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Mapping The Colonies: The Directorate of Overseas Surveys' Unexpected Second Chapter

SHEILA MASSON
Independent photo historian and former photographic preservation manager of the National Collection of Aerial Photography / Historic Environment Scotland.
www.ncap.org

Abstract

Following World War II, the British government created the Directorate of Overseas Surveys (DOS) to aerially photograph, survey and map 55 Commonwealth countries across the globe, including nearly two dozen across Africa. The photographic collection of approximately 1.7 million images is now held by the National Collection of Aerial Photography / Historic Environment Scotland and is part of a modern international digitisation and mapping programme. This article examines the scope of the initial project as well as the unforeseen 21st century benefits and usage, specifically concerning climate change research. Furthermore, it explores contemporaneous colonial attitudes and inherent issues, both then and now, of aerial photography surveillance. Original DOS promotional publications, photographs, maps, annual reports and personnel biographies were examined to gather historic intentions and outcomes. In contrast, modern academic publications help to create a new framework within which to review these historic documents in a postcolonial setting. Key findings reveal the original intent of the project was successful in creating accurate and beneficial mapping of the involved countries, and the preservation and digitisation of the historic photographic archive has produced a 21st century body of data for potential national and global benefit. The DOS archive is a critical document of decades of physical change enacted by the environment, agriculture, commerce and governments. With its roots embedded in wartime aerial reconnaissance, the use of military aircraft blurs the line between surveillance and survey photography. Online access to the digital DOS material will transform its original stated premise of simple territorial mapping into a global archive of scientific data.

Keywords

Aerial photography, survey photography, mapping, surveying, Directorate of Overseas Surveys, colonialism, postcolonialism, British Commonwealth.

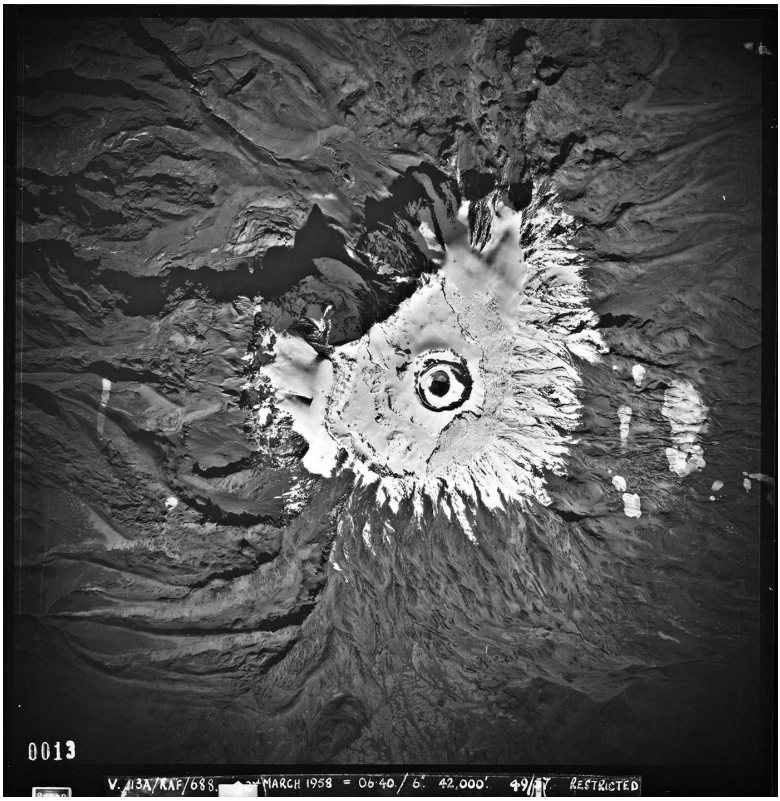

Figure 1: RAF aerial photograph of Tanzania for DOS, March 1958. Photography by the Directorate of Overseas Surveys.

In the late 1940s, British planes began to methodically fly across foreign skies far removed from their headquarters on the outskirts of London. Following geometric, predetermined patterns, they crossed a myriad of environments: sparkling blue waters surrounding tropical islands, dense green forests, swathes of grassland punctuated only by meandering rivers, burgeoning cities and scrubland dotted with tiny settlements. Over decades, Royal Air Force and commercial aircraft systematically photographed this 'God's-eye-view'[1] of select countries on almost every continent, including Africa, Asia and the Americas. With technology, training and experience garnered from World War II aerial reconnaissance missions, RAF teams were primed to undertake survey photography within more peaceful conditions. The same locations were periodically revisited to record changes in geology, land use, urban growth, international boundaries and sometimes 'ambiguous national borders',[2] with each new batch of oversized rolls of film then delivered to London for painstaking translation into paper maps.

1 M. Dorrian, 'The Aerial Image: Vertigo, Transparency and Miniaturization', *parallax*, 15, 4, 2009, 83–93.
2 K. P. Feldman, 'Empire's Verticality: The Af/Pak Frontier, Visual Culture, and Racialization from Above', *Comparative American Studies*, 9, 4, December 2011, 325–41.

These planes were sent by the Directorate of Colonial Surveys (DCS), a unit established by the British Colonial Office in 1946 to uniformly photograph and map dozens of countries within the Empire, with aerial coverage creating a presumed 'serene transcendent and magisterial subjectivity'.[3]

The DCS began surveying select countries on almost every continent,

> ... after two decades of lobbying by prominent scientists and land surveyors, who were concerned that Britain was not fulfilling its Imperial role of mapping its Colonial territories in the well-thought out manner of the Ordnance Survey at home. Its job was, first, to provide national geodetic frameworks throughout the Colonial Empire which would both contribute to man's understanding of the size and shape of the earth and provide the basis of accurate mapping and, secondly, to produce such mapping, using modern methods based on aerial photography.[4]

Later renamed the Directorate of Overseas Surveys (DOS) following decolonisation and independence of the former colonies, these multinational expeditions engaged aerial photographers, engineers, geologists, surveyors and cartographers who mapped 55 countries across the world. In Africa alone this included Botswana, Cameroon, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Liberia, Malawi, Nigeria, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Swaziland (now eSwatini), Tanzania, Uganda, Zambia and Zimbabwe. (See Figures 1 and 2.)

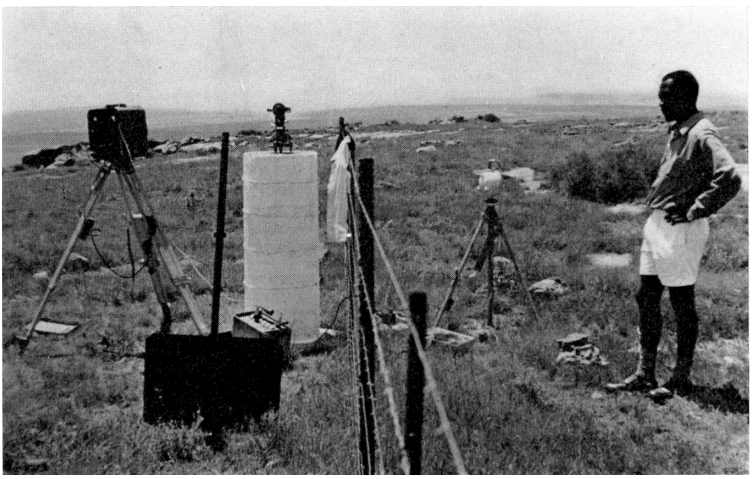

Figure 2: 'Lesotho: The survey framework of Lesotho is linked to that of neighbouring South Africa, observations being made across the international border. During the preparations for observations from South African station 2927/27 (Holywell) the labourer and survey lamp were in Lesotho, the tellurometer in South Africa, and the theodolite on the survey pillar.' (Original DOS caption.) Photography by AJ Savage/DOS, 1975.

3 Dorrian, 'The Aerial Image', 83–93.
4 A. Macdonald, *Mapping the World: The Directorate of Overseas Surveys 1946-1985* (London: HMSO, 1996), 2.

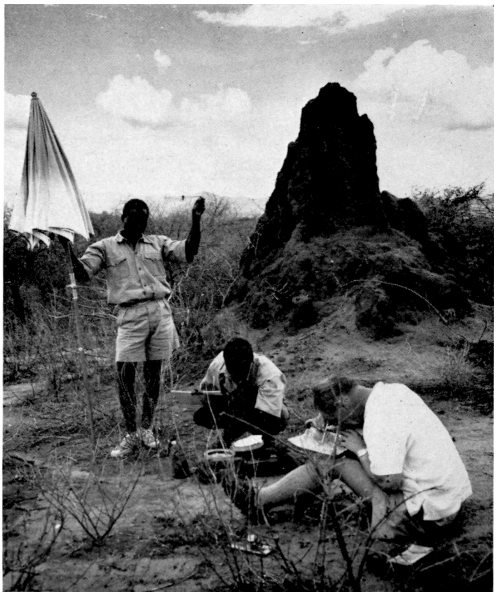

Figure 3: 'Tanganyika: Directorate surveyor using a hand stereoscope, together with two African assistants "heighting" a field point and identifying the spot on an aerial photography.' (Original DOS caption.) Photography by Central Office of Information, 1962.

Commonwealth countries with a well-established and self-sufficient military air force were excluded, including Canada, India, Australia and New Zealand. The South African Air Force (SAAF) was particularly well-trained in photographic reconnaissance and surveying, with a photographic section that pre-dated World War II. The outbreak of the war and a dedicated aerial photography training programme established in Pretoria meant that by 'the end of 1941, some seventy skilled aerial photographers and photographic instructors had completed their training in the combined RAF and SAAF programme'.[5] As with the British photo reconnaissance groups, the end of the war resulted in the dissolution of the SAAF photographic units, 'only for a restructured 60 Squadron to resurface again on 1 January 1948, responsible for all photographic survey and reconnaissance in South Africa'.[6] As I will discuss later, countries that did not have similarly well-established resources and experience as South Africa would be encouraged to develop their own surveying departments, with DOS-led training in the field and at their headquarters in London.

Primarily focused on the surveying and mapping elements of the project, a 1976 DOS promotional brochure (one of many produced throughout its lifetime) described their work in these terms:

5 https://www.theheritageportal.co.za/article/southern-africa-above-aerial-photography-historical- overview (retrieved 10/06/2024).

6 https://www.theheritageportal.co.za/article/southern-africa-above-aerial-photography-historical- overview (retrieved 10/06/2024).

> Maps are essential for development. In the developing world they provide accurate base data for the planning of essential services, such as water supplies, telecommunications, roads and harbours, for investigating the optimum use of land for agriculture, and for locating sources of energy. They contribute to the inventory of an ordered exploitation of natural resources, thus helping developing countries to help themselves.
>
> Many of the less developed countries have not yet been adequately surveyed, and in order to take full advantage of the rapid advance of technology, which now makes development possible in even the most remote areas, there is an urgent need for accurate basic surveying and mapping in widely scattered parts of the world.

The phrase 'exploitation of natural resources' alongside the mention of developing essential services is one which is often repeated throughout DOS's own literature. The perceived inherent potential of the colonial countries is apparent throughout the project, as were the issues of balancing expectations with the realities of foreign relations.

Furthermore, as Caren Kaplan writes, 'aerial observation is always already a form of waging war … the more time I spent with accounts of the early years of flight, the more I noticed a tension between those who assumed that aerial views produced an improved vantage point on the "real" and those who found the same view to be confounding, disturbing, or overwhelming'.[7] Within DOS this underlying tension can be found in the power imbalance of the surveilled (or mapped) and the 'watching machine'.[8] As can be seen in the notations on the original DOS prints and boxes, borders that are undefined from the air are easy to cross and neighbouring territories can be effortlessly photographed.

Tension was also apparent in the hiring and training of both British and overseas personnel, due to financial and cultural issues. Early in the project, the London headquarters faced large numbers of resignations due to substantially better salaries available in the commercial field, and a lack of permanent roles. However, as the project progressed these issues subsided. In the field there were other, unexpected hurdles as the Directorate attempted to hire local surveyors or other staff.

> In nearly every case, the aim was to train a local candidate for the post. This was not always successful if the job involved a significant element of field work. It was common to find that, in a developing country, great status attached to office-bound jobs and that these attracted the more competent and ambitious applicants. This led to difficulties in recruitment and longer timetables for self-sufficiency. The Directorate itself was sometimes

7 Caren Kaplan, *Aerial Aftermaths: Wartime from Above*, (Durham: Duke University Press, 2018), 29.
8 Kaplan, *Aerial Aftermath*, 29.

criticised for failing to bring emerging Survey Departments to a state of self-reliance more quickly. Many inside the organisation, however, argued that the problem lay in the poor status that land surveying enjoyed in the minds of local people leaving higher education.[9]

Figure 4. 'Northern Rhodesia. Observing vertical angles from a primary trigonometrical station. The "booker", sitting on the right, is taking down readings while the two labourers pause after clearing the trees which obscured visibility. Note, immediately to the left of the observing platform, the semaphore board positioned ready for the light keeper to sight his heliograph correctly on to an adjoining survey station.' (Original DOS caption.) Photography by R.A. Bardua/DOS.

While in developing countries the field work was not immediately considered attractive by local surveyors, for some of the British personnel the lure of working on the DOS project overseas was a novel one, particularly in a period of post-war austerity. And with up to 15 topographical survey teams seconded across the globe at times, there were ample opportunities for international travel for those with limited domestic commitments and an appetite for adventure.

'The exploits of the surveyors on the ground who travelled across fifty-five countries of the world in the course of DOS history – battling through blizzards in the high mountains of Lesotho and dust storms in the deserts of Sudan – often drew comparison with characters in a John Buchan novel.'[10]

9 Macdonald, *Mapping the World, 139.*
10 Allan Williams, *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons* (London: Preface Publishing 2013), 358–9.

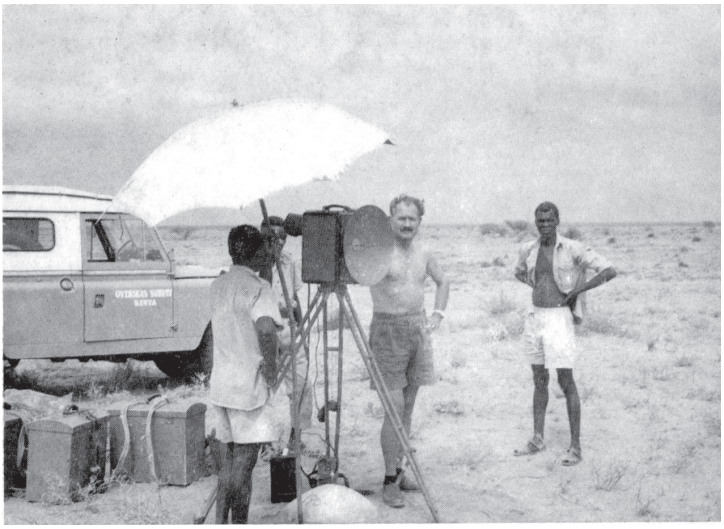

Figure 5. 'Kenya: In Northern Kenya survey work was extended into the semi-desert area of Turkana – a region of few trees and very little water." (Original DOS caption.) Photography by P.M. Kozlowski/DOS.

Meanwhile, DOS also offered training for cartography, photogrammetry and photography at its headquarters in London for up to 20 overseas participants per year, with courses lasting from three months to two years. These were financed through various schemes, fellowships and by their own governments, with the idea of eventually creating self-supporting survey teams in the field.

Figure 6. 'Technical officers from many developing countries come to the Directorate for training, and courses are tailored to meet the requirements of each. Many trainees go home to take up responsible posts in their own departments.' (Original DOS caption.) Photography by DOS, 1976.

Figure 7: Overseas trainees at DOS headquarters in Tolworth in Greater London. Photography by DOS, 1972.

The original photographs, numbering some 1.7 million black-and-white prints, were ultimately considered a by-product of the project as its primary focus was on creating accurate maps and distributing the final printed product around the world. The Mapping Division at Tolworth alone employed 300 cartographers, photogrammetrists and photographers.[11] Just one application of the images were plastic templates used as a facsimile of each photograph, which would be laid out on a carefully levelled and painted floor. The photographs were scaled and positioned using surveyors' ground points and each piece had several radial slots in it – these were joined together with studs, and they could be adjusted until all the templates overlapped correctly, thus creating a large map. Once the maps were accurately created the photographs were no longer needed, and with every new survey launched to document new developments or change of land use, each set of images became increasingly redundant.

Astonishingly, one virtually complete set of all the photographs was kept in the DOS archive, despite its immense volume, with another full set of images offered to the participating country. The meticulous planning, procedures and documentation undertaken by DOS created an invaluable archive of images and associated records that, once reconstituted as globally accessible data, can become a veritable time portal to many under-served countries.[12] This unintended outcome of the original project now provides us with a unique historical perspective and is in effect a 'Doomsday Book' of the Commonwealth, as the photography records the changing urban and

11 *The Directorate of Overseas Surveys*, prepared for the Directorate of Overseas Surveys and the Ministry of Overseas Development by the Central Office of Information, 1970, 3.
12 J. Nyssen et al, Online Digital Archive of Aerial Photographs (1935-1941) of Ethiopia, *Geoscience Data Journal*, 2020.

rural landscapes of the Commonwealth throughout the second half of the 20th century. However, while some of the second sets of prints may remain in other national archives, due to both environmental decay and natural disasters, it has been documented that some of the original sets held overseas have been destroyed.

As the DOS project and its support structure petered out in the late 1990s and early 2000s, the print collection of almost 1.7 million images plus associated documents, plots, finding aids and maps, remained housed at Ordnance Survey International headquarters in Tolworth. A move of the collection to Southampton on the south coast of England was followed by an almost fatal relocation to Bristol.

In 2003 the DOS collection became part of the short-lived and ultimately controversial[13] British Empire & Commonwealth Museum (BECM) in the former Bristol Temple Meads station, built by Isambard Kingdom Brunel in 1840. Self-described as 'the first major institution in the United Kingdom to present the 500-year history and legacy of Britain's overseas empire',[14] the museum was described as 'a notable exception, offering space to contending narratives' surrounding encyclopaedic museums, 'the contested nature of their acquisitions'[15] and other issues of colonialism.

For almost 10 years the collection sat in former engine sheds at the iconic but damp 19th century train station; not ideal conditions for a photographic archive. Many boxes of photographs suffered from mould and water damage (Figure 8) and thousands of prints became curled or fused to their adjacent prints. The BECM was ultimately closed to the public in 2008 and entered voluntary liquidation in 2013, and the main collection was moved to the care of Bristol Museum and Art Gallery and the Bristol Archive. In 2012, however, just days before it was due to be destroyed due to a lack of interest from other institutions, the print library was hurriedly transferred to the National Collection of Aerial Photography (NCAP), almost 400 miles away in Edinburgh, Scotland. The collection is now stored in controlled conditions, and the various historic environmental issues inflicted in its previous locations have been stabilised and/or rectified by the photographic preservation team at NCAP.

The eleventh-hour rescue operation transpired during NCAP head Dr. Allan Williams' research for his book *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*. While writing the epilogue, Williams was trying to establish the current location of the DOS collection and discovered that it had been transferred to the BECM. Upon visiting the museum's website, he learned that it had been permanently closed, so Williams immediately contacted them to find out where the collection would be going next. Several emails and phone calls later it was revealed that there was no other interest in the collection, and that the entire DOS print library and associated records were about to be sent to landfill. A plan was swiftly drawn up and within just weeks, an NCAP team was in Bristol to rescue the collection from its certain destruction.

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13 https://www.theguardian.com/culture/2011/mar/17/british-empire-museum-director-dismissed (retrieved 11/06/2024).
14 https://web.archive.org/web/20070128214016/http://www.empiremuseum.co.uk/aboutus/aboutus.htm (retrieved 12/06/2024).
15 https://360info.org/museums-complicated-relationship-with-colonialism (retrieved 11/06/2024).

Figure 8. A stack of mouldy DOS boxes at the British Empire and Commonwealth Museum at Bristol Temple Meads railway station in 2012. Photography by NCAP.

The next move in the DOS collection's journey was an arduous one. Sorting, accessing, barcoding, documenting and moving the collection to Edinburgh took one month and eight NCAP employees in two-week stints to move over one and half million prints, plus thousands of associated plots, finding aids, maps and other documents. The 13,000 DOS print boxes were packed into 2,666 cartons on 67 pallets before being driven via lorries up to Scotland.

Since the 2012 move the DOS collection has been stored offsite at a private records storage facility on the outskirts of Edinburgh, in a controlled environment. Most of the collection is still housed in its original boxes, typically with each box holding one sortie consisting of anywhere from five to 300 original prints. The storage facility currently holds 4,679 cartons of DOS material, with roughly six original DOS boxes in each storage carton, for a total of 14,967 DOS boxes and almost 1.7 million prints. The DOS boxes are usually plain brown cardboard, although occasionally they are the original commercial print box from the photographic paper manufacturer, typically Kodak or Ilford. When obvious disrepair, mould or damage was discovered, the housing would be replaced with new archival-standard boxes and the original boxes destroyed. As these items would have printed or hand-written notations on the outside edge detailing the location, air force or commercial company, date, sortie code, print numbers, etc, the original boxes were photographed to preserve this information.

After many years of preliminary discussion, the DOS collection began a new life phase in 2021 with the launch of the international DOS Project. Through a Bank of Sweden Tercentenary Foundation grant, NCAP and its parent organisation, Historic Environment Scotland, partnered with Stockholm University and the University of California, Berkeley, to create a new vehicle for utilising the DOS material in environmental and climate change research. The 21st century version of the DOS Project has continued to work across multiple continents, with emails, phone calls, Slack messages, Teams calls and Fedex packages replacing the typed letters of distant

Figure 9. DOS project assistant Nic Ruecroft (right) explains to Stockholm University's Anna Tompsett (centre) some of the conservation issues relating to DOS prints, in the Print Preservation room during the DOS Project International team's visit to NCAP in March 2022. Photography by Sheila Masson/NCAP.

communications. In-person visits were also achieved, with international visitors arriving from both Sweden and California to better understand the challenges and processes being undertaken in Edinburgh (Figure 9).

NCAP's role in this project has been to preserve and digitise the approximately 1.7 million photographs before sending the data to its international partners. Tight project deadlines resulted in the need to automate the print digitisation process, a pioneering practice in itself. Working with dedicated robotics engineers in England, NCAP developed a system of automated digitisation using seven cobots (collaborative robots) that have the capacity to work 24/7, eliminating the boredom and potential of Repetitive Stress Injuries incurred by human employees undertaking monotonous tasks.

As the NCAP collection is stored offsite, material is received daily or weekly, depending on the commercial job or long-term project. The DOS Project received several fully stacked pallets of boxes every few weeks and these typically remained onsite for months at a time.

The DOS collection consists of mostly 9 x 9-inch bromide or resin-coated photographs, plus a more limited number of 7x7, 5x5 and large panoramic images. NCAP hired a team of eight employees, including six full-time DOS Project assistants who worked in all the various roles throughout the process. This began in the Print Preservation room, where each box was opened and assessed. The prints were checked for mould, rips, Sellotape, peeling emulsion, dirt, curling, creases, and notations, including chinagraph, ink and pencil markings. Two dedicated fume cabinets were used for cleaning prints – one in the Print Preservation room, which was used for cleaning chinagraph, dirt, and Sellotape, and a second cabinet in a separate room where mouldy prints could be cleaned, safely removed from the main collection to avoid contamination.

Figure 10. A cobot (collaborative robot) places a DOS print on the scanner glass in the robotics suite at NCAP. Photography by Sheila Masson/NCAP.

As some of these sorties were directly used to create the original Ordnance Survey maps, many contained many images with written notes, glued paper slips or scribbled directions, which are time-consuming to clean. However, it was important to remove all notations, because if left on the image, they would interfere with the international team's geomapping algorithms. This is an unusual detour from standard cleaning of NCAP's historic prints and does not happen with any other collection. In particular, NCAP's World War II collections are left with all notations intact because they are considered part of the military artefact, and therefore must be preserved.

Due to the age of the material and the prior storage conditions, many sorties became curled or creased and require conservation intervention. Some sorties might only have a couple of prints that are curled or bent, while others might consist of an entire box that needed to be treated. For this time-consuming process NCAP has three large humidification chambers which can each accommodate hundreds of prints at a time.

All this work was done to ensure that the prints were clean and flat when they reached the robot room as the repetitive nature of the process requires consistency in the material. Once they have placed a print on the scanner, the robots can make a scan in 45 seconds, with a potential of 500 automated scans per day on each scanner, leading to a potential total of around 36,000 scans per week, when all the robots and scanners are working correctly. Without this automated scanning, NCAP would not have been able to complete this project, due to the sheer size of the DOS collection. NCAP completed digitising the entire DOS collection in November 2023 and the boxes were then slowly returned to storage, pallet by pallet. Following this completion by NCAP, the remaining data was sent to the international partners for the considerable step of interpreting the material into a globally accessible format.

At this point it should also be noted that a previous, somewhat similar project focussing solely on Ethiopia was led by Ghent University (Belgium), the Ethiopian

Mapping Agency (now Ethiopian Geospatial Information Institute) and Mekelle University (Ethiopia). This project used an archive of pre-1940 aerial photography of north and central Ethiopia, acquired by the Italian military geographical institute in 1935-41, and the data was made available to Ethiopian universities, research institutes and the broader scientific community.[16] We hope that the two projects will complement each other and the DOS material will be beneficial to those researching Ethiopia.

Receiving the scans piecemeal, country by country, our international partners in Sweden and California began digitally stitching together the images to create merged, georeferenced mosaics that resemble modern satellite imagery, albeit in black and white. In creating complex 21st century algorithms, the international partners are essentially recreating the original mosaics and maps, but now as interactive digital material. By making the photography accessible in digital form, the DOS Project will transform the availability of historical data that records global environmental change over the past century. The data will increase understanding of the causes and consequences of long-run environmental change, including biodiversity loss, deforestation and climate change. And as such, the merged / georeferenced mosaics will be freely and publicly available for all non-commercial use.

As the end of the project draws near, the international team continues to work on stitching the images into country-scale, georeferenced mosaics, that can be browsed or analysed alongside modern satellite imagery. The team expects to have mosaics complete for sub-Saharan Africa (about 70-80% of the whole archive) by the end of 2024 and to submit a paper for publication shortly thereafter that describes the process of creating the archive and provides a reference point for potential users. On publication of that paper, they plan to release the full 200 TB of mosaics online for non-commercial use under a Creative Commons license (NC-BY), for use by non-profit organisations, governments, academics, students, and so on without incurring licensing fees. However, due to the sheer size of the project, the international team is still in the process of resolving how to store and maintain access to this volume of data in the longer run.

Outside of the funded DOS Project and following the completion of digitising, cataloguing and footprinting by NCAP, the individual digital images will be made available online for licensing and reference use. Again, due to the volume of imagery and data, and the significant time and resources needed to footprint and host each image, the target date for online access of DOS material via the NCAP website is still several years in the future.

Reflecting on its origins, it should be no surprise that there remains a symbiotic relationship between military aerial reconnaissance and survey photography. Indeed, from 1956 onwards the Royal Navy and commercial aerial survey contractors photographed the Falkland Islands for DOS; almost 30 years later, this material proved invaluable to the British government and military during the 1982 Falklands

16 https://www.ethiopia1935.ugent.be/ (retrieved 07/11/2024).

War with Argentina. Aerial photography gathered under the auspices of a benevolent and 'Imperial role of mapping'[17] may also be useful in warfare, an advantage which presumably was not accidental. There remains an uneasy tension between these applications; the blurred lines of both international borders and governmental intentions can be difficult to clarify. The 'serene transcendent and magisterial subjectivity'[18] of aerial views are now embedded with ambiguous ambitions, even when engaging with historic imagery.

Returning to the critical issue of climate change, historic aerial surveys of smaller nations held by NCAP have already been licensed in their entirety by overseas national libraries, whose own collections were destroyed in natural disasters. These newly digitised surveys may be used for disaster resilience research by environmentally vulnerable countries, or islands prone to significant weather, seismic, and oceanographic events. The periodic return surveys that punctuated decades of DOS's lifetime provide significant data for tracking changes in natural and built environments. They will be invaluable in anticipating and moderating the inevitable environmental impact of climate change, now captured in digital colour by distant satellites; a far cry from the original teams of dusty DOS surveyors in-country, listening and waiting for the hum of RAF planes overhead.

Figure 11. RAF aerial photograph of Tanzania for DOS, July 1949. Photography by the Directorate of Overseas Surveys.

Figure 12. RAF aerial photograph of Zanzibar, Tanzania for DOS, 24 August 1977. Photography by the Directorate of Overseas Surveys.

17 Macdonald, *Mapping the World, 139.*
18 Dorrian, 'The Aerial Image', 83–93.