Maps and 3D Data Sources Available for Content and Context for Digital India and Smart Cities

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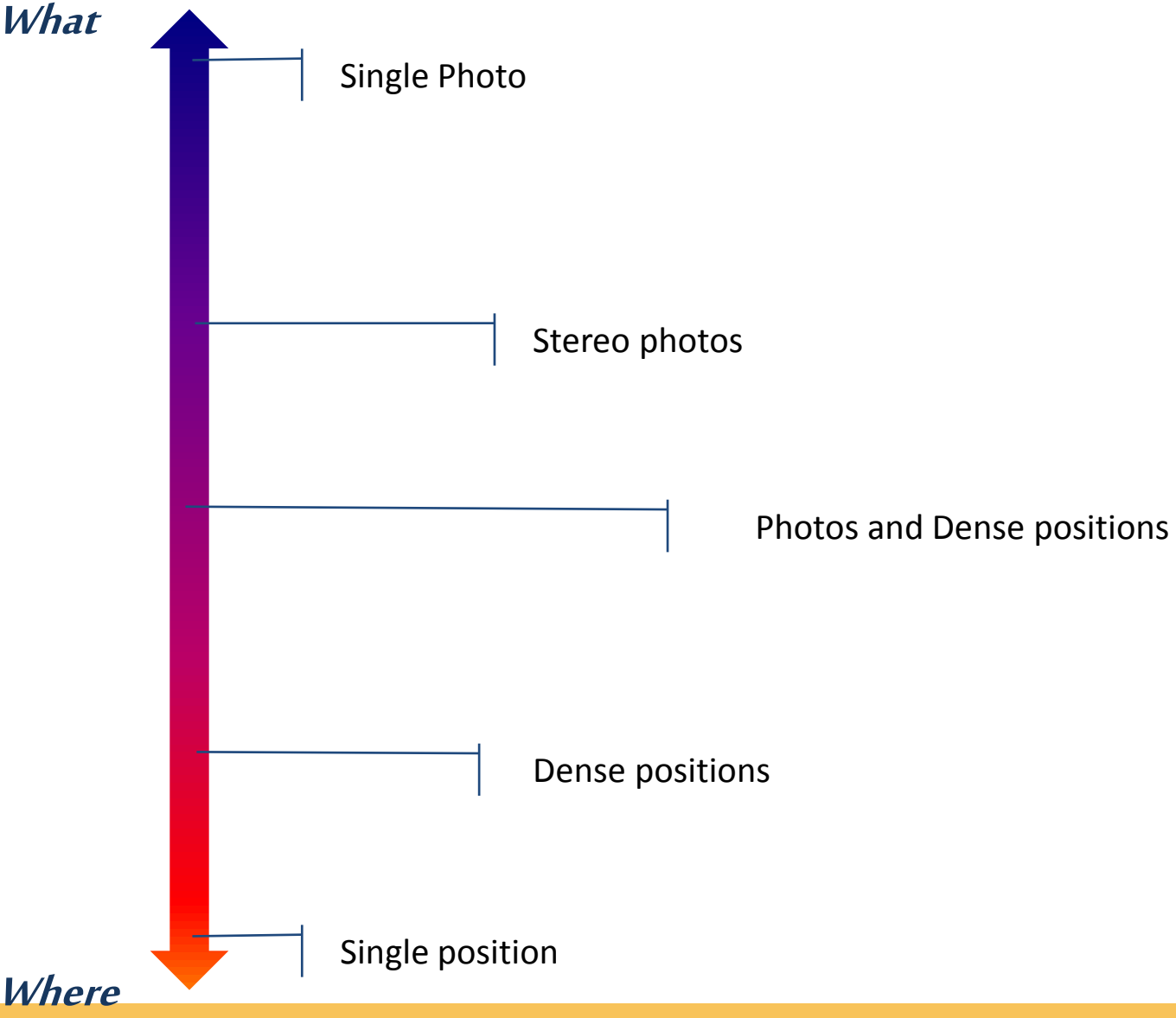
PRESENTATION OUTLINE

Data Sources Available for Content and Context for Digital India:

1. Review mapping technologies open to Digital India, with an end-user perspective
2. Differentiate between **What** and **Where**
3. Then select a **Platform**
4. Review the various data sources available
5. Close with review of Delivery Mechanisms.

SENSOR: THE "WHAT" AND "WHERE"



PLATFORMS

Aerial

Sets scale of coverage

Satellite

Aircraft

UAV

Tripod: stationary

Ground

Sets degree of mobility

Person: slow mobile

vehicle: fast mobile

Data Sources for “WHAT”

SATELLITE

30 cm

Satellite

Imagery

of Delhi

SATELLITE IMAGERY

Features:

- Includes traditional platforms like Cartosat, Digital Globe, …
- Also includes new-age micro satellites like Planet Labs

Pros:

- No mobilisation costs
- Repeat visits are ideal for change detection over larger areas
- Can provide the 3rd dimension with stereo coverage
- Provide multi-spectral capability to add more depth to the "What"
- New age micro-satellites increasing repeat cycles

Cons:

- Lower accuracy
- Higher cost than aerial photography over larger areas, especially in stereo.

TRADITIONAL AERIAL PHOTOGRAPHY

Features:

- Large frame cameras, fitted with GPS and IMU

Pros:

- Well understood in the Indian market
- Large resource in India to process frames to orthos, vectors and DTM

Cons:

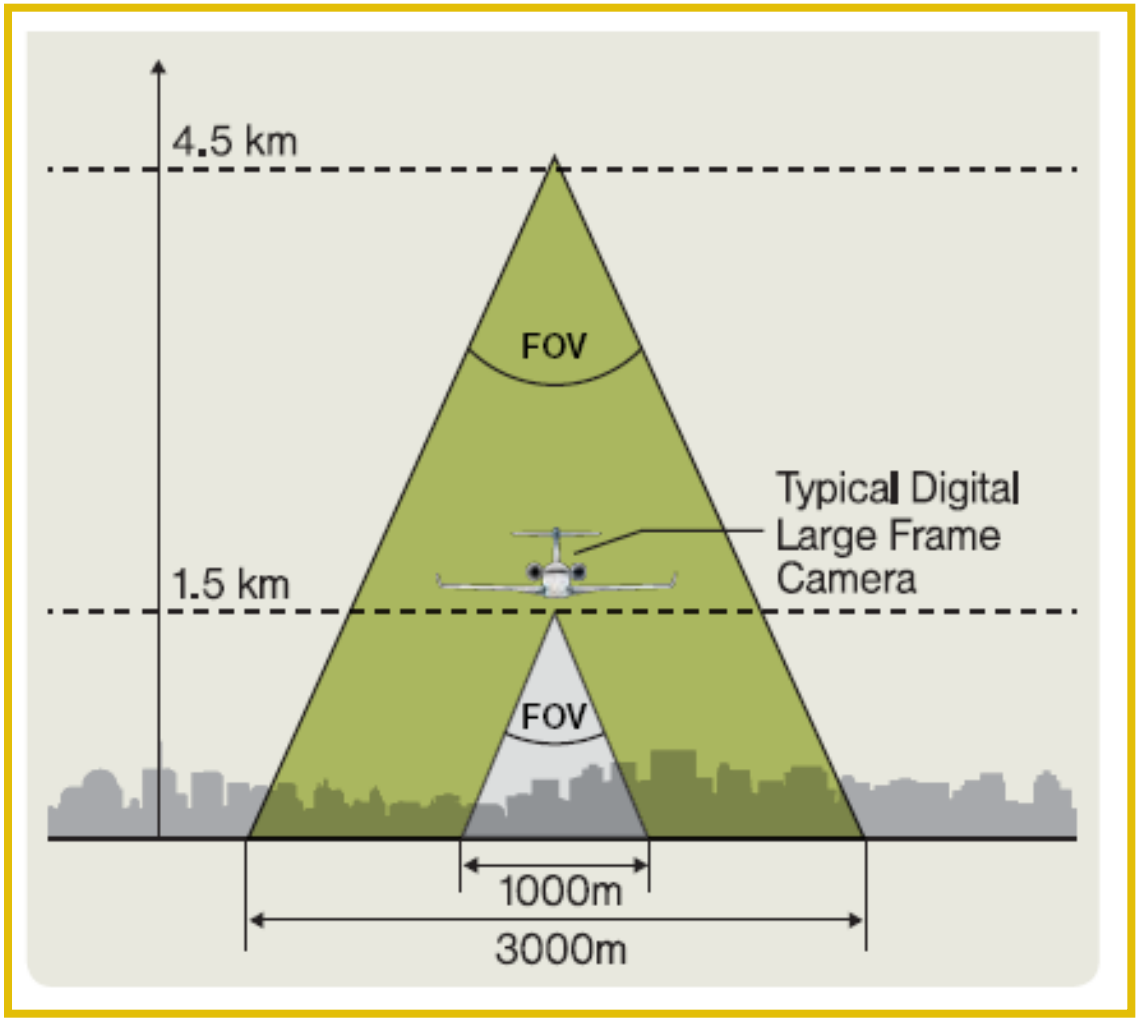
- Requires DGCA/DRI security permits (takes 2 to 3+ months)
- Mobilisation costs make it less efficient for small areas
- Require more flying (cost, time and weather risk) than modern cameras.

MODERN AERIAL PHOTOGRAPHY

New Technology: eg.

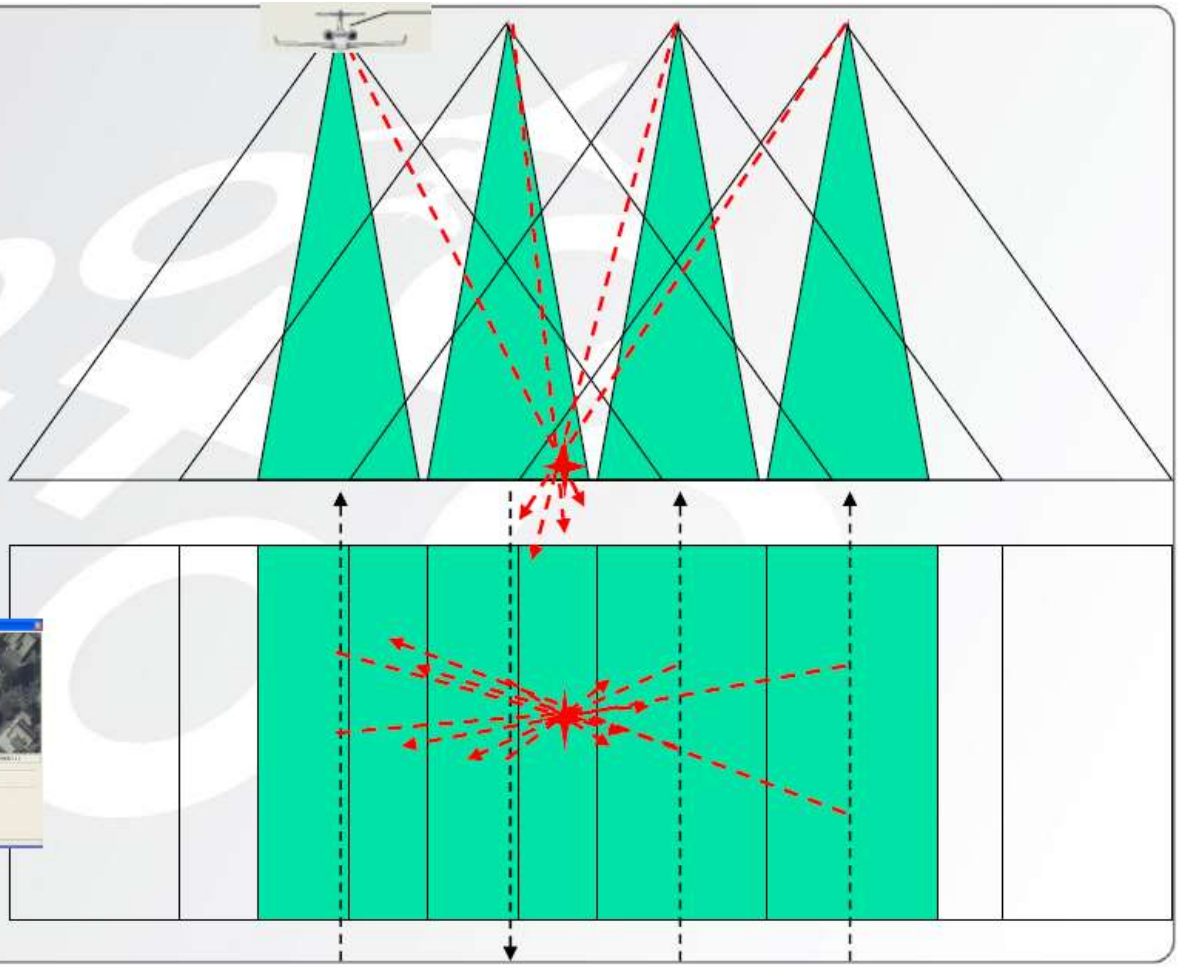
VisionMap A3

Allows wider capture per run



VisionMap A3: Rotating Head Camera

- Multiple images
- Multiple directions
- 90-100° angles
- X00,000 tie-points



MODERN AERIAL PHOTOGRAPHY

Features:

- Rapid capture from frame camera with long focal length
- Every ground feature appears on many frames
- Allows image capture 2-3x higher than traditional cameras
- Suits very large areas (10,000km^2 +)

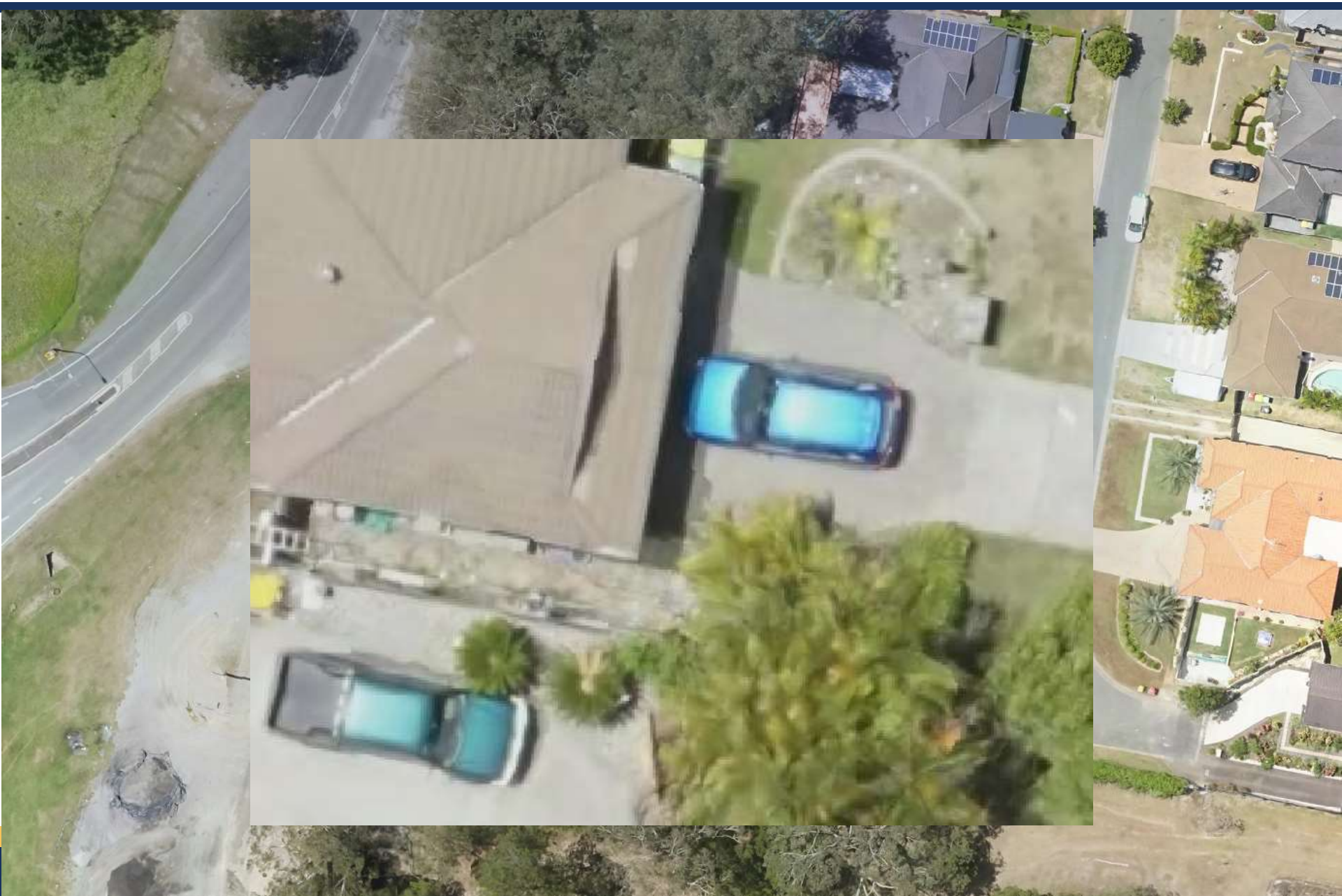
Pros:

- Less flying means lower aviation costs, less time, and less weather risk
- Redundant imagery allows automatic processing (quicker and cheaper)
- Can produce stereo frames for traditional stereo vector capture

Cons:

- Requires DGCA/DRI security permits (takes 2 to 3+ months)
- Mobilisation costs make it less effective for small areas
- Specialised processing means less capability in India.

UAV PHOTOGRAPHY



UAV PHOTOGRAPHY

Features:

- Small format camera,
- mounted on small un-manned aircraft

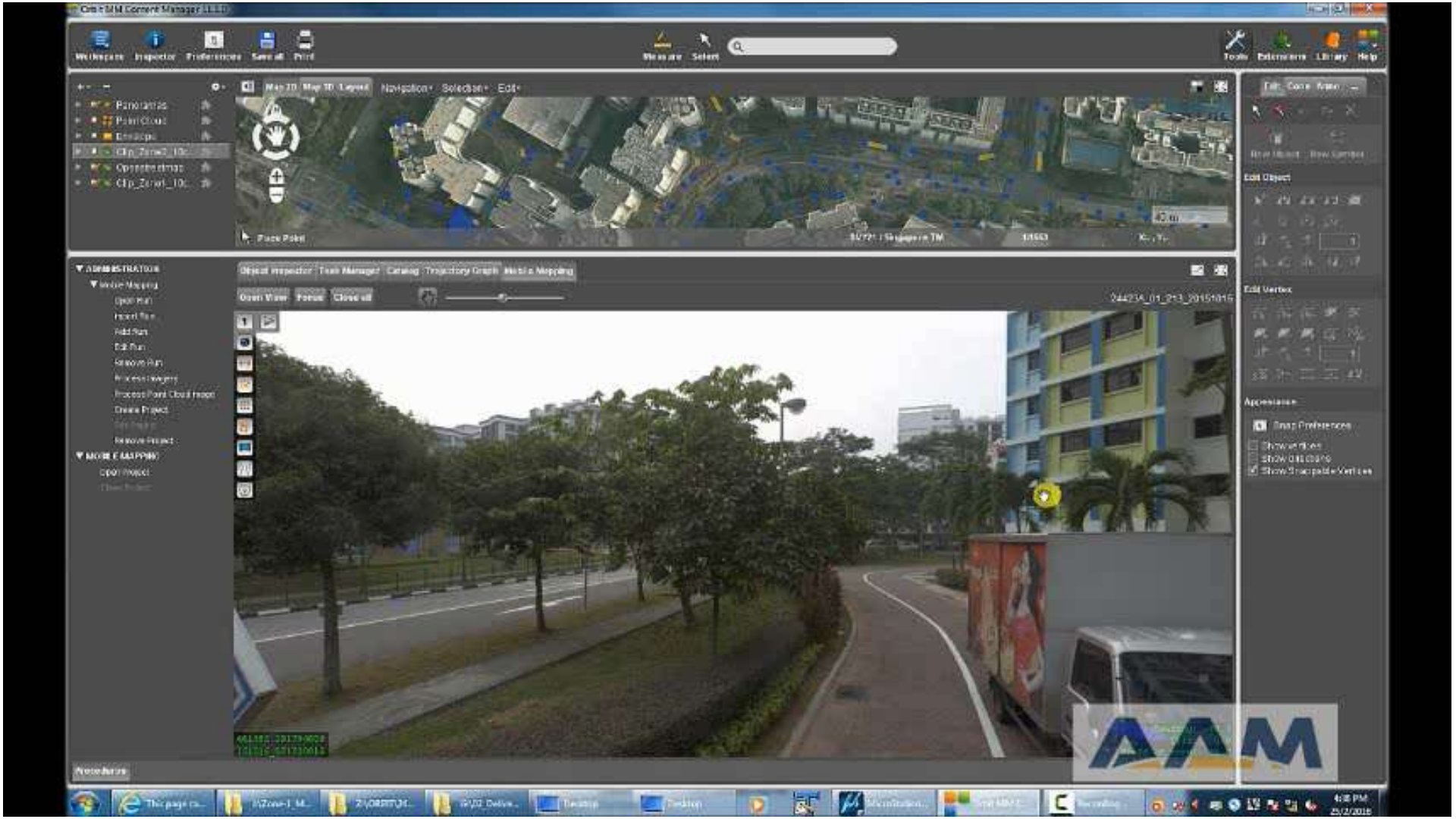
Pros:

- Easy to mobilise
- Low cost equipment
- High resolution available, typically 2 to 5 cm
- Automatic software can build 3D surface models

Cons:

- Short sortie duration, typically supporting 1 to 2 km^2 per day capture
- More problematic (less safe) over urban areas
- Uncertain DGCA permission process.

TERRESTRIAL PHOTOGRAPHY



TERRESTRIAL PHOTOGRAPHY

Features:

- Generally spherical and georeferenced imagery

Pros:

- No permits required
- Acquisition at vehicle speed
- Efficient means of defining the "What" of streetscapes

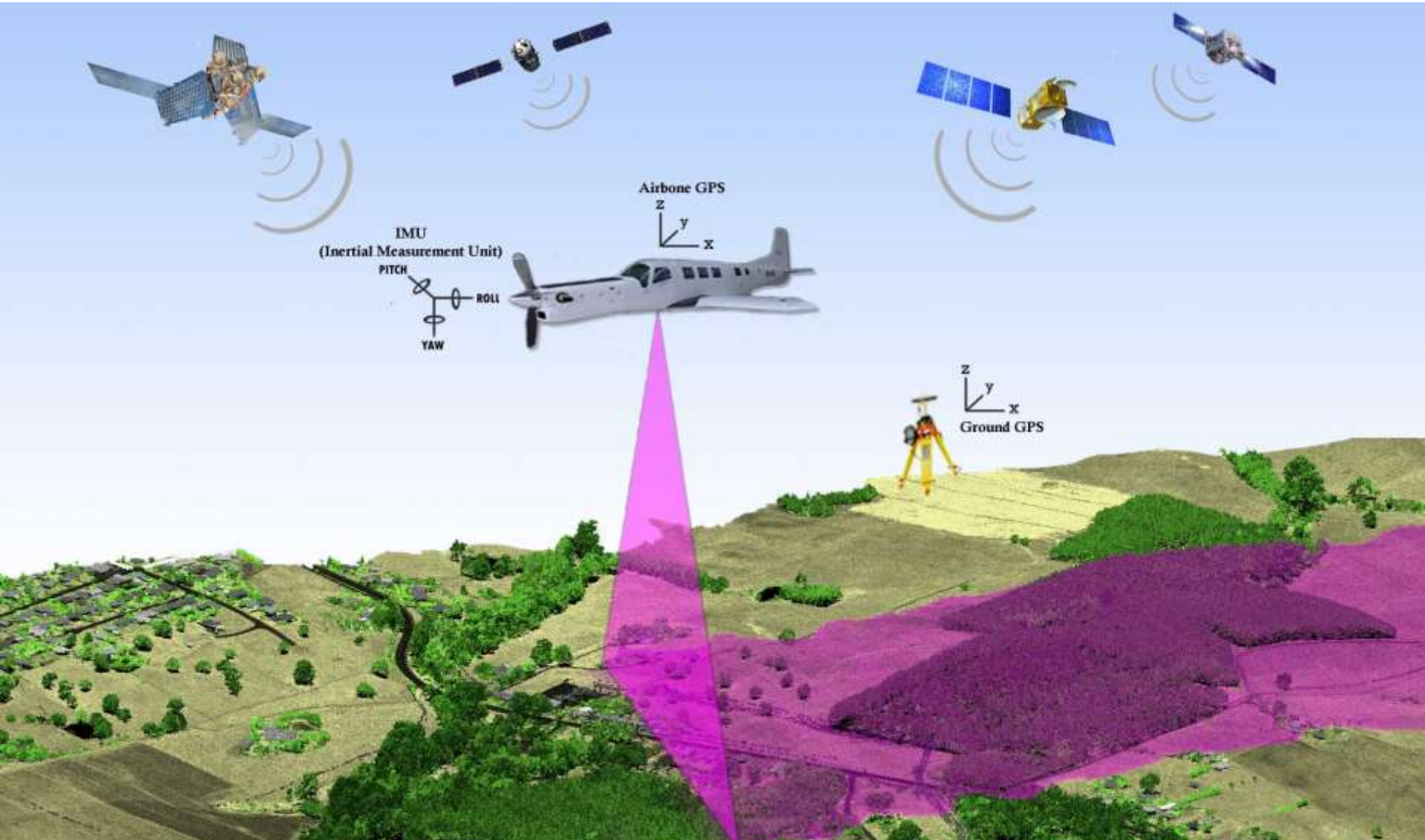
Cons:

- Only limited measuring capability.

Data Sources for “WHERE”

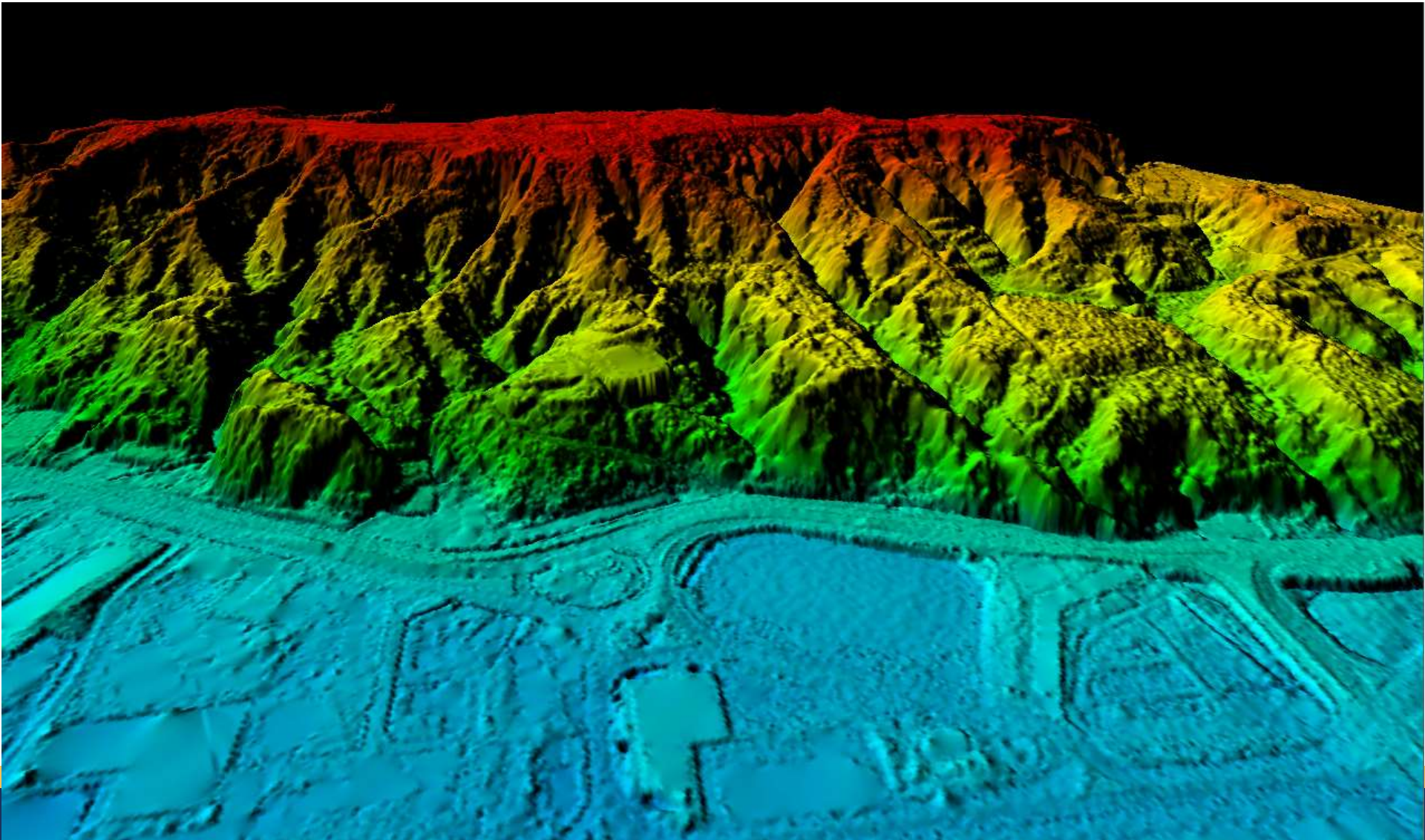
AIRBORNE LIDAR

Aircraft based measuring laser, with GPS/IMU positioning



AIRBORNE LIDAR

Defines terrain under vegetation and all above-ground features



AIRBORNE LIDAR

Features:

- Aircraft based (helicopter or fixed-wing)
- Laser defining surface with many points per square metre (1 to 60 pt/m^2)
- Often operated with aerial camera (to add "what" to the LiDAR's "where")

Pros:

- Very dense definition of terrain and everything on it
- Defines the terrain under vegetation
- Defines non-ground features such as trees, buildings, powerlines
- Well understood in the Indian market
- Large resource in India to process DTM

Cons:

- Requires DGCA/DRI security permits (takes 2 to 3+ months)
- Mobilisation costs make it less efficient for small areas.

AIRBORNE GEIGER LIDAR

Features:

- Experimental / Emerging technology using LiDAR at photon level
- Also called "Flash LiDAR"

Pros:

- Fly at very high altitude to define very large areas
- Open ground point accuracies comparable to pulse LiDAR
- Very high point spacings

Cons:

- performance through vegetation not yet proven
- Performance in urban environment and steep terrain not yet proven
- USGS evaluation has raised a number of performance questions
- Only one or two worldwide suppliers
- Pricing, processing and supply models still to be determined.

UAV LIDAR

Features:

- Small format LiDAR
- mounted on small un-manned aircraft

Pros:

- Easy to mobilise
- Mid cost equipment (US$100,000 upwards)
- Sensors and platforms improving quickly

Cons:

- Short sortie duration, typically supporting 1 to 2 km^2 per day capture
- More problematic (less safe) over urban areas
- Uncertain DGCA permission process
- Sensors are un-insurable: $100,000 sensor in platform prone to crash ☹.

TERRESTRIAL LIDAR (VEHICLE)

TERRESTRIAL LIDAR (VEHICLE)

Features:

- Vehicle based (usually car but also boat, train, rickshaw, trolley, backpack)
- Laser defining surface with many points (50 to 1000+ pt/m^2)
- Often operated with camera (to add "what" to the LiDAR's "where")

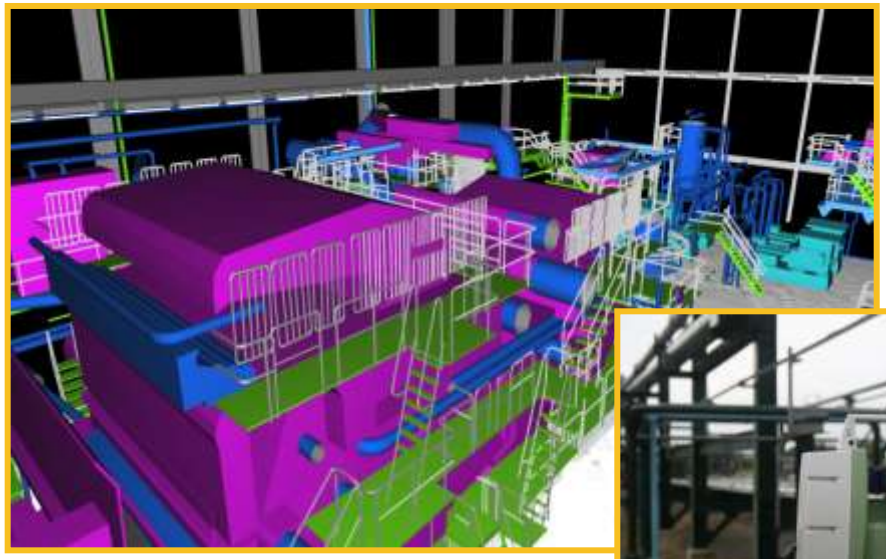
Pros:

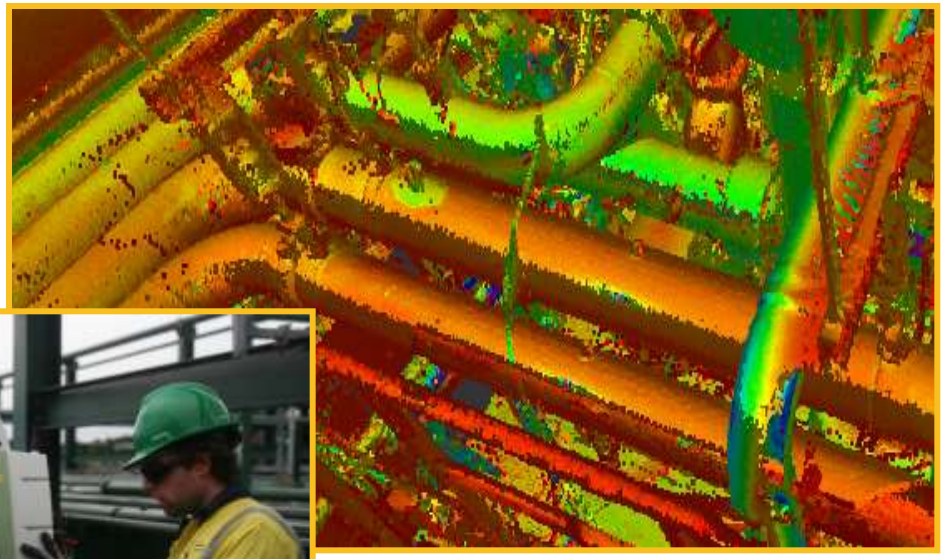
- No permits required
- Acquisition at vehicle speed
- Efficient means of defining the "What" of streetscapes

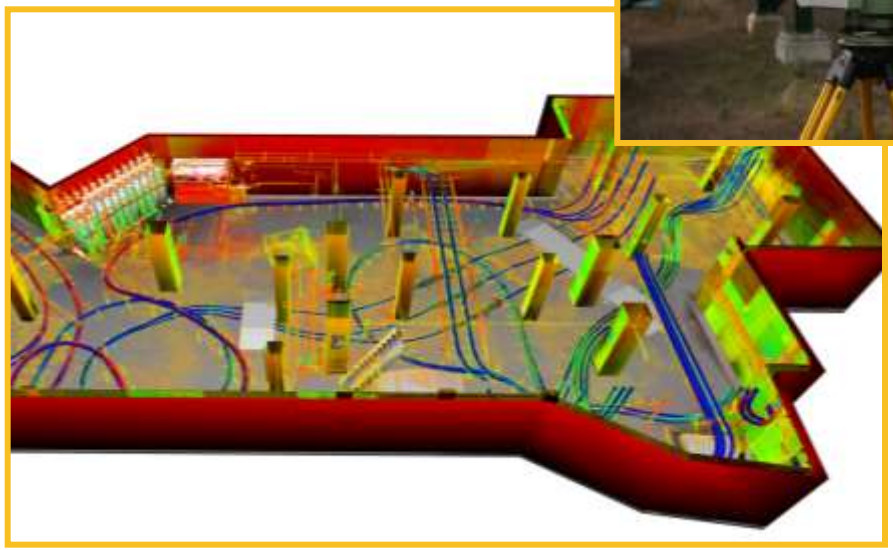
Cons:

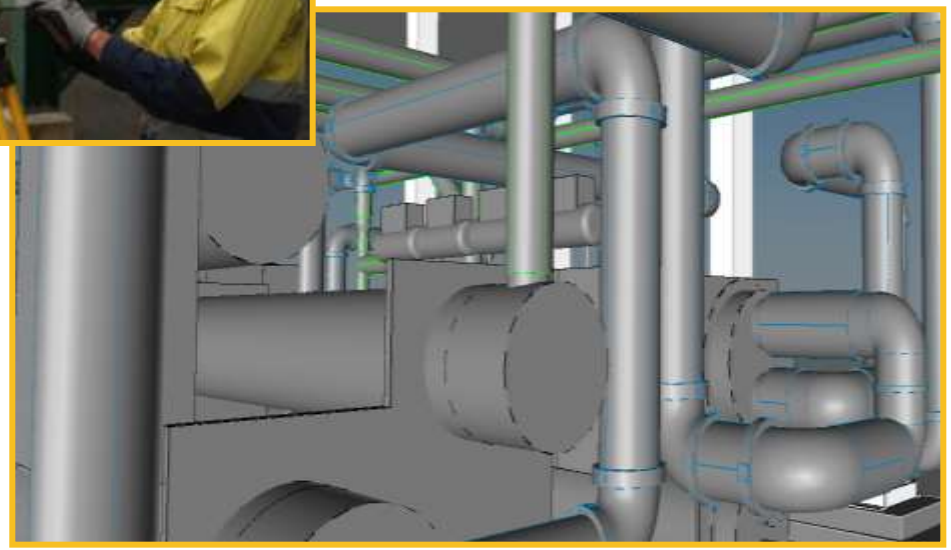
- Accuracy deteriorates in urban canyons (GCPs can assist)
- Sites limited to those visible from roadway (or other platform)

TERRESTRIAL LIDAR (STATIONARY)









TERRESTRIAL LIDAR (STATIONARY)

Features:

- LiDAR mounted on a tripod or permanent structure
- Often several standpoints combined to form one pointcloud
- Typically used for as-built plans in complex sites: industrial, heritage
- Often combined with imagery to add "what" to the "where"

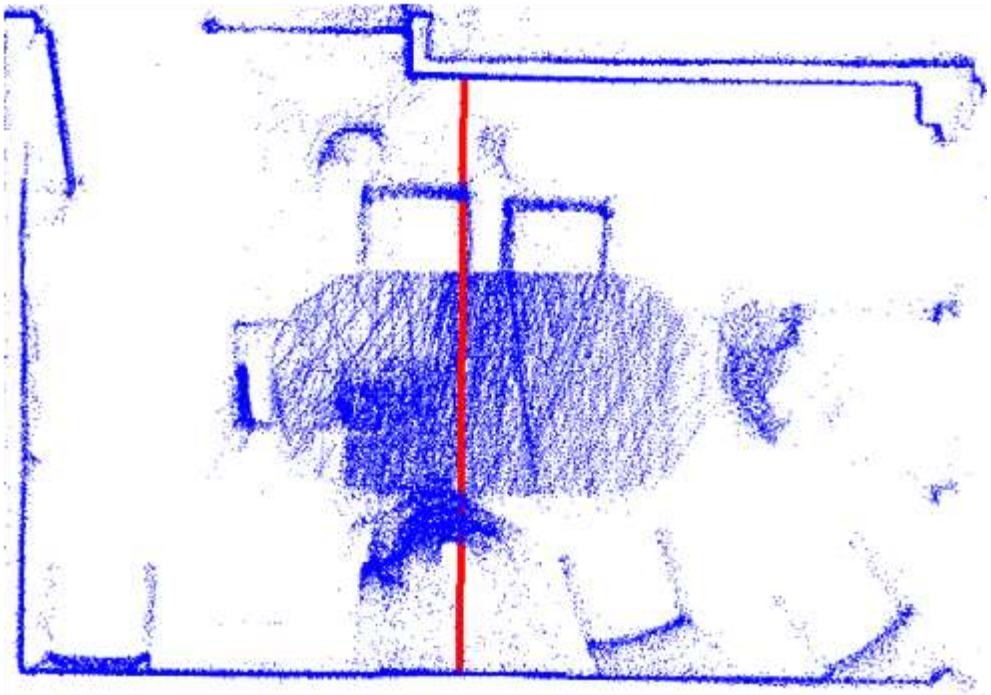
Pros:

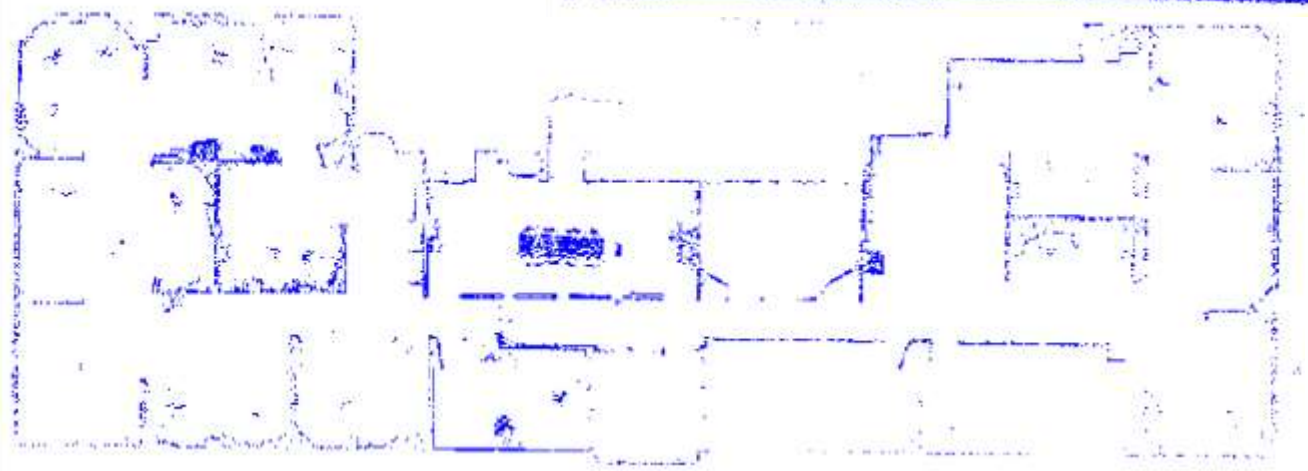
- Most accurate LiDAR deployment, as it simplifies positioning
- mm accuracy and mm density possible
- Can define very complex sites, very quickly
- Shorter time on site than traditional surveying (shorter shutdown)

Cons:

- Multiple standpoints required to minimise/avoid shadowing
- Planning & costing often has to be refined on site to overcome shadowing.

PERSONAL LIDAR (INDOOR)





PERSONAL LIDAR (INDOOR)

Features:

- Handheld or backpack LiDAR, not reliant on GPS
- Usually uses Simultaneous Localisation and Mapping (SLAM) : software solution to position sensor and pointcloud using site geometry
- Often used to record internal room and building geometry

Pros:

- Very flexible acquisition
- Easy to collect: eg. 370m^2 floor area with 25 million points in 15 minutes
- Includes low cost options (US$5000 +)
- Rapidly improving technology

Cons:

- Only relative positioning (unless GCPs introduced)
- Needs careful planning to achieve required accuracies and specifications
- Limited range.

Delivering Digital India

DELIVERING DATA

Distributing data involves some or all of:

1. Paper maps
2. Digital maps
3. Data layers to corporate GIS
4. Data and functionality to external stakeholders:
    1. colleagues,
    2. partners,
    3. Authorities
    4. general public

- Provide external access to corporate GIS,
- or Host and serve data from the Cloud
    - ✓ No need for own hardware / software / IT
    - ✓ Scalable to meet needs
    - ✓ Add functionality as required
    - ✓ Support for all platforms.

IN CLOSING

Leave you with these thoughts:

- Spatial Data for Digital India can come from a wide range of sources
- Decide the source based on project's need for WHAT and WHERE
- Decide the platform which provides the optimum perspective
- If writing a tender, don't limit your access to these data sources. Specify DELIVERABLES or OUTCOMES and let providers offer you data sources
- Consider how best to DISTRIBUTE your data to those who need it.

Thank you
Any Questions ?