The National Geospatial Information Museum in Cape Town: From Chains and Theodolites to 3D Scanning

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SUMMARY

This paper examines the historical development of surveying and mapping in South Africa through the lens of the National Geospatial Information (NGI) Museum in Mowbray, Cape Town. It traces surveying from early colonial practices (e.g. using chains and simple theodolites) to demarcate land and impose European property systems, to the establishment of the national surveying and mapping institutions such as the Trigonometrical Survey Office, now the Chief Directorate: National Geospatial Information (CD:NGI). While often framed as technical progress, the paper emphasises that surveying and mapping functioned as instruments of colonial governance, facilitating land dispossession, and the bureaucratic control of Indigenous territories.

The paper documents key technological shifts, including triangulation networks, aerial photography, electronic distance measurement, satellite positioning (GNSS), and contemporary digital mapping. The NGI Museum preserves this material heritage through an impressive collection of historic instruments, archives and maps.

A central focus is a 2025 collaboration between NGI and Global Digital Heritage Afrika (GDHA) to digitally document selected museum objects using 3D scanning and photogrammetry. The resulting models are archived and publicly accessible online, expanding access and pedagogical potential. However, the authors caution that digitisation is not inherently emancipatory: without critical framing, digital heritage risks reproducing technocentric narratives. When embedded within interpretive contexts that foreground histories of dispossession and power, 3D models can support critical engagement with the spatial politics of surveying and land governance in South Africa.

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Introduction

This paper provides a brief history of surveying in South Africa and the institutional development of the state directorate responsible for surveys and mapping, with a particular focus on the National Geospatial Information (NGI) Museum in Cape Town. It situates surveying not only as a technical practice, but as a foundational mechanism through which land was measured, governed, and rendered legible to colonial and later state authorities, with lasting implications for dispossession and the marginalisation of Indigenous people. The paper further highlights a recent collaboration between NGI and Global Digital Heritage Afrika (GDHA) to digitally document selected museum objects through 3D scanning and photogrammetry and considers the value of digital heritage approaches for access, preservation, and interpretation.

A Brief History of the Surveying of Southern Africa

The National GeoSpatial Information (NGI) Museum in Mowbray is closely tied to the historical development of surveying, mapping, and geospatial governance in South Africa. Its origins lie in the long institutional history of the state's mapping and surveying functions, which began under colonial administrations at the Cape and Natal and were progressively formalised as surveying became central to land administration, infrastructure development, and territorial governance. These processes were not neutral or purely technical: colonial surveying and mapping practices played a foundational role in the dispossession of Indigenous Khoi and San communities, the imposition of European concepts of fixed property boundaries, and the transformation of land into a commodified and governable resource.

When the early Dutch settlers arrived at the Cape of Good Hope in 1652, portions of land were allocated to farmers primarily along the banks of the Liesbeek River, an area already embedded within Indigenous Khoi systems of seasonal movement and land use. Pieter Potter, a midshipman from Amsterdam appointed by the Dutch East India Company, was the first sworn land surveyor at the Cape in the 1650s, responsible for surveying the earliest freehold farms and producing some of the first cadastral plans that laid the foundations for formal land tenure and boundary systems in what would become South Africa (Whittal & Jones, 2010). Simple methods of survey and instruments such as simple theodolites and chains were used to mark out the farms and register the erven with the governing authorities. These surveys did not merely record space; they actively produced a new spatial order grounded in European legal and cadastral concepts, facilitating dispossession and the displacement of Indigenous communities from land that had previously been governed through relational and customary systems of tenure (Motala, 2022).

It was in 1751 when L'Abbe de LaCaille arrived at the Cape to conduct certain astronomical work including the measurement of an arc of meridian that geodetic measurements commenced in South Africa. A number of arcs had been measured in the Northern hemisphere including one on the equator in Peru. It was felt that the measurement of an arc of meridian in the Southern Hemisphere would clarify the question whether or not the Earth was equally elliptical in the two hemispheres. The arc that LaCaille measured between Cape Town and Aurora, approximately 133 km North of Cape Town, gave a somewhat perplexing result and it was only when Sir Thomas Maclear verified the measurement between 1840 and 1841 and, after allowing for gravitational attraction of nearby mountains, verified that the shape of the Earth in Northern and Southern hemispheres was found to be more or less equal. Maclear extended the triangulation from Aurora to Kamieskroon approximately 430 km north of Cape Town and thus laid the foundation for the geodetic survey of South Africa. He also extended the triangulation from Cape Town eastwards along the coast to Cape Agulhas, a distance of approximately 175 km.

When Sir David Gill became the Astronomer Royal at the Cape in 1879, one of tasks he set himself was to guide the geodetic survey of South Africa. To do this he planned the geodetic chains of triangulation of the country and extended the triangulation eastwards from Cape Agulhas to the Eastern Cape and onwards into what is today known as KwaZulu-Natal. Much of the field work was carried out under the leadership of Lieutenant Colonel Morris of the Royal Engineers. Initially an 18-inch Troughton and Simms theodolite was used for the survey but, because of its size and mass (approximately 472 kg), smaller and equally accurate 10-inch Repsold theodolites (260 kg including stand) were used extensively by Morris and his team for the greater portion of the triangulation (Gill, 1896). These projects were not simply scientific achievements; they underpinned the production of authoritative maps that enabled colonial expansion, military logistics, infrastructure development, and the formalisation of land ownership across increasingly large and contested territories.

The institutionalisation of these practices continued into the late nineteenth and early twentieth centuries through figures such as JJ Bosman or, more formally, Johannes Jacobus Bosman. As Wonnacott (2010: 25) notes, "prior to his appointment in 1892 as "Examiner of Diagrams" in the Office of the Surveyor General in Cape Town, Bosman set out and observed a triangulation scheme extending from Vryburg to the 20th meridian in what was then a part of Bechuanaland (now Botswana). He was appointed as the Geodetic Officer by the Surveyor General in 1903 with the task of undertaking a secondary triangulation of the Cape Colony. The result of this work is the well known Bosman co-ordinate system which still crops up from time to time even today and which was linked to Gill's geodetic triangulation. A similar secondary triangulation was undertaken in Natal under the direction of August Hammar. Bosman retired as the Director of Secondary Triangulation in 1919 and WC van der Sterr was appointed to take over from him."

While often celebrated for their technical rigour and longevity, these secondary triangulation systems must also be read as infrastructures of colonial governance. By enabling uniform cadastral surveys, diagram examination, and the registration of land parcels, they facilitated the consolidation of settler land ownership and the bureaucratic management of dispossession, processes that would later be intensified under segregationist and apartheid land policies. As Motala (2022) emphasises, the legacies of these geodetic and cadastral frameworks continue to shape contemporary land administration and geospatial practice in South Africa, including the institutional histories represented within the NGI Museum.

The Chief Directorate: National Geospatial Information

The institution now known as the Chief Directorate: National Geospatial Information (CD:NGI) can be traced back to the establishment of the Trigonometrical Survey Office (TSO) in 1920, which operated under the leadership of W.C. van der Sterr. During his tenure as Director of Secondary Triangulation, van der Sterr produced a series of influential policy reports that shaped the future organisation of surveying in South Africa. Two of these were particularly consequential:

1. The reorganisation of the survey department of the mandated territory of South West Africa (now Namibia). South West Africa became a mandated territory of South Africa after World War 1 (1914-1918); and
2. That all surveys must be based on the main triangulation and the establishment of a survey organisation for the Union of South Africa for the economic development of the country.

These reports directly informed the formal establishment of the Trigonometrical Survey Office, initially housed in Parliament Street, Cape Town, before its relocation to Mowbray in 1929. From this point onward, Mowbray became the enduring institutional home of the TSO and its successor organisations.

In 1921 a commission, of which van der Sterr was a member, was set up by the Governor-General of South Africa to enquire into matters concerning land surveys and at the end of their deliberations submitted thirty recommendations which have had a significant impact on the South African survey industry. A few of these recommendations were:

- The primary, secondary and tertiary triangulation of the country must be complete;
- The topographical survey of the country must be started;
- A central authority to control the trigonometrical and topographical surveys must be established;
- A director general of surveys must be appointed;
- Wherever possible all cadastral surveys must be based on the main triangulation;
- A survey regulations board must be established; and
- A land survey act must be passed to control cadastral surveys and embody the recommendations of the commission (Wonnacott 2010: 26).

In contrast to the Geodetic Division of the Trigonometrical Survey Office, which had a well-defined lineage rooted in the astronomical and triangulation work of Thomas Maclear and David Gill at the Royal Observatory, as well as in the secondary triangulation offices of the

Surveyors-General of the Cape and Natal, the origins of a formal topographic function within the TSO were less clearly established. Apart from influences drawn from military mapping activities, there was no direct institutional predecessor for a Topographic Division. Nevertheless, in 1929 van der Sterr initiated the formation of a dedicated Topographic Division, co-located with the Geodetic Division at Mowbray.

Early experimentation with aerial photography formed part of this emerging topographic capability. The CD:NGI archives contain aerial photographs dating back to 1926, covering areas of the Cape Peninsula and Saldanha Bay. These early efforts built on much earlier conceptual advances, notably the work of Dr H.G. Fourcade, who had demonstrated the principles of stereoscopic photography in 1901 through paired photographs of Table Mountain. Despite this, the 1926 aerial surveys were regarded as experimental, and no immediate move was made towards the systematic use of aerial photography for national mapping. As a result, topographical surveys continued to rely primarily on plane-table methods, which were time-consuming and labour-intensive. It was only in 1937 that a coordinated aerial mapping programme was formally introduced, and several decades later, in 1976, that comprehensive aerial photographic coverage of the country was finally achieved (Wonnacott, 2010).

From the time that the TSO was established, and even before then, all angular measurements would have been carried using open circle theodolites ranging in size from the relatively small 8-inch theodolites up to the 18-inch and 24-inch theodolites used when the geodetic triangulation was done under the direction of Gill. The 18-inch and 24-inch theodolites were, however, soon phased out because of their size and mass, and the 10-inch theodolites manufactured by Repsold were favoured for the geodetic triangulation. These open circle theodolites were used until about the mid-1920's when Heinrich Wild of Switzerland introduced the somewhat revolutionary closed circle Wild T2 and T3 theodolites. The circles were made of glass and with engraved graduations were exceptionally robust and compact with the T2 having an approximately 3½ inches (90 mm) circle while the T3 had a circle of approximately 5½ inches (140 mm) diameter. The T3 theodolite was capable of reading to 0,2 seconds of arc. The T2 and T3 became the standard by which all theodolite manufacturers made theodolites and were used by many national mapping and geodetic agencies. The T2 theodolite was used by many surveyors and engineers as their everyday instrument for geodetic, topographic, engineering and general survey work.

All triangulation had to be scaled by establishing a number of baselines throughout the country measured by means of sets of base bars each of about 3m long, or invar wires. The last baseline to be measured using invar wires by a South African team was in Otjovasandu in the early1950's. In 1957, Dr Trevor Wadley of the Council for Scientific and Industrial Research (CSIR) in close co-operation with TSO, produced an electronic distance measuring (EDM) device based on microwave technology capable of measuring distances of up 100 km. Initially, the Tellurometer, as it was known, was provided as a pair of two separate instruments namely a Master and a Remote. The instrument was further developed and embodied both function in one instrument and became known as the Tellurometer MRA. Further development by CSIR and a number of international companies produced electrooptical instruments capable of achieving accuracies of ±1,5mm over 1000m which was suitable for high precision engineering surveys. (Smith et al 2008)

1957 was perhaps the most significant year for modern surveyors and geodesists as this was year in which the first artificial Earth orbiting satellite was launched by the Russians introducing the world to the so-called "space race". However, the Chief Directorate: Surveys and Land Information, as the TSO had become known, only took up the new technology in the mid-1980's, when five US Navy Navigation Satellite Systems Doppler receivers were purchased to be used to identify scale errors and distortion within the geodetic network. Shortly after the purchase of these receivers, the receivers were replaced by Global Navigation Satellite System (GNSS) receivers early in the 1990's. It was now possible to conduct surveys at almost any time of the day. Accuracies were excellent and positions could be determined to better than 1cm over hundreds of kilometres. Depending on the technique used, the system could also be used to determine positions in real time with accuracies of better than 5 cm being achieved regularly. In 1999 a new form of reference network was established by CD:NGI when a network of more than 60 permanent GNSS base stations was established that covered the entire country and provided a continuous reference service for users wishing to determine positions based on a highly accurate co-ordinate reference frame. This network has become known as Trignet.

Apart from the computerisation of mapping processes, aerial mapping was not immune to developments in electronics and, as a result, a new era of digital aerial cameras has become the norm for mapping. There is no longer a need for traditional films and all data is held on removable storge devices on the camera. The traditional film has been replaced by CCD (Charge-Coupled Device) sensors, either as linear arrays (pushbroom) or as area arrays, to capture light. The current resolution of the imagery used by CD:NGI is 25cm.

The CD:NGI Museum

Alongside its operational responsibilities in geodetic and topographical surveying, the Chief Directorate: National Geospatial Information gradually became the custodian of a substantial material record of South Africa's surveying and mapping history. Over time, instruments, archival materials, maps, and photographs that were no longer in routine use were retained rather than discarded, reflecting an emerging recognition of their historical and educational value. This process ultimately led to the formal establishment of the CD:NGI Museum at Mowbray, housed within the long-standing institutional home of the Trigonometrical Survey Office. The museum was conceived as a means of preserving and interpreting the technical heritage of surveying and mapping in South Africa, with a particular focus on instruments and practices spanning from the early colonial period through to the twentieth century.

The Museum holds a remarkable collection of surveying and mapping instruments from the mid-1600's to the present which traces over three centuries of surveying and mapping in South Africa. The period represented by the museum's artifacts mirrors the trajectory of both technological progress and the complex histories of colonial expansion and scientific advancement. Today, the Museum provides an important context for understanding the evolution of geospatial practice in the country, linking the development of national surveying institutions to the physical artefacts that supported their work, and serving as a bridge between historical surveying methods and contemporary digital and three-dimensional recording technologies.

Scanning of selected pieces

In 2025, the CD:NGI Museum embarked on a programme to digitally document some of its collection using advanced three-dimensional scanning technologies. Working in collaboration with Global Digital Heritage Afrika (GDHA), the museum has captured high-resolution 3D models of a selection of surveying instruments and historical objects. This initiative serves multiple purposes: it enhances preservation by producing detailed digital reconstructions; it broadens access by making objects available to a global audience; and it supports new forms of scholarly engagement by enabling interactions with artefacts. The resulting 3D models are publicly accessible through an online collection hosted at Sketchfab, where visitors can explore them directly and download them. A curated set of these models can be found at: https://skfb.ly/py8Mz.

The three-dimensional documentation of some pieces were carried out using a structured-light scanning device, the Artec Leo. Other museum pieces were photographed with a Canon R5 camera and modelled by photogrammetry. The Artec Leo (Figure 1) is a wireless, handheld structured-light 3D scanner with an integrated display and onboard processing, enabling real-time capture and immediate visual feedback without the need for a tethered computer. It is well suited to the rapid acquisition of high-resolution geometric data for medium- to large-scale objects with complex surface detail, particularly in situations where portability and limited setup time are important. The system performs best on matte, opaque surfaces and mechanically defined forms, but is less effective on transparent or highly reflective materials such as glass and polished metal (common materials contained in the CD:NGI collection), which may require surface treatment or complementary capture methods. For pieces that contained small text or detailed pictures, photogrammetry was used to model the objects. While the Leo enables efficient data capture, its use involves higher equipment cost than image-based photogrammetry and offers limited colour fidelity compared to dedicated photographic workflows, making it most appropriate where geometric accuracy and speed of acquisition are prioritised over photorealistic texture.

Figure 1. Artec Leo (Artec 3D, 2026)

Throughout the scanning process, particular care was taken not to disturb the instruments, which are fragile, have moving parts, and historically significant. The Leo also has a ‘capture distance range’ within which it has to remain while in operation, in order to keep its internal tracking working properly. If the instrument does not stay within that distance range to the object, it will lose its location with respect the object being scanned, and the procedure must be restarted, wasting time and resources.

To illustrate the process of 3D model creation, we describe the scanning of the Wild T4 Astronomical Theodolite. The 3D model can be viewed at https://skfb.ly/pyArM .

Scanning the Wild T4 Astronomical Theodolite

During the scanning of the historic Wild T4 using the Artec Leo, several practical issues were encountered that were related to the instrument’s materials, geometry, and mounting. The Wild T4 incorporates a combination of dark painted surfaces, polished metal components, engraved scales, and glass optical elements, each of which responded differently to structured-light scanning.

In practice, reflective metal parts and transparent glass elements did not reconstruct consistently; in particular, one of the glass bubbles (Figure 2) did not model correctly and appeared incomplete in the final model. Capturing fine mechanical detail required close-range scanning and careful control of coverage to resolve small features such as graduations, adjustment screws, and thin edges.

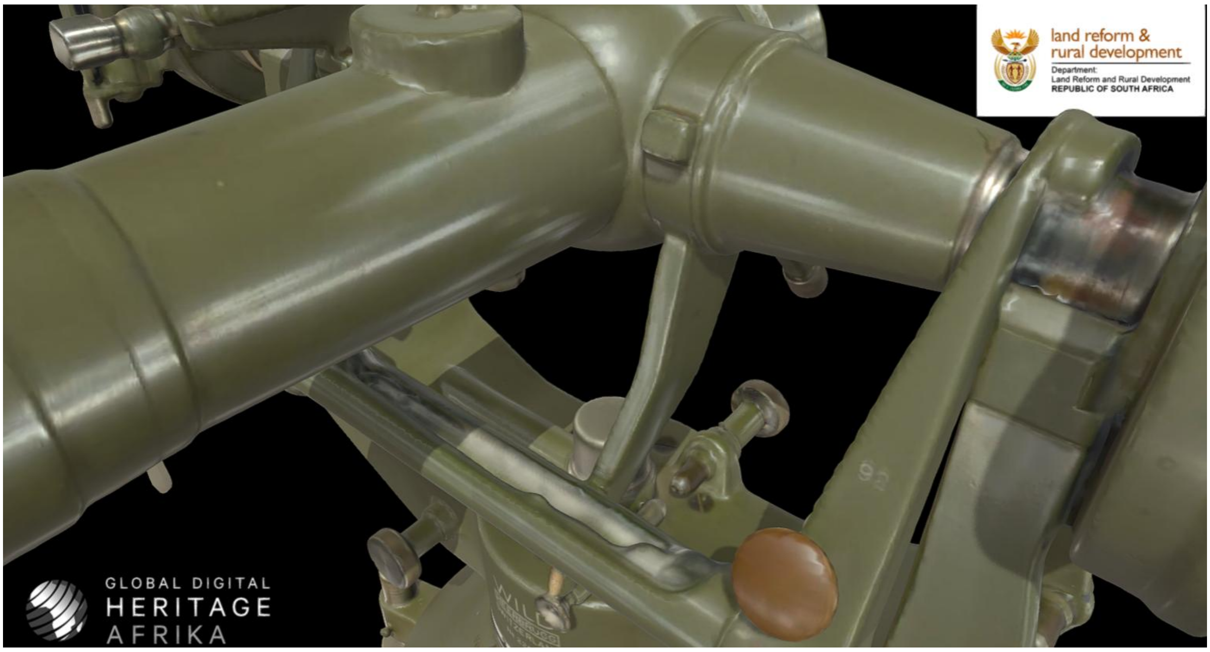

Figure 2. 3D model of T4 Theodolite, showing incompletely modelled glass bubble

Occlusion was a limiting factor in areas beneath the telescope and around mounting interfaces. Although disassembling the instrument into its constituent parts could have improved access and reduced occlusion, this approach was deliberately avoided to minimise handling of the object and to limit additional post-processing complexity. Disassembly would have required digital reassembly of components, increasing processing time and alignment effort. These factors informed the chosen scanning strategy and reflected a balance between data completeness, object safety, and processing efficiency.

Data Processing

Processing of the Artec Leo scan data proved to be straightforward, with alignment, fusion, and mesh generation carried out efficiently using the Artec Studio software. The integrated capture workflow and automated processing tools allowed usable results to be produced with minimal manual intervention, supporting a smooth transition from data acquisition to final model output. Blender software was also used to achieve some refinement on the textures.

It is also noteworthy that newer versions of the Artec Leo data processing software support the integration of photogrammetric images to supplement the texturing process, enabling the generation of higher-quality textures than those produced by structured-light colour capture alone. This hybrid approach has the potential to combine accurate scanned geometry with improved surface appearance, and further testing is currently underway to evaluate its effectiveness within the context of this project.

3D Modelling using Photogrammetry

A photogrammetric approach was also utilised, using a Canon R5, as part of the documentation process; however, except for one object (The "Millionaire" Calculating Machine - see https://skfb.ly/pEIGn) it did not produce satisfactory results within the constraints of this project. Limitations related to access, lighting, and the material properties of the instruments affected the quality and completeness of the reconstructed models. As a result, photogrammetry was not adopted as the primary capture method for this work.

Selected Interesting Museum Pieces

Some of the interesting pieces housed in the museum and that were scanned are briefly discussed below. At the time of writing, two of these pieces (the 10-inch Repsold Theodolite and the Wild T3 Theodolite) were scanned by GDHA and are available on the Sketchfab collection.

1. Gunter’s Chain

   The Gunter’s Chain is a device that was first introduced in 1620 and was used to survey not only the British Empire, but also the wilderness and early American settlements. The Gunter’s Chain measures 66 feet in length and consists of 100 links, usually marked off into groups of ten by brass rings or tags. Though this device has become obsolete, it’s use has left an imprint on our nation’s history and how property has been measured and divided. The chain, the link, and the rod all became statutory units of measurement, made convenient by the standardisation introduced through the Gunter's Chain (Era Consultants, 2026).

Figure 3. Gunter's Chain

2. Simple Theodolite

   Some research on the possible origin and significance of the instrument was undertaken by Mr Hurly, a prominent land surveyor in Cape Town. His research included input from the Curator of Environmental Sciences at the National Science Museum in London. Based on the information gleaned from this and other sources, it would appear that the instrument is of late seventeenth-century Dutch design. Unfortunately, there are no manufacturers' marks or dates on the instrument to verify this. The first known surveyor at the Cape was Pieter Potter, and it is highly likely that he and other early Cape surveyors could have used this or similar instruments. Neither Mr Hurly nor the authors were aware of a similar instrument in the Cape or elsewhere in South Africa.

   The previous owner of the instrument was a Mrs. Stott. Based on her information, Dr. Hubertus Adriaan Moorees Bosman (her late husband's stepfather) owned the instrument before her and further research into the Bosman family was carried out particularly on the unusual name "Moorees". From this research it transpired that Dr. Bosman's father, Johannes Jacobus Bosman, was a land surveyor who retired as Director of Secondary Triangulation in 1919. JJ Bosman, as he was generally known, was the founder of the Bosman co-ordinate system which was used extensively in the Western, Eastern and Northern Cape at the time. There are still many farms today that are based on this co-ordinate system. The Office of Secondary Triangulation became known as the Trigonometrical Survey Office in 1920 under the Directorship of Dr. WC van der Sterr and, after a number of subsequent name changes, is known today as the Chief Directorate of Surveys and Mapping (Wonnacott. 2002).

Taken together, the provenance of this instrument links early colonial surveying practices with the later consolidation of state geodetic infrastructure, illustrating how technical lineages helped stabilise enduring regimes of measurement and administrative control.

Figure 4. Simple Theodolite

3. The 36-inch Great Theodolite

This instrument is one eight great theodolites ever built and was constructed by Troughton and Simms over a period of 10 years. It was completed in 1867. The first of the Great Theodolites was used to determine the relative positions of the Paris observatory and Greenwich by triangulation between the observatories across the Channel. The instrument maker Jesse Ramsden was commissioned to build a second instrument which together with first instrument was used extensively for the geodetic survey of Great Britain during the first fifty years of the nineteenth century.

The instrument on display in the museum was built by Troughton and Simms between 1857 and 1867. It was sent to India in 1874 and was used during observations of the Transit of Venus. It remained in storage until 1882, after which it was permanently lent to the Royal Observatory in Cape Town, where Sir David Gill was Astronomer Royal.

The instrument was used for astronomical work between 1885 and 1887 and was not used for any geodetic measurements.

This Great Theodolite was the last of the eight to be built, of which only three remain in museums. The first instrument was destroyed when the headquarters of the Ordnance Survey was bombed in 1940. The scraps of one of the instruments were later found at a metal merchant in Berne, Switzerland. Two instruments destined for the survey of Sicily were never completed, and one instrument was badly damaged in an accident in India.

Of the three remaining instruments, one is on display at the Survey of India in Dehra Dun, one at the Science Museum in London, and the third in Cape Town. The latter instrument was donated by the Royal Observatory to the Chief Directorate: National Geospatial Information in 1947, alongside numerous other instruments, documents, and reports (Insley 2008). The presence of this instrument in the NGI collection situates South African surveying within a wider imperial and scientific network of precision measurement.

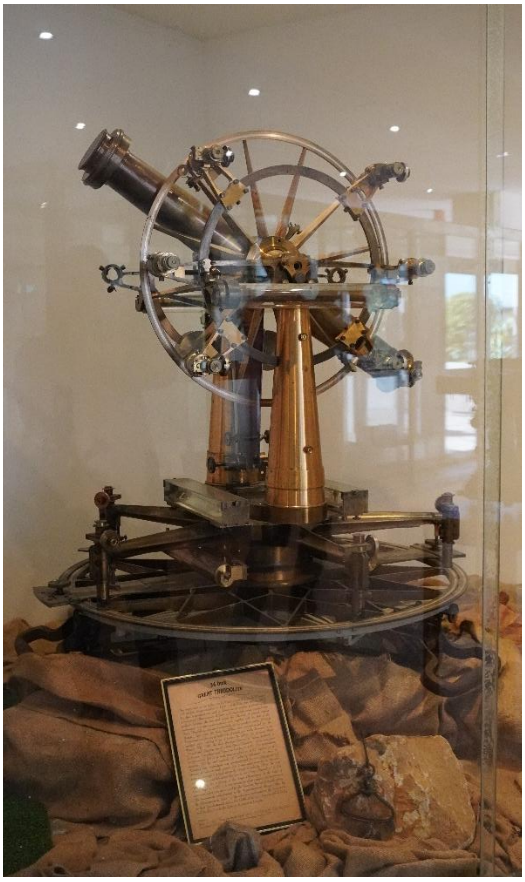

Figure 5. The 36-inch Great Theodolite

4. 10-inch Repsold Theodolite

In his 1896 report on the Geodetic Survey of South Africa, Sir David Gill noted that when the survey reached King William's Town, where labour was more expensive than in Natal and Griqualand East and mountain ascents were more difficult, the weight of the 18-inch theodolite became a serious drawback. It affected not only the economy of the survey but also its rate of progress, as transporting the heavy cases by hand to elevated and inaccessible sites posed logistical challenges and increased risk. Gill recorded that the instrument and its stand were packed into five boxes with a combined weight of approximately 1,042 lbs (472 kg). He therefore approached Messrs Repsold of Hamburg to procure an instrument that would be easier to transport, while still providing sufficient accuracy in angular measurement and adequate optical power for astronomical observations (Gill 1896). The result after some correspondence and discussion with Repsold regarding the design, was the 10-inch theodolite which was used extensively in the geodetic survey and later in the measurement of the 30th Arc of Meridian. The 3D model of the 10-inch Theodolite can be viewed here: https://skfb.ly/py8Px . The Sketchfab model of the 10-inch Repsold Theodolite includes interactive annotations that identify key components of the instrument and explain their functions when viewed in 3D.

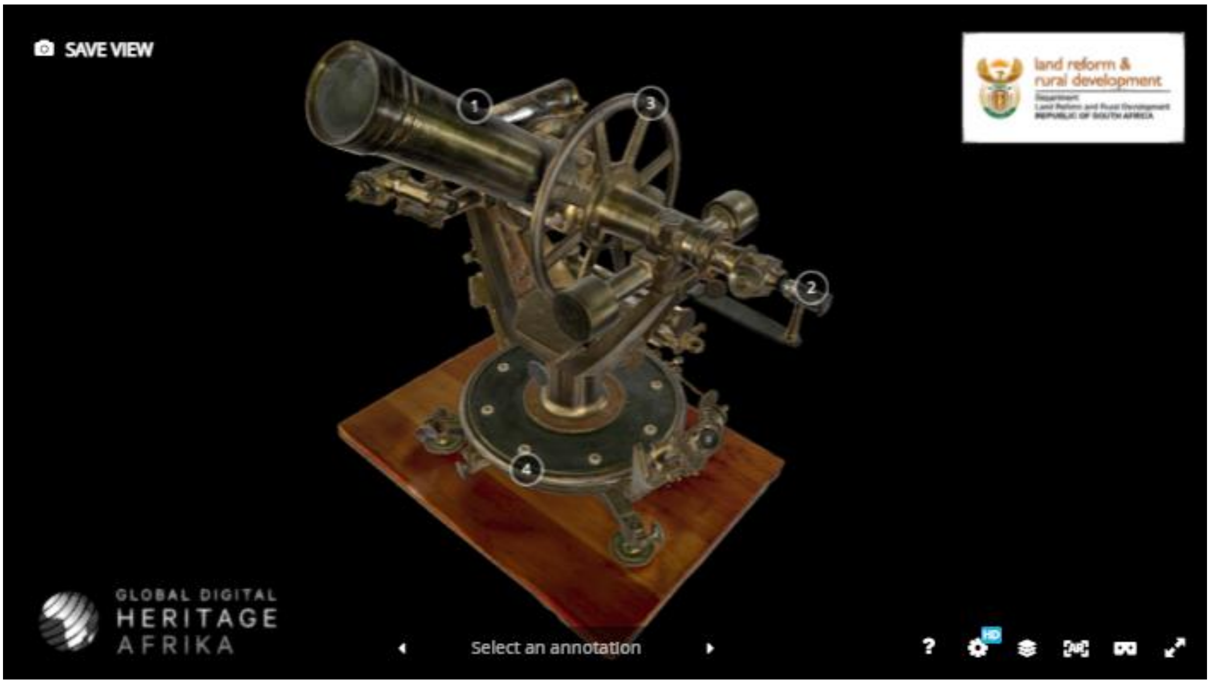

Figure 6. 3D model of 10-inch Theodolite on Sketchfab

5. Wild T3 Theodolite

The Wild T3 is a precision theodolite and was produced between 1925 and 1988 (Wild Heerbrugg 2026). It is similar in appearance and operation to the Wild T2, but larger and with even more accurate circles. Originally intended for first- and second-order triangulations, the T3 has also become popular for high-precision measurements in applications such as dam deformation surveys, industrial installations, and machine tooling.

The T3 on display in the Chief Directorate: National GeoSpatial Information Museum is particularly notable for having serial number 1, suggesting it was produced around 1925. While the instrument's full provenance is unknown, it is thought to have been used in Namibia for geodetic triangulation and astronomical work. The CD:NGI has employed T3 theodolites extensively for geodetic and primary triangulation, with the last instruments purchased around 1980. The 3D model of the Wild T3 Theodolite can be viewed here: https://skfb.ly/py8Qx .

Figure 7. 3D model of Wild T3 Theodolite on Sketchfab

Conclusion

As an important custodian of South Africa's national mapping and surveying archives, the National GeoSpatial Information (NGI) Museum in Mowbray materialises the authority of the state over land. The instruments, maps, aerial photographs, and geodetic records preserved in the museum are often presented as neutral artefacts of scientific progress and technical innovation. Yet, as critical scholarship on cartography has long argued, mapping is never merely descriptive: it is performative, actively producing the spatial order it claims to represent (Harley 1989; Pickles 2004). In the South African context, surveying and mapping functioned as foundational technologies of colonial and apartheid governance, enabling the demarcation of farms, the imposition of cadastral boundaries, the regulation of mobility, and the systematic dispossession of Indigenous land. The NGI Museum does not merely document the history of surveying; it archives the material infrastructure through which land became governable, alienable, and extractable.

The 3D scanning of selected NGI Museum objects by Global Digital Heritage Afrika extends the life of these artefacts beyond the physical museum, enabling pedagogical use and critical reinterpretation. The digital collection makes it possible for the public to engage directly with instruments that historically operated behind institutional and professional boundaries. All the models published by Global Digital Heritage Afrika and its parent organisation, Global Digital Heritage, are freely available to download for non-commercial and educational purposes. However, digitisation is not inherently emancipatory. If 3D models circulate without critical framing, they risk reinforcing a technocentric celebration of surveying expertise divorced from its colonial consequences. Conversely, when embedded within interpretive narratives that foreground dispossession and contested land histories, these models can function as critical pedagogical objects.

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