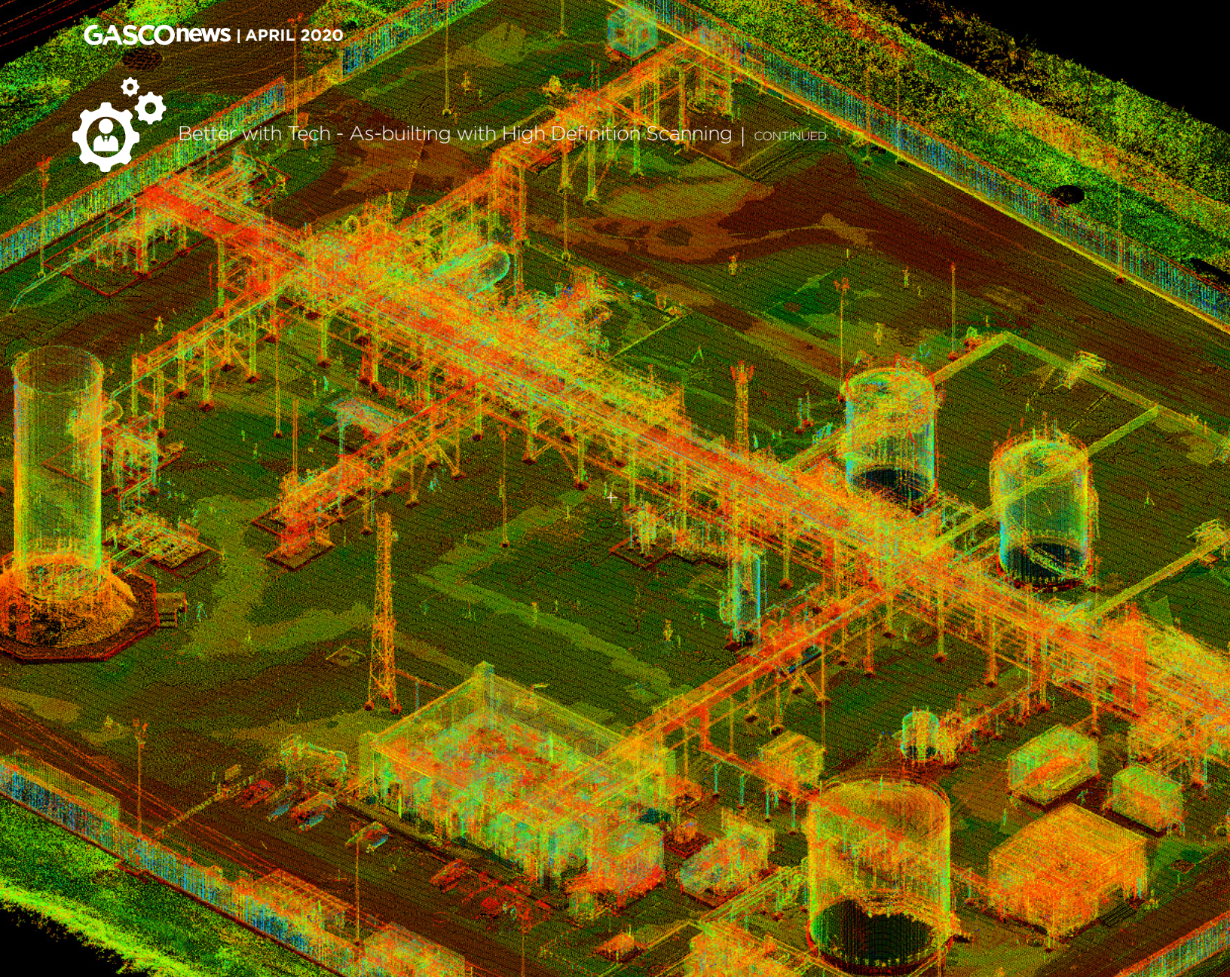
Business in a New Age

BETTER WITH TECH -

As-builting with High-Definition Scanning

Employee Ashley Ramadhar imaging one of NGC's facilities



Cove, Tobago

SO you've bought a new refrigerator for your spouse – a birthday surprise. To avoid suspicious tape-measuring, you've checked your house plan to ensure the recess designed to accommodate this appliance would fit the bigger (very expensive) model you've just purchased. Out with the old and almost in with the new, you've encountered a problem. The brick recess tapers slightly towards the back, denying passage to the refrigerator past a certain point. To make it fit, you may now have to remodel your kitchen. (Surprise!).

THE IMPORTANCE OF AS-BUILT DRAWINGS

Any homeowner or contractor ever led wrong by a blueprint can appreciate the value of as-built drawings. As-built drawings are schematics of completed builds, which capture any deviations from original design plans. In the course of construction, certain specifications such as dimensions, elevations, shapes and materials can depart from what was designed, due to human error (that recess mason) or deliberate responses to site or budget imperatives. For future works, it is useful to have an accurate picture of the final product as it was built.

In complex industrial environments with many structural components, as-built drawings are extremely important. Even marginal variations between blueprint and actual specifications can result in costly or dangerous errors when maintenance, modifications, updates or retrofits are needed. For a company like NGC, which manages and maintains complex gas facilities, accurate as-built imaging of completed assets is crucial to planning, procurement, maintenance and process safety management.

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Accordingly, one of the priority deliverables of NGC's Geospatial Information Services Department (GISD) has been updating the Company's as-built records.

HDS TECHNOLOGY

For domestic projects, determining final specifications can be a fairly straightforward task for a contractor and measuring tape. In industrial settings where builds are far more complex and the stakes of precision much higher, the as-builting process is much more involved and more essential.

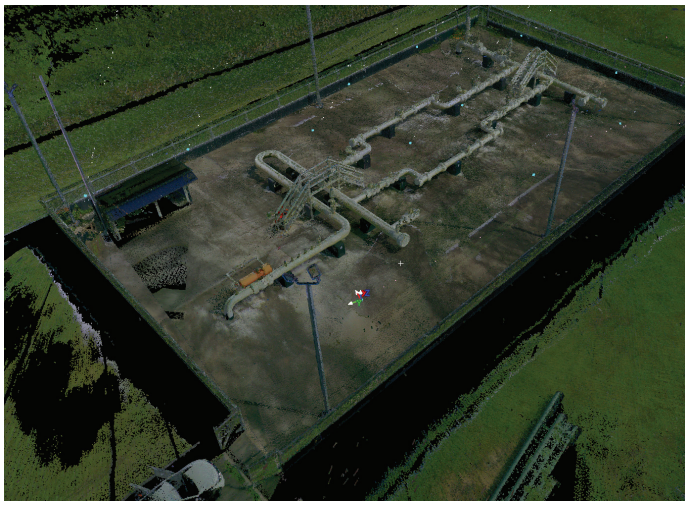
In the past, as-built drawing was a labour and time-intensive undertaking using manual measurement tools such as measuring tape, plumb bobs, spirit levels and piano wire. Measurements would then be used to produce two-dimensional technical drawings. One could well imagine the painstaking effort required to accurately as-built industrial facilities with miles of convoluted pipes, fittings and equipment, each of which needed to be precisely positioned and scaled in the output as-built drawing.

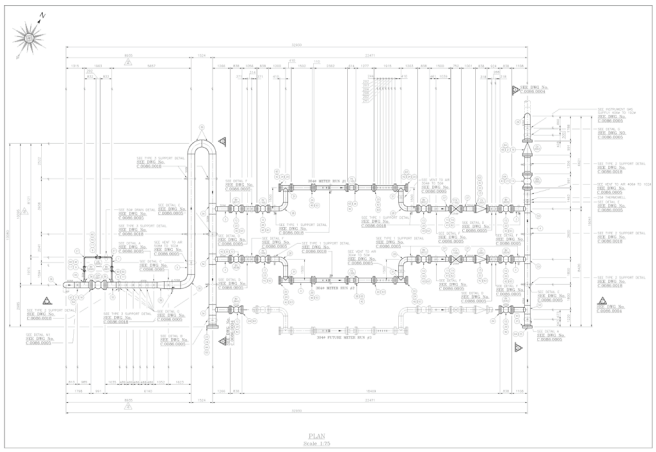
Fortunately, technology has come a long way. Today, industries make use of special laser scanners with a range of information-capture capabilities. These generate photorealistic and intricately detailed 3D point clouds of facilities that provide users with intelligent data.

Starting in 2016, NGC contracted High-Definition Surveying (HDS) services from external suppliers for imaging of four of its facilities. The high cost of outsourcing these services led the Company to explore the possibility of in-house delivery. In 2019, the Company acquired its own HDS equipment, and earlier this year, funded associated training for eight members of the GISD. Since then, within a short window, two employees – Jesse Rajoo and Ashley Ramadhar – have completed scans of two additional facilities, saving the Company hundreds of thousands in contractor costs. In line with GISD's theme for its 2020-2022 strategy (improving data reliability), the team is now preparing to take on as-builting on a larger scale for NGC and other Group subsidiaries. In the future, it could even extend its services to other companies in the sector.

HOW IT WORKS

Only slightly bigger than an oversized coffee mug, and lighter than your laptop, NGC's HDS laser scanner is nevertheless a powerful tool. The scanner has a rotating component that swings about its vertical axis and sweeps a laser beam over the area to be scanned. When the beam encounters a surface, it is reflected back to the scanner which records the surface's co-ordinates relative to its (the scanner's) own position. The entire scanner itself also rotates about a horizontal axis so that the laser beam is swept across 360 degrees in both planes. The resulting dataset provides co-ordinates for every point on every object encountered within the complete sphere traced by the scanner's moving beam. The scanner can be moved to different vantage points to ensure all areas of the facility are captured. Special software is then used to stitch the millions of individual co-ordinates or spatial measurements together to generate a 3D point cloud picture of the scanned area, from which dimensional, locational and other categories of data can be extracted.





Beachfield Interconnect: 3D scan (above) vs 2D drawing (below)

BENEFITS OF LASER SCANNING

HDS technology has enabled significant process improvements which have pushed NGC to invest in the requisite resources.

Logistics and safety

The most obvious advantages are logistical. A laser scanner can perform the task of imaging a space with

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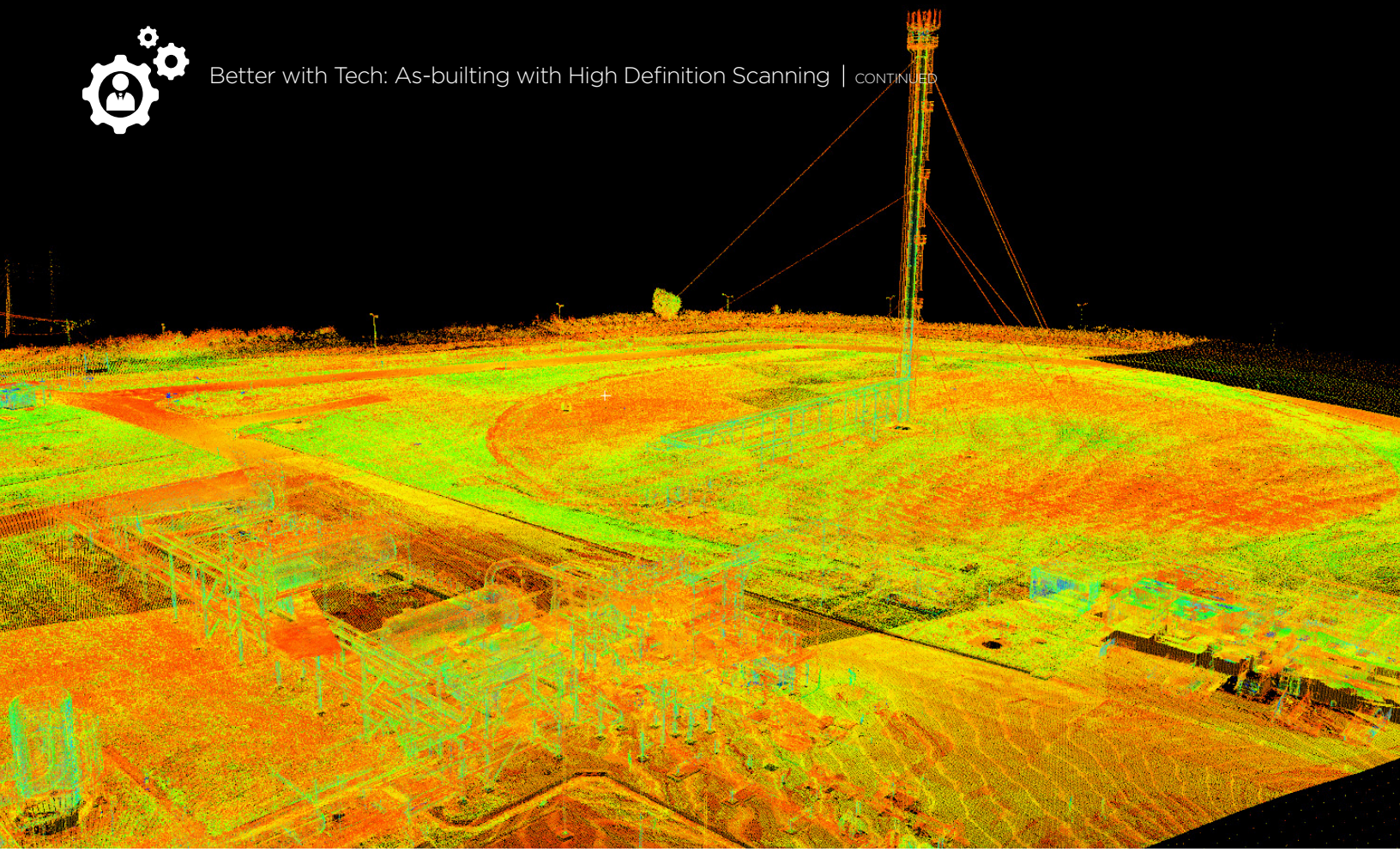

Phoenix Park Valve Station

far greater speed and precision than humans and manual measures could. A facility that might ordinarily have taken a technician or team weeks to render as line drawings can be scanned and imaged in days. Time shaved means money saved, so HDS costs can be amortised quickly.

Reducing the man-hours required to capture field data for as-built drawings also has positive implications from a health and safety perspective. Many industrial plants, including NGC's facilities, are high-risk environments with areas of restricted access. Some mechanical parts may be dangerous to approach or may be impossible to access for manual measurements. With laser scanners, surveys are no longer tactile undertakings and can be executed in short time frames, facts which both significantly reduce human exposure to environmental hazards and risks.

Data quality

Then there is the fact that laser scans produce superior as-built drawings compared to traditional survey methods. Depending on the instruments used and the experience (and eyesight) of the technicians involved, manual measurement processes can have wide margins of error. Though not infallible, laser scans offer greater precision. Moreover, since they produce 3D point cloud data, laser scans capture environmental features such as trees and surrounding topography that traditional surveys may not. In this way, the scans are more holistic representations of facilities than line drawings.

Applications

For end-users, the real benefits of HDS technology lie in the intelligent interface of the point cloud images that it is used to generate. Traditional 2D schematics are static and can carry limited data. Conversely, special software allows massive quantities of data to be overlaid on 3D scans, such as equipment specifications and maintenance records. With a click, a user could learn the model number of a specific component in a system, its cost and even where it was last purchased – as long as this information has been input by the technician. Because data is digitally archived, it can be hidden from view until needed, leaving the images uncluttered but still rich in information.

When paired with other software and technology, laser scan data sets can be even more useful. CAD designs of new infrastructure or equipment could be fitted into scans to see how they would work in a real-world setting. Since point cloud data is navigable, an engineer would be able to assess clearances from all angles to determine whether the new equipment or build would conflict with surrounding structures. This can eliminate the need for site visits and allow contractors to purchase with confidence.

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In NGC's experience with laser scans, the fact that they allow for remote planning of site works has been particularly beneficial. NGC's Beachfield facility at Guayaguayare is far removed from the Company's base operations in Point Lisas. Planning for a recent construction project at the facility would ordinarily have required teams to commute long hours over multiple days to assess the site, but having updated 3D as-builts allowed for the bulk of preparation to occur in office.

An even timelier example of their value – restrictions imposed by the government in response to the pandemic COVID-19, have forced employees across many functions to telecommute since March 18th 2020. This development could have been disruptive for ongoing project planning. However, since Point cloud data sets serve as reasonable proxies for site access, work can progress in spite of restrictions.

It is noteworthy here that point clouds are not only useful for brownfield projects but can also be deployed to gather site data ahead of new builds. In instances where modules for projects are prefabricated, having a precise picture of the build site allows for remote design and procurement, with positive implications for project cost and delivery time.

NGC could also make use of another feature of the HDS technology. Scanners can not only capture spatial and geometrical characteristics of a site – they can further be used for thermal imaging. For maintenance purposes, scans could be taken of a facility to determine whether components are overheating or if energy is being used efficiently. A recent energy audit conducted at NGC's Head Office revealed inconsistent cooling across the facility. This meant the cooling system had to work harder and consume more energy. To treat with the issue, thermal scans can help pinpoint bottlenecks in the ventilation network that prevent cool air from reaching certain areas.

IN WITH THE NEW

While HDS may look like the future, technology is constantly pushing the limits of what's possible. Companies are already merging HDS and LiDAR technology to yield even more accurate and holistic imaging. Besides as-builting applications, HDS can be combined with extended reality functionality to produce virtual tours for industry, commerce, real estate and even tourism. NGC's GISD will, therefore, continue to explore innovative ways to integrate this and other technology into operations as seamlessly as possible. Out with the old and in with the new – the GISD is making it fit.

HDS of NGC's Warehouse Complex