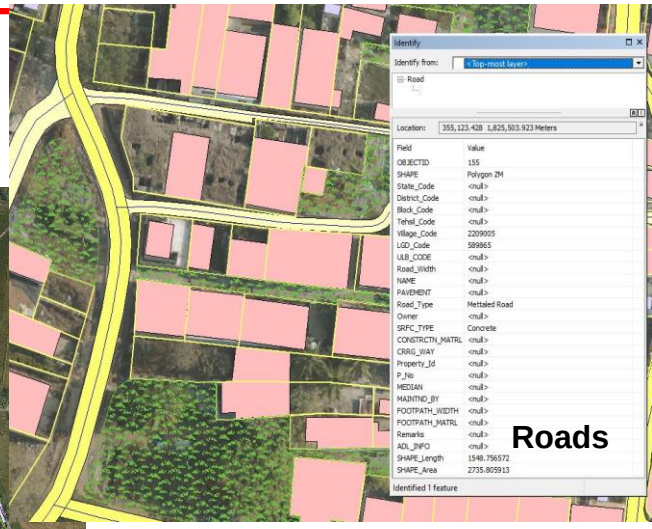
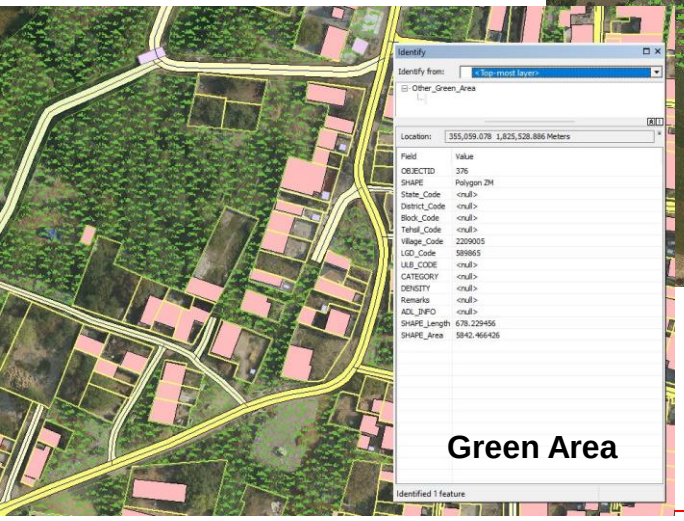
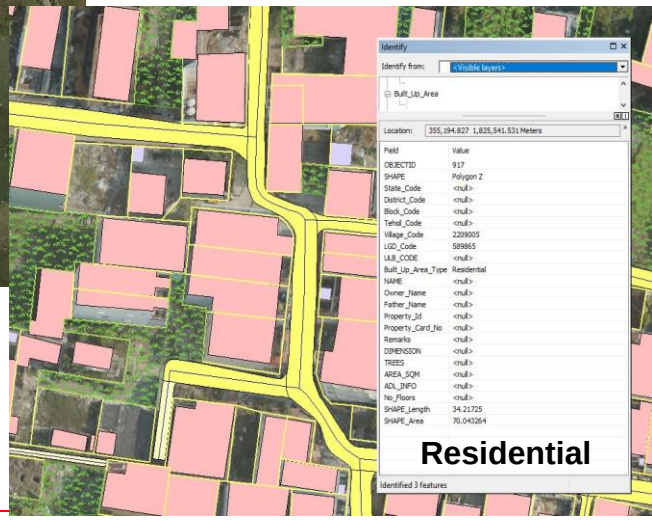






Complete ORI of Village Map



Deliverables

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- ✓ Ground Control Points and check points with Geo-codes
- ✓ Raw data and other data-products generated during Aerial Photography
- ✓ Post Processed data (DEM/ DSM) & ORI
- ✓ Report on quality check of ORI conducted
- ✓ QA/QC reports
- ✓ Hard Copy of ORI of entire village and Tiles
- ✓ Soft copy of ORI (village wise) in .ecw/ geotiff and.pdf formats
- ✓ Seamless ORI data of entire AOI in soft copy
- ✓ Habitational area map in 1:500 scale

ORI Samples

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Advantages of Aerial Photography for Large Area Cadastral Mapping

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- ✓ High resolution aerial photography with 5cm GSD
- ✓ Less no. of ground control points
- ✓ Faster data acquisition. 150-200 sq. km of data in one sortie
- ✓ Gyro Stabilized sensor mount helps perfect Vertical Imagery
- ✓ Forward Motion Compensation for high quality Imagery
- ✓ IMU and Survey grade GNSS receiver which provide continuous 3D Positioning, velocity and altitude
- ✓ Cost effective in data storage and processing
- ✓ Accurate and reliable data
- ✓ Ideal Option for Large Area Mapping

Thank You!!!

www.iictechnologies.com