DIGITAL TWINS FROM THE AIR DOWN

In current articles about infrastructure and the built environment, it's difficult to miss the discussion about digital twins.

A digital twin leverages artificial intelligence (AI), the internet of things (IoT), and virtual and augmented reality (AR/VR) in conjunction with digital models of real world assets, systems, or processes. Digital twins can come in many forms and can help to visualize and understand an environment. The value of a digital twin can be beneficial at every phase of an asset's lifecycle. It can provide context for design and permitting, help to manage progress and compliance during construction, and monitor and predict behavior throughout the operations and maintenance phase. The key to a successful digital twin is the ability to accurately represent the current and historic environment in context with other datasets.

As a company inherently interested in allowing customers to see and shape the livable world, Nearmap has worked with a number of customers and partners to build the foundations for digital twin models.

Nearmap captures aerial imagery with proprietary camera systems and develops highly accurate, high-definition, 3D and AI-derived content. Nearmap's automation pipeline transforms high-resolution imagery and spatial data into 3D models for city planning, construction and urban planning. The company is increasingly being asked to help leverage data to build models used in the creation of digital twins. As a company inherently interested in allowing customers to see and shape the livable world, Nearmap has worked with a number of customers and partners to build digital twin models. Nearmap captures aerial imagery with proprietary camera systems and develops highly accurate, high-definition, 3D and AI-derived content. Nearmap's automation pipeline transforms high-resolution imagery and spatial data into 3D models which can seamlessly provide the foundation for a digital twin with timely and accurate data. That data includes high-resolution imagery, 3D mesh, point clouds, digital elevation models, and high value AI-based geospatial features. Perhaps the greatest value is that the data is provided at a massive scale that can accommodate nearly any project and is continuously updated.

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DIGITAL TWINS IN PRACTICE

Before discussing how digital twins are built, it's important to share how practitioners in the infrastructure space use them. Recent Nearmap examples include building digital twin models to:

- Propose, win, conceptualize and plan new infrastructure projects by helping stakeholders visualize existing conditions and even immersing them in the "digital world" and allowing them to experience the projects before moving forward with design and construction.
- Understand and coordinate asset-management projects at airports and campuses including evaluating the impact of construction on existing facilities.
- Enhance design concepts and planning of 5G networks.
- Understand urban mobility opportunities by assessing shared ride, autonomous vehicles and public transit alternatives.
- Review logistics for events and event planning.
- Coordinate construction logistics and planning.

HDR – a top-ranked design firm specializing in engineering, architecture, environmental and construction services – leveraged frequently updated 3D-textured mesh from Nearmap to gain a ready view of the built environment and surrounding infrastructure. At the conceptual planning level, this helped HDR designers understand potential environmental constraints and assets needing monitoring. HDR needed to identify different asset classes within a 45-square-mile linear corridor.

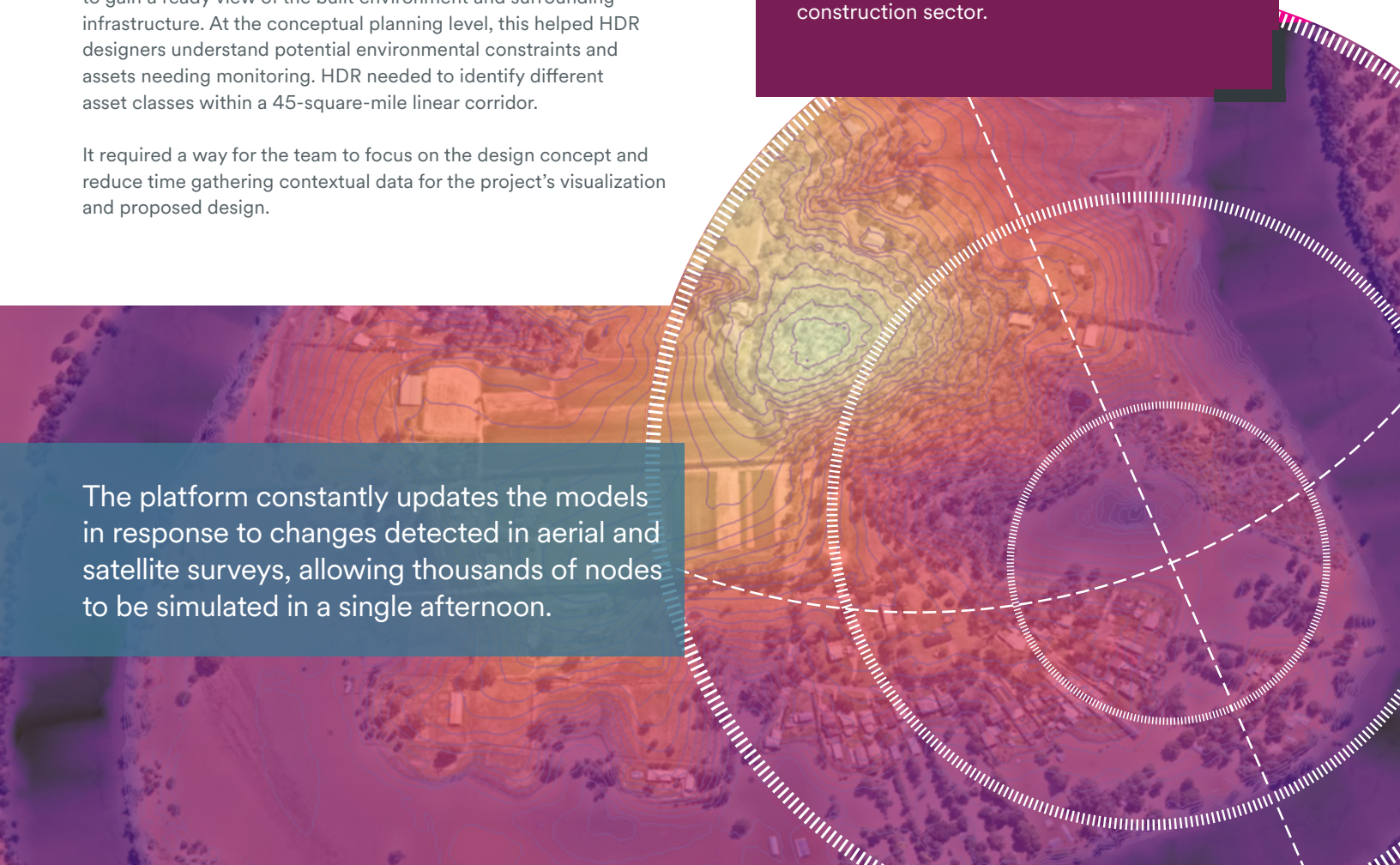
It required a way for the team to focus on the design concept and reduce time gathering contextual data for the project's visualization and proposed design.

WHY IMAGES FROM DRONES AND SATELLITES AREN'T ENOUGH

Aerial data can be sourced via satellites, drones and planes. Each has its uses, but data needed for modeling must be highly precise.

Satellite photos are often free to users, but aren't updated frequently and the level of detail is insufficient for digital twins and Level of Detail 2 (LoD2) models. In contrast, images captured by drones are good for monitoring the progress of a small site. However, in areas where access is restricted such as airports, aerial imagery is typically the best option, as manned aircraft operations can obtain authorization to enter the space when site visits or drone capture cannot. The images have four to five times greater resolution and clariity than satellite images and in some cases are getting close to the resolution of drone imagery.

These factors motivate many engineering firms and urban planners to turn to aerial images taken from planes. These images are provided as a subscription service from aerial imagery companies such as Nearmap, whose services have become widely used by the construction sector.



The platform constantly updates the models in response to changes detected in aerial and satellite surveys, allowing thousands of nodes to be simulated in a single afternoon.

Another major AEC firm used Nearmap to create a 3D airport model. The firm's goal was to help its client walk through the existing site safely and remotely, and see external features such as directional signage and trees, pavement conditions and markings. Nearmap data provided context on the built environment and was used as the basis for external site features. It incorporated building information modeling (BIM) of key facilities, letting the client peel back the roofs and view different floor levels and subsurface utilities.

Digital Twin Sims – a telecommunications business and network modeling advisory firm – partnered with Nearmap to create accurate digital twins of cities to help firms roll out 5G and new IoT services. Nearmap's platform automatically feeds data into the Digital Twin Sims engine to generate models that reflect changes including new construction and even the growth of vegetation that might affect coverage. The platform constantly updates the models in response to changes detected in aerial and satellite surveys. This approach allows Digital Twin Sims to simulate thousands of nodes in a single afternoon. A manual survey would traditionally require several days to plot a single node in a 5G network.

HOW CAN ENGINEERING FIRMS AND INFRASTRUCTURE OWNERS GET STARTED?

As evidenced by these examples, a digital twin of fixed assets or real-world systems can be used to support planning, simulation, designing, managing and maintaining phases of the infrastructure lifecycle. But building a digital twin can require a significant amount of data that may not always be readily available or current. So how does one start?

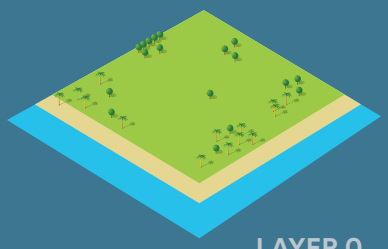
CREATING A MODEL AND A DIGITAL TWIN BEGINS WITH SEVERAL CRITICAL BUILDING BLOCKS OR LAYERS:

- Ground conditions from a digital terrain model.
- 3D building and structure information.
- Infrastructure assets including roads and utilities.

Nearmap's aerial capture and automated processing pipeline transforms high-resolution imagery and spatial data into 3D models and extracts critical assets through AI.

DIGITAL TWIN FOUNDATION

Terrain and basic ground level information



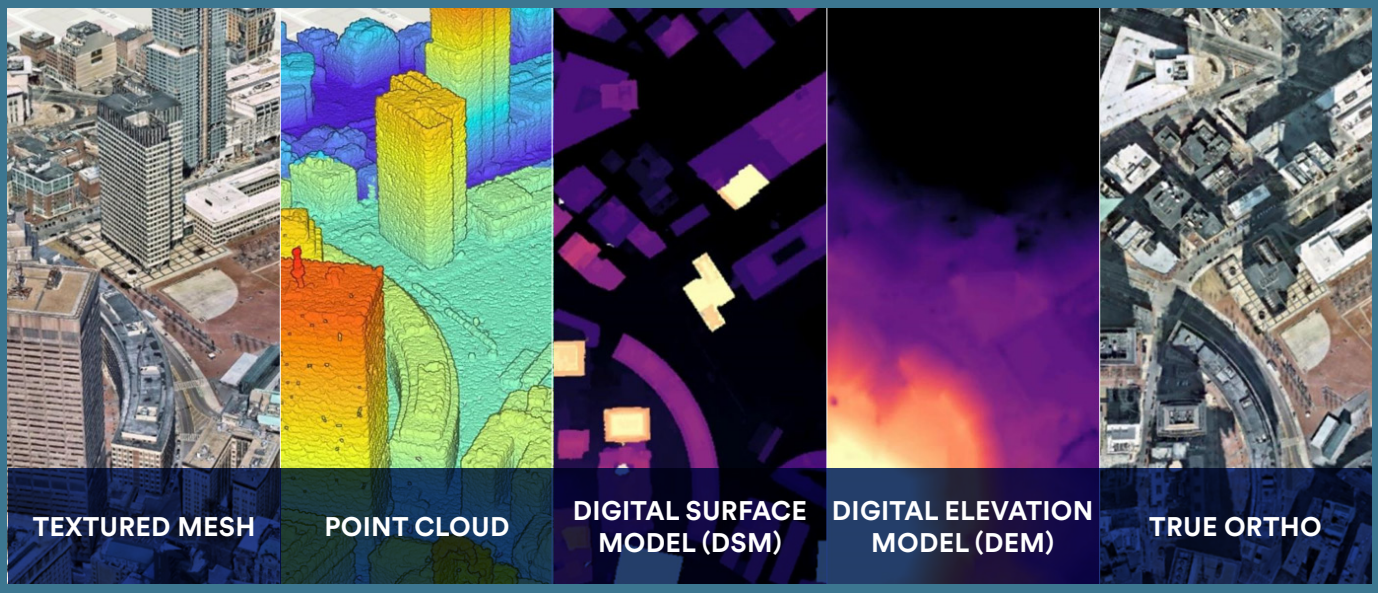
LAYER 0
Terrain

Current buildings and structures in the area of interest

LAYER 1
Buildings

Current infrastructure including transportation and utilities

LAYER 2
Infrastructure



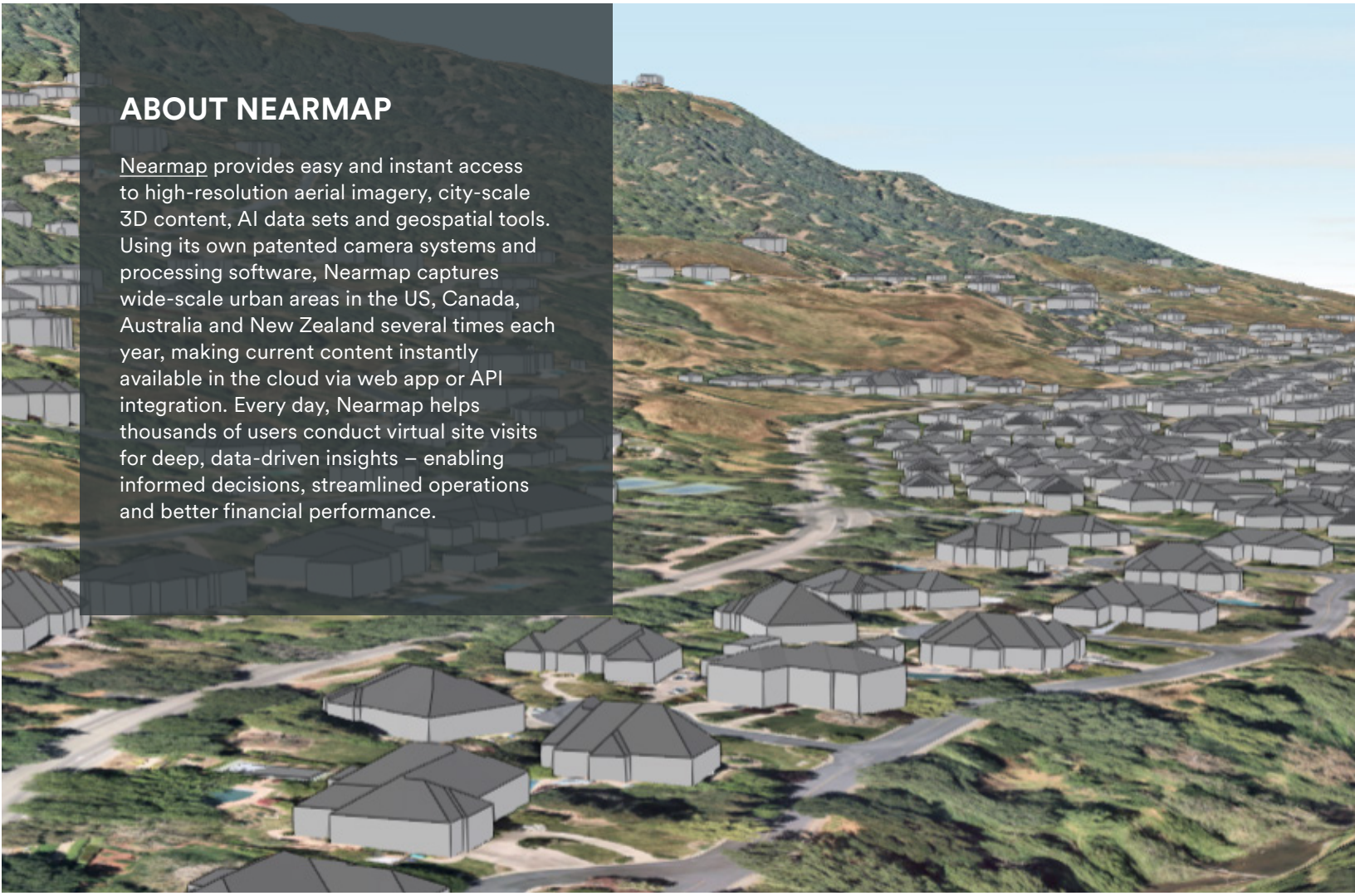
Foundationally, it's important to have a highly accurate digital terrain model of the ground surface, as well as high-value 3D models of vegetation. Nearmap provides both inputs from its automated processing, at scale and on demand. Accurate representations may benefit from a combination of manual surveys, drone imagery and manned aircraft-based surveys.

Once the ground surface is established, buildings and structures need to be "grown" from analysis of vertical and oblique imagery. Nearmap provides inputs to grow the shell of a structure. Engineering firms then can incorporate BIM models where they exist or models can be created to provide additional detail. An alternate approach to "growing" the digital twin model is possible with Nearmap's 3D Mesh, which provides a highly detailed 3D model from Nearmap's aerial captures. With the foundations in place, additional details can be added to incorporate real-time information, conceptual designs of buildings and infrastructure, and interactive analyses for line of sight.

IMPROVING ROI

These details provide digital twin benefits such as improved monitoring, concept testing, risk reduction and return on investment. The latter is especially important when margins are being squeezed and input prices are changing. Material costs are rising, labor shortages continue and supply chain delays remain persistent. All these issues support the increasing value of digital twin models.

Nearmap's at-scale, highly accurate on-demand imagery and 3D and AI content help organizations see their projects before they build them and better understand and anticipate impacts. Project teams can accomplish more with less headcount and increase the efficiency of field staff. More accurate visual data enables firms to see the truth on the ground in the present, past and future. In summary, better data informs smarter and more strategic decision-making at project and firm levels.



ABOUT NEARMAP

Nearmap provides easy and instant access to high-resolution aerial imagery, city-scale 3D content, AI data sets and geospatial tools. Using its own patented camera systems and processing software, Nearmap captures wide-scale urban areas in the US, Canada, Australia and New Zealand several times each year, making current content instantly available in the cloud via web app or API integration. Every day, Nearmap helps thousands of users conduct virtual site visits for deep, data-driven insights – enabling informed decisions, streamlined operations and better financial performance.

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