Addressing the challenges of displaying geotechnical information in 3D environments

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During an OSI, inspectors should expect to have access to certain types of data for an Inspection Area (IA) prior to deployment, irrespective of where on Earth the OSI occurs. Satellite and aerial imagery, cartographic maps, digital elevation models, geological maps are all data types that can be found for almost any part of the planet prior to OSI deployment. We explore how to visualise such baseline datasets in 3D to support of the Inspection, from pre-deployment through to entry into country. In an OSI, there are four main scenarios where this type of data visualisation is important:

1. Planning prior to Deployment **2. Mission planning and logistics during the OSI** **3. Visualisation of treaty-relevant data** **4. Producing briefing materials for all stakeholders**

In this poster, we present a detailed exploration of how best to represent these data in both 2D and 3D environments. We contrast the power of visualising such data in a 3D environment to standard 2D representation of the same data, using the commercial software GeoVisionary, developed by the British Geological Survey and Virtalis Ltd.

Baseline datasets

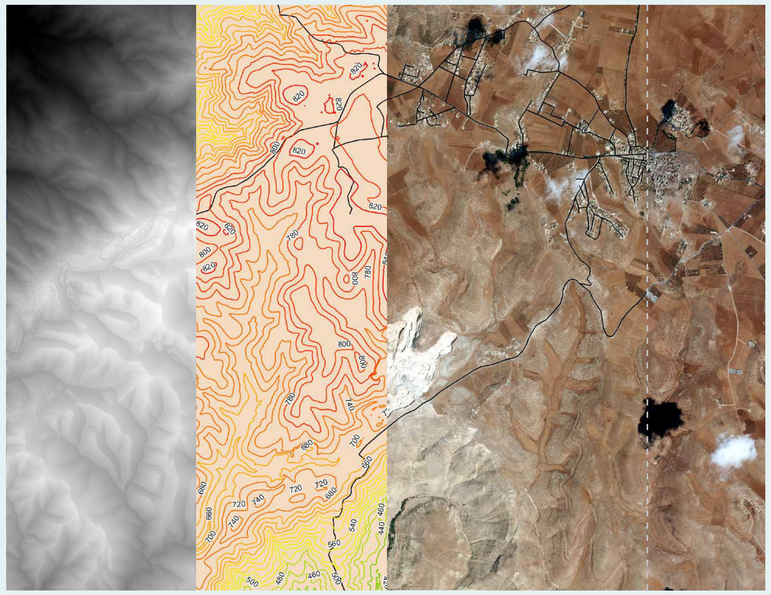
Prior to the inspectors being deployed a large quantity of data should be collected on the country to be inspected and the IA itself. This data should be used to help familiarise the Inspectors with the IA and allow them to effectively plan for deployment and the inspection. We consider this the baseline dataset which should include:

- Elevation data for the area, hill-shade and/or contours
- Cartographic maps, e.g. showing transport infrastructure etc.
- High resolution aerial or satellite imagery
- Geological maps of the area

All of these can be presented as traditional 2D maps either on paper or digital display or as 3D maps.

The power of 3D maps for inspection work is that they can give the viewer a thorough appreciation of an area more rapidly than a 2D map can, as shown in the panels on the right and in the videos shown on the display.

Components of the baseline dataset as seen in convectional 2D mapping view



Elevation data for the terrain. Ground height data is available for most of the planet's surface at 30 m resolution down to 50 cm or less.

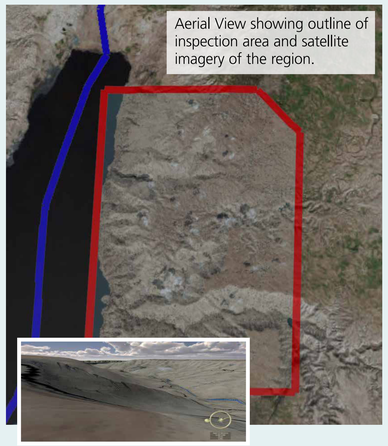
Contour map showing topography. 2D maps abstract data so relevant information can be absorbed more easily. The same process is also needed when displaying in 3D.

Satellite imagery is now available for most of the planet's surface at 50 cm resolution down to 31 cm resolution. Other information such as paved road locations can be added to the imagery.

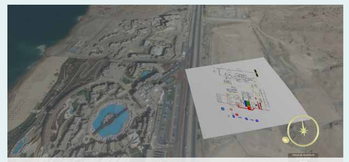
Bare satellite imagery.

1. Planning prior to Deployment

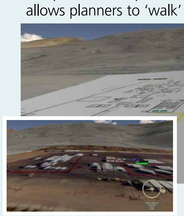
It is essential that the Inspection Team can rapidly create an effective plan prior to reaching the Point of Entry in the Inspected State. Using the baseline datasets and knowledge of inspection equipment and procedures the inspectors can execute their planning more effectively with access to both 2D and 3D maps of the region.



View from outcrop in IA showing terain with satelite imagery overlaid.



Area showing satellite imagery with location of roads according to base data set. Image of proposed layout of Base of Operations (BoO) has been scaled and placed in the planned location. 3D environment allows planners to 'walk' the BoO virtually.



Photograph of actual BoO layout applied to area.

View from ground level of proposed location for BoO.

2. Mission planning and logistics during the OSI

Effective planning for activities such as logistics and field missions requires good understanding of the locality. Good quality 3D maps improve the planning process. Combining base map data with information collected during the inspection and visualising it in 3D allows planning of safe field missions. Being able to plot the live location of field teams using GPSS data streamed from the field team's equipment helps the logistics team track the progress of field team activities. The location of Inspection Team assets, such as SAMS stations and gas sampling rigs as well as the location where samples have been taken also help the team in planning and execution of the Inspection.

Area of interest terrain is recreated using collected data. This allows field missions to be remotely planned, improving safety.

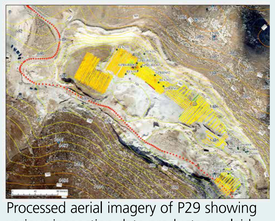
The actual flight lines flown during an overflight and the data-products created can be displayed in 3D making it easier to assess where there are gaps in the data and where else should be overflown.

3. Visualisation of treaty-relevant data

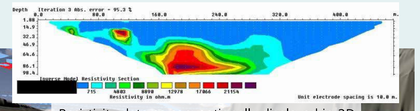
As the inspection progresses treaty relevant data will be accumulated which needs to be displayed in a manner accessible to the whole Inspection Team and not just particular technical specialists. Most of this data will be processed data or data products and not raw data. For example, the location of seismic events are the relevant dataproducts from the SAMS stations the raw traces are not.

Other data-products include:

- Heat maps of radioactivity, gravity surveys, resistivity, etc.
- High resolution imagery collected during overflights
- Elevation models generated from data collected, e.g. from overflights
- Resistivity data, displayed in 3D at the location of the measurements
- Ground penetrating radar data displayed as 3D volumetric data



Processed aerial imagery of P29 showing various inspection data products overlaid.



Resistivity data as conventionally displayed in 2D.

The same data as above reprocessed and shown in 3D.

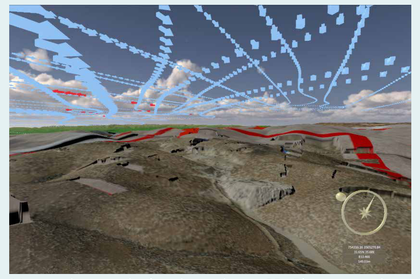
4. Producing briefing materials for stakeholders

A critical task for the Inspection Team is to brief various stakeholders effectively and efficiently on the work of the Inspection Team.

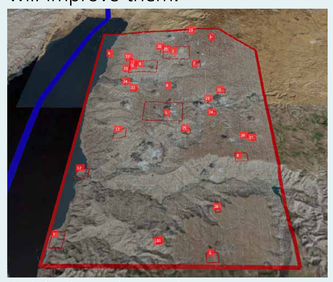
Stakeholders include:

- Inspection Team members
- Inspected State Party representatives
- CTBT Executive Committee
- World press

Being able to prepare briefings for these stakeholders that are both effective and quick to produce is a requirement for any tool to be used to create the briefings. Using 3D maps as part of such briefings will improve them.



Various datasets displayed together in 3D. Blue arrows show flight path during overflight.



High level view showing the inspection area boundary and location of all polygons of interest identified during the inspection.

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