when it has to be right

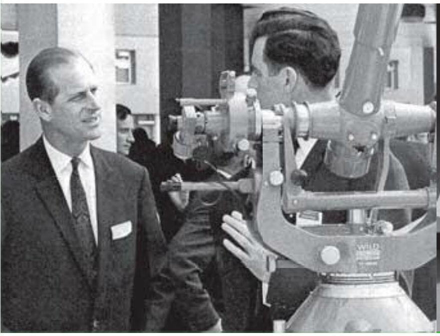
50 YEARS OF WILD HEERBRUGG & LEICA GEOSYSTEMS IN THE UK

UK 50 YEARS TRADING 1964 ~ 2014

WILD HEERBRUGG

CELEBRATING 50 YEARS IN THE UK

Leica Geosystems




The Wild Factory at Heerbrugg

Front cover illustrations, from left to right beginning at the top: HRH The Duke of Edinburgh is shown a Wild T4 theodolite whilst on a visit to Ordnance Survey in 1969 • The champagne corks popped for the sale of the 50,000th Wild T2 in 1956 • Concorde takes off along with the Wild GPS System 200 in 1992 • MergeTEC is the technology in the Leica MS50 MultiStation launched in 2013 • A point cloud created from several laser scans of Leica Geosystems new Tongwell headquarters in Milton Keynes.

Author's Note

This book would not have been possible without the enthusiasm, encouragement and dedication of current and former employees of Leica Geosystems, many of whom have eagerly contributed anecdotes and their knowledge of the company. I am indebted to Nigel Bayford who was my link into the company, twisting arms and extracting the essential information from colleagues. I must also mention Hugh Anderson, who until his retirement two years ago was the "go to" person in the company for technical issues and historical aspects of Wild, Kern and Leica. Hugh has also, with great dedication, sourced many of the numerous photographs used throughout the book. He has also been my constant source of technical information about Wild and Leica products as well as guidance on some of the more obscure aspects of surveying.

Finally, the project would not have been possible without the enthusiastic support and friendly guidance of Mark Concannon, President, EMEA GSR for Hexagon Geosystems.

About the author

Stephen Booth is the editor and publisher of several magazines serving the surveying, geomatics and geographical information sectors. He has over fifty years experience of working in the built environment as a surveyor, writer and publisher. He can be contacted via PV Publications Ltd, +44(0)1438 352617 or through www.pvpubs.com

Sources

In addition to company resources the author is indebted to past issues of industry magazines like *Surveying World* (now *Geomatics World*), *Engineering Surveying Showcase* and *Civil Engineering Surveyor*.


CLEVELAND

Opposite page: surveyors at work on the Canary Wharf tower, until 2010 the tallest building in the UK. Wild T2 still being used, shown here with the Diagonal Eye Piece.

when it has to be right

– 50 years of Wild Heerbrugg & Leica Geosystems in the UK

WILD HEERBRUGG

50 YEARS TRADING UK 1964 to 2014

Leica Geosystems

CELEBRATING 50 YEARS IN THE UK

Designed and published by PV Publications Ltd on behalf of Leica Geosystems Ltd. Text set in 10/13pt Garamond text, 10/13pt Stone Sans for box-outs.

Printed and bound in Great Britain by The Gomer Press Ltd, Llandysul, Ceredigion, Wales

Hardback: © 2014 Leica Geosystems ISBN 978-0-946779-35-2
Softback © 2014 Leica Geosystems ISBN 978-0-946779-36-9

Opposite: an Ordnance Survey surveyor with a Leica GNSS unit in the vicinity of the iconic London Eye captures positional data to add to the National Topographic Database.

Celebrating 50 years of Supply, Support and Service in the UK.
This book is dedicated to all our customers.
For your continuous loyalty, trust, valued support and
on occasion your patience, a sincere,

Thank You


- when it has to be right
Leica
Geosystems

FOREWORD from Mark Concannon, President EMEA

From the 31 August 2014 Leica Geosystems is privileged to celebrate 50 years of continuous sales, support and service to the UK. It is an anniversary of which we are tremendously proud and fully recognise that this achievement was not possible without the valued loyalty of our customers, both old and new, together with our truly dedicated team of staff, past and present.

Last November an exciting new era began for us when we relocated to our new combined UK and EMEA headquarters in Tongwell, Milton Keynes – a move prompted by sustained growth in sales and technical service. The move marks the start of an exciting new era for us and as part of that we felt that a record of our time-line in the UK through the last half century would celebrate both our and our customers' successes. This book records, in words and images, the links to people, products and projects that have contributed to this success.

Over the years numerous professionals have invested in Leica Geosystems' positioning technologies. They have come from sectors as diverse as surveying, engineering, civil engineering, building construction, heritage recording, fabrication and manufacturing industry and academia. They also include sectors such as the highly competitive arena that is Formula 1. But they all have in common the need to put trust in their measurements; they depend on 'getting it right'. That is at the core of our ethos: - *when it has to be right*.

For the UK, since 1964, we have been the 'Measurement Partner' of choice by supplying and supporting the Leica brand's world-leading technologies. At the same time we have always sought feedback from customers' of their needs and desires so as to contribute to further development of our instruments. We have assisted customers in developing new uses for our systems and solutions to meet their ever-growing measurement requirements, delivering products that contribute to the success and growth of their businesses.

Our UK operation, from Wild Heerbrugg UK through to Leica Geosystems, has enjoyed this growth and achievement because of the effort of our truly dedicated team of staff. They have engaged enthusiastically in all areas of sales, support and service. It is they who have ensured that we have become the 'First Choice Provider' to the UK measuring and positioning market. In addition, this effort has been mirrored by a network of carefully-selected Distribution Partners who, along with dedicated staff, provide a 'local presence' and support when required by customers.

In my time since joining Wild Heerbrugg UK in 1988, and especially since 1997 when I became managing director of Leica UK, I have been honoured to work alongside both staff and customers, many of whom have become true friends. By sharing my vision for the company I am proud of that which we have achieved together. We pioneered a new type of presentation to the industry in 1992 with the 'New Era' series of product launches, which have gone on to become our regular annual roadshows. We have always looked for an edge in business, not just for competitiveness but to give our customers better service and to fulfil their needs as closely as possible. This is why we constantly seek feedback from customers on what they want from our products and services. We want them to feel that we're part of their team.

On behalf of Leica Geosystems UK we are most grateful to Stephen Booth for his marvellous effort in researching, writing and compiling this compelling book. Stephen has long been associated with survey instrument manufacturers as well as reviewing instrumentation through his editorial work with survey publications. Stephen's narrative is a third party view into our history - together with a touch of the humour that prevails in the world of surveying. In addition, by adding some factual elements to his narrative, it gives a better understanding and context of the development and application of technology, as well as the key changes to our corporate entity.

Finally our thanks to Hugh Anderson and Nigel Bayford. Although retired, Hugh has made a major contribution to the book by gathering, sorting and archiving hundreds of images from which Stephen could choose from. Nigel too has worked tirelessly with Stephen - pointing him in the right direction and seeking out vital information. I know that both Hugh and Nigel have worked closely on this project by checking proofs, finding elusive images and other information. I am proud that they have brought the same level of professionalism to the book as they have to their business lives.

This book initially commenced with the intention of writing an article reviewing the early years of Wild Heerbrugg UK, in particular how we developed and transformed in those early years. However, it soon became apparent we should take the story to where we are today: ready for the next 50 years!

September 2014

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Part of the old Service Department at Knowlhill. With increased demand in recent years Leica Geosystems' new headquarters, Hexagon House, has a substantially larger facility for servicing with a service department of nearly 20 staff.

INTRODUCTION

We need to clear up a few points at the outset about this book. It is not a definitive account of all the many instruments and devices made by Wild and Leica over the last half century. Neither is it an attempt to recount in great detail the comings and goings of individuals who have worked for these companies over the years. What it is, is more of a (hopefully) interesting snapshot, a window into an enterprise that began in 1964 as the UK branch of an already world renowned Swiss company, Wild Heerbrugg and is today a world leading brand.

It has evolved through several entities to encompass equally renowned companies and brands like Kern Swiss, Leica, Leitz, Cambridge Instruments, Cyrax, Cable Detection and Scanlaser amongst others. Today these names continue in one form or another as part of the Swedish Hexagon Group with a worldwide turnover of over three billion euros derived from products and services involved in measurement, positioning and navigation. Our story however is about the UK operation, today known as Leica Geosystems.

The story begins 50 years ago when the world was a very different place to the one we know today in the early decades of the 21st century. In 1964 surveying involved spending a lot of time on site, often in remote places. It was all about instruments, capturing the measurements in an orderly fashion, doing some computing (not by electronics but by reference to mathematical tables) and then leaving it to others to prepare maps and drawings. Today surveying as a discipline has expanded far beyond its origins in land measurement. Now we use terms like geospatial, geomatics or just measurement. Many who practice it don't even call themselves surveyors.

We are now in a world where anything physical that can be seen, even under a microscope or by a telescope, can be measured. We can do it in 2D, 3D, 4D or more. We can do it on land and above or below water. And almost imperceptibly the old outdoor world of surveying has changed to one where large amounts of measurement data are acquired very quickly by laser scanning, digital imaging or other scene capturing technologies, sometimes from the air or even space.

The emphasis has switched from data capture to the desk-bound skills of processing, analyzing and modelling. For surveyors and end users of Leica Geosystems technologies, the end product is more often than not the deliverable: the point cloud or 3D model. Constantly evolving software puts real power into the hands of end users to reveal attribute data, bring captured scenes to life through visualisation, evaluate 'what if' scenarios and show how objects change. Importantly, this data allows engineers, architects and developers to optimise designs so that projects can be achieved on time and to budget.

Our story is one that stretches back more than 200 years to the days immediately after the Napoleonic wars (argued by many historians today as the true 'first world war') as well as the 1914-18 war. Those events, like other conflicts, probably sparked innovation in the minds of people like **Jakob Ker**n and **Heinrich Wild**. In our own era the Global Positioning System (GPS) developed by the US military in the Cold War has brought massive benefits to consumers and opportunities for businesses and professionals like surveyors.

For me, this has been a fascinating journey, not least because it has forced me to look back over almost 40 years of my own involvement with surveying publications where the names of Wild and Leica have figured prominently.

In compiling this history I have had to rely on many sources – company newsletters, contemporary journals and magazines, books, the web, fallible human memory and Leica Geosystems' archives. What comes through time and again is of a company committed to excellence, to solving problems and supporting its customers through the lifetime of their products. The strapline 'when it has to be right' is not a hollow boast but a commitment to achieving what customers want. Read on and – hopefully – enjoy!

Opposite page, main image: a Wild GPS System 200 in the Himalayas as part of a campaign to measure the height of Mount Everest. Inset: a more prosaic image of a Wild T2 theodolite at work on a road scheme in the UK.

SURVEYING

– a profession with ancient origins

Although this book is very much focused on the history of Wild and Leica Geosystems in the UK, the story cannot be told without some reference to the history of surveying and to Leica's own history, which predates the formation of the UK company by almost 150 years.

Surveying has been closely intertwined with the development of human settlements. There is evidence of land surveying from Babylonian, Egyptian and Chinese civilizations several millennia before Christ. In the UK, from the Roman occupation and onwards through the Middle Ages, surveyors were necessary to define land holdings as well as for setting out new developments. A major spur for the latter came in 1666 with the Great Fire of London. The aftermath created a massive opportunity for redevelopment, led by the surveyors **Robert Hooke** and **Christopher Wren**.

At that time surveying instruments were relatively crude compared to what we have today. Nevertheless, high regard was placed on instrument manufacture. During the 17th and 18th century British instrument makers based in London and York developed an unrivalled reputation for their skill and craftsmanship. Critical was the ability to accurately divide a circle for a theodolite or quadrant. Names like **Stone**, **Dolland**, **Troughton** and **Ramsden**, who was given the task in 1784 of making a transit theodolite for **General Roy**'s first triangulation of the British Isles preceding the founding of the Ordnance Survey. Ramsden's dividing engine marked the 3ft horizontal circle of the theodolite and such was its accuracy that the instrument remained in use with the Ordnance Survey until 1853.

While development of the theodolite continued throughout the 19th century gradually the mantle passed to German and especially Swiss instrument makers. One of the greatest, indeed revolutionary, developments came in 1921 when a former instrument maker with Carl Zeiss decided to return to his Swiss home and set up in business in the little town of Heerbrugg.

It is all too easy to underestimate the contribution **Heinrich Wild** made in the development not only of the theodolite but also

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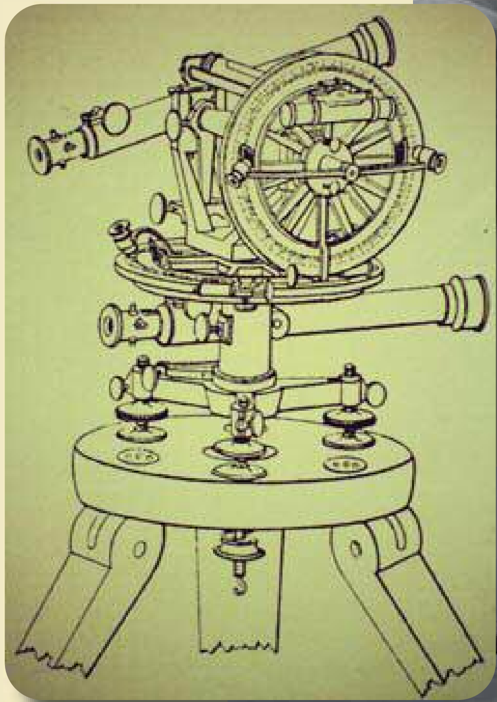
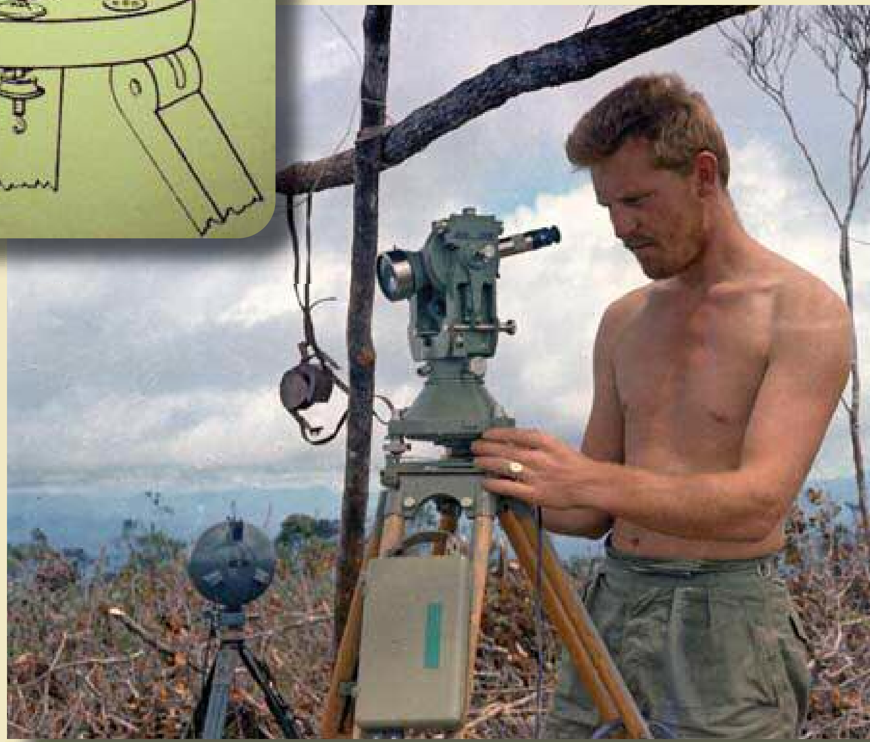
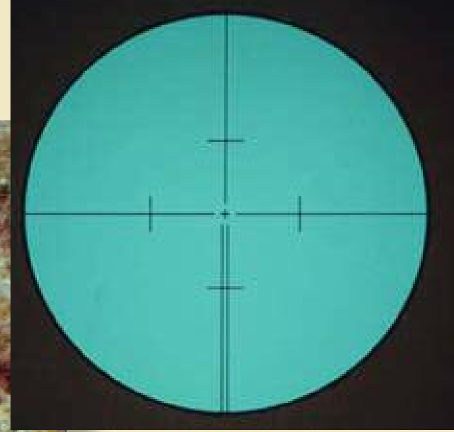


Left: a design for a theodolite from the 19th century. Above: the late Frank Plowman, one of the founders of surveyors Plowman Craven, checks a level. Below: James Butterworth at work with a Wild T3.





Above: Ron Craven, joint founder of surveyors Plowman Craven, with a T2 somewhere in Ethiopia in 1958.

Left: Hugh Anderson at work with the T2000.

Right: a survey party on the move in Ethiopia, image courtesy of Halcrow.

photogrammetric equipment. Wild's undisputed achievement was the T2 one second theodolite, a development from the first photo theodolite, the P30. This was basically a camera and theodolite where the latter's circle was arranged so that when set to 0° the camera and theodolite were aligned.

The T2, which appeared in 1924, became synonymous with precision surveying. The T2 was way ahead of its time; its concept came from Heinrich Wild's personnel experience surveying on the Rhone Glacier some ten years earlier. In particular his experience of assembling and setting up a triangulation theodolite on *Dent du Midi* at 3257m, spending 2–3 hours adjusting it, only to be prevented from taking any readings by a thunderstorm and snowfall that stopped work for several days!

Wild believed that there had to be a better way, thus the modern theodolite was conceived. By 1924 the T2 specification featured powerful optics, a ±65° tilt to the telescope, both circles observed in a reading microscope eyepiece and all contained within a dust-proof casing and metal carrying case weighing only 6 kgs. Surveyors loved it.

The T3 for first order triangulation followed in 1926 and from 1931 onwards Wild was responsible for the design of the Wild N1, N2 and N3 levels as well as the world's first dedicated aerial camera, a photo theodolite and revolutionising photogrammetric plotters.

Below: a Leica System 1200 Smart Station with GPS on a highways project.

Below, left: an Ordnance Survey surveyor using GPS to capture data for the national topographical database.

Below, right: a surveyor in New Zealand leans perilously to capture a height by GPS.

Below: a smart young staffman (Nigel Bayford) demonstrates the Wild NA2000 bar-code reading digital level.

Above: surveyors from English Heritage using a total station and laser scanner to capture the fine detail of Stonehenge. Above right: the police are major users of surveying equipment for accident and crime scene investigation. Right: a surveyor checks a manhole invert with GPS. Below: a variety of applications that all trust the Wild brand name.

The Wild factory at Heerbrugg in Switzerland in the 1970s

Why the UK went "Wild" for a Swiss company

– the history and evolution of Wild Heerbrugg into Leica Geosystems

Part 1: The Wild Years: 1964 - 1989

It's 1964. The Beatles are riding high in the charts, Mary Poppins is playing to record cinema audiences, the Mini is the most popular small car (as well as a skirt favoured by younger women), a new newspaper called The Sun is launched and plans are announced for the building of the twin-towered World Trade Centre in New York.

At the beginning of the year US president Lyndon Johnson had only been in the job for six weeks following the assassination of John F Kennedy in November. Meanwhile, Nelson Mandela is about to begin a 26-year prison sentence in Robben Island, South Africa. And in Britain the new prime minister Harold Wilson promises a new Britain 'forged in the white-hot heat of the technological revolution'.

The cosy world of BBC radio, whose three stations were the only spots on the dial unless you tuned into Radio Luxembourg, was about to be discomforted by the arrival of the first pirate commercial radio stations.

The 1960s were formative years for Britain's infrastructure too. The M1 had been completed in 1959 and during the next decade over 600 miles were added to the motorway network. Trunk roads too were improving rapidly. Journeys that once took 8 hours shrunk in some cases to half that. Everywhere you looked Britain seemed to be busy with construction: bridges, underground railways (the Victoria Line), iron & steel works, nuclear power stations, sewerage schemes and oil platforms. In addition, new towns were established and expanding including one in Buckinghamshire that was to play a significant role in the development of surveying and measurement technology. But we're getting ahead of ourselves.

Dimensional control is essential

A common thread for all infrastructure development is dimensional control. You can't build a motorway without ensuring that it's in the right place and the bridges, usually built ahead of the carriageways, are in exactly the right spot when the road paving gang arrives. While representing a tiny part of the cost of these projects, accurate and reliable surveying equipment lies at the heart of all construction projects: get it wrong and the consequences can be very expensive indeed.

Responding to this burgeoning development the Swiss precision instrument company Wild Heerbrugg decided to establish a UK branch in 1964. Previously distributed in the UK by drawing office suppliers Hall Harding, Wild's world renowned instruments would now be sold directly.

The business began in Church Street, Maidstone Kent in August 1964 under the directorship of Major Jack ("Stiffy") Simpson, previously the company's UK representative servicing blue-chip customers like Military Survey, academia and Great Britain's mapping organisation Ordnance Survey, whose activities at

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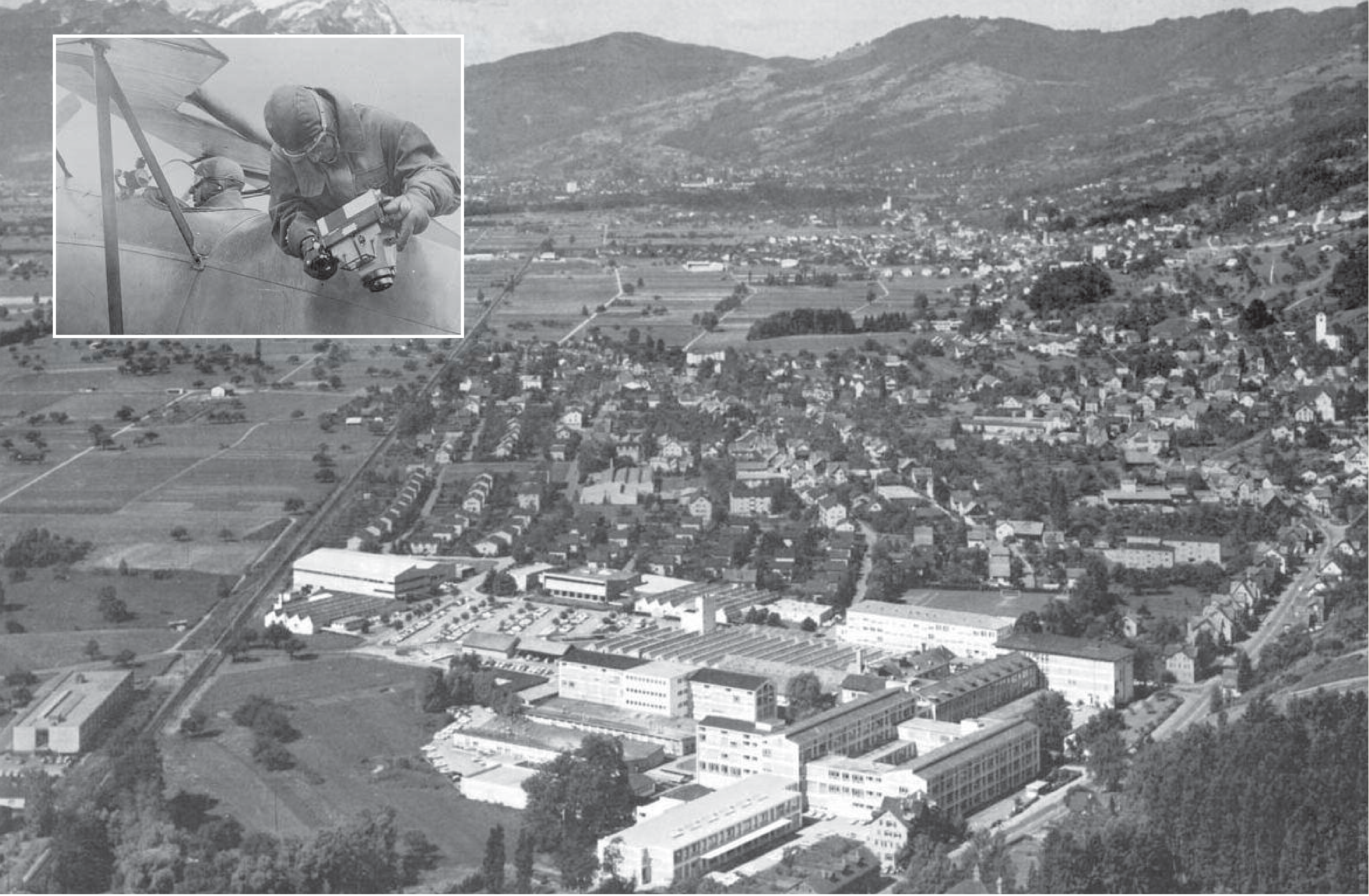

The Wild factory in the early days, perhaps snapped by the brave camera operator (inset)!

The Wild-Leica story

Two small towns in Switzerland – Heerbrugg and Aarau – have played a major role in the evolution of measurement technology. Their two founders names are intertwined in the histories of Wild Heerbrugg and Kern of Aarau. These former companies that now comprise Leica Geosystems (part of the Hexagon Group) trace their origins back nearly 200 years to the founding of Kern in Aarau.

As Europe began to get back to normality after the Napoleonic wars, Jakob Kern returned to his native land after serving an apprenticeship as a mechanic in Germany. His workshop first manufactured mathematical instruments but with the arrival of the steam age and the demand for surveying instruments he moved into optics. Kern's instruments were used on the construction of the Simplon and Gotthard tunnels under the Alps as well as other major infrastructure projects during the 19th century.

Kern's business grew and prospered through two centuries built on a reputation for the highest possible quality. Kern had always remained a family business, so much so that it was the fifth generation of the family that eventually merged the company with Wild Heerbrugg.

The second significant name is that of Heinrich Wild, the designer of the renowned T2 theodolite, which he introduced in 1924. Wild too served his apprenticeship in Germany but with the Carl Zeiss company. He returned to Switzerland and the little town of Heerbrugg in 1921 to establish his business as Wild Heerbrugg, backed by the Schmidheini family, who retained their interest in the company until 1998 when Investcorp took over.

After many significant developments to surveying and mapping technologies, in 1935 Heinrich Wild left the company he founded to join Kern where he contributed to the design of many survey instruments.

Meanwhile, Wild Heerbrugg carried on growing as an innovative company under the leadership of the Schmidheini family. In the 1930s the company launched the world's first stereo plotter – a device that was in demand by both sides in the Second World War as photo-reconnaissance came of age and invading armies demanded maps quickly.

Following the war, the company quickly responded to peacetime demands. In 1948 a microscopy division was formed. For surveyors 1950 saw the launch of the Wild RDS1, a tachymeter – precursor to the modern total station – that was able to give direct readings for height and distance.

Throughout this book you will read mention of the T2 theodolite,

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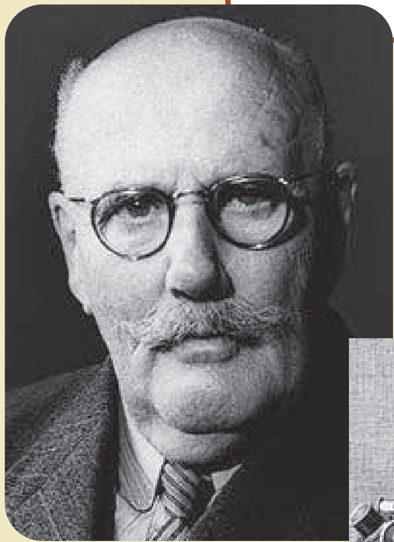
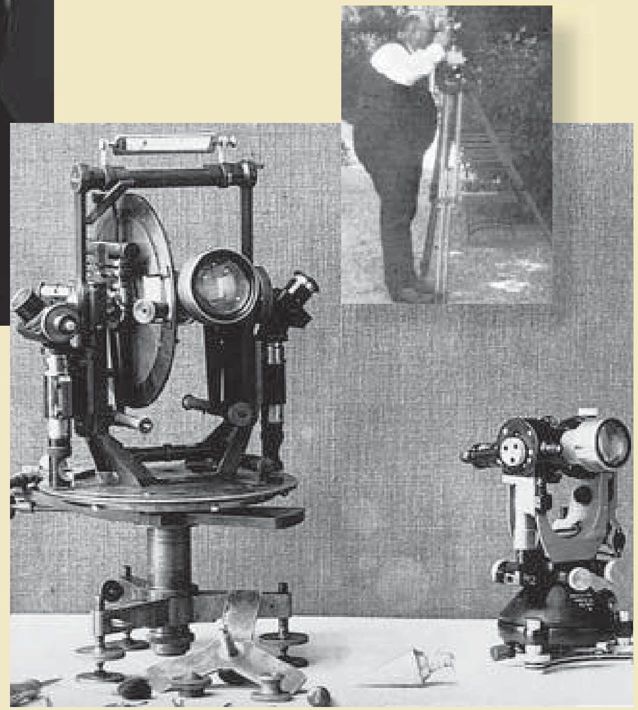




Above: Heinrich Wild and his business nameplate for the company in Swiss-German - elegant as it is it translates as "Incorporated Sales Company Heinrich Wild Geodetic Instruments Heerbrugg".

Also shown above is a typical theodolite that surveyors had to contend with before the arrival of its compact competitor, the T2. The small inset shows Heinrich Wild at the instrument.

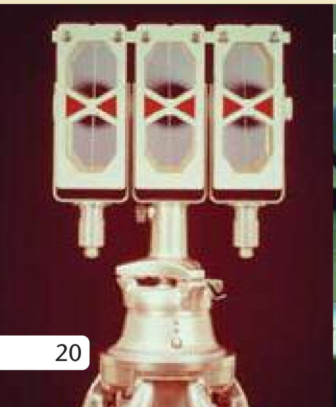
Mathematischen Instrumente
verfertigt in den Werkstätten von
J. KERN
Mechanikus
in AARAU. Schweiz

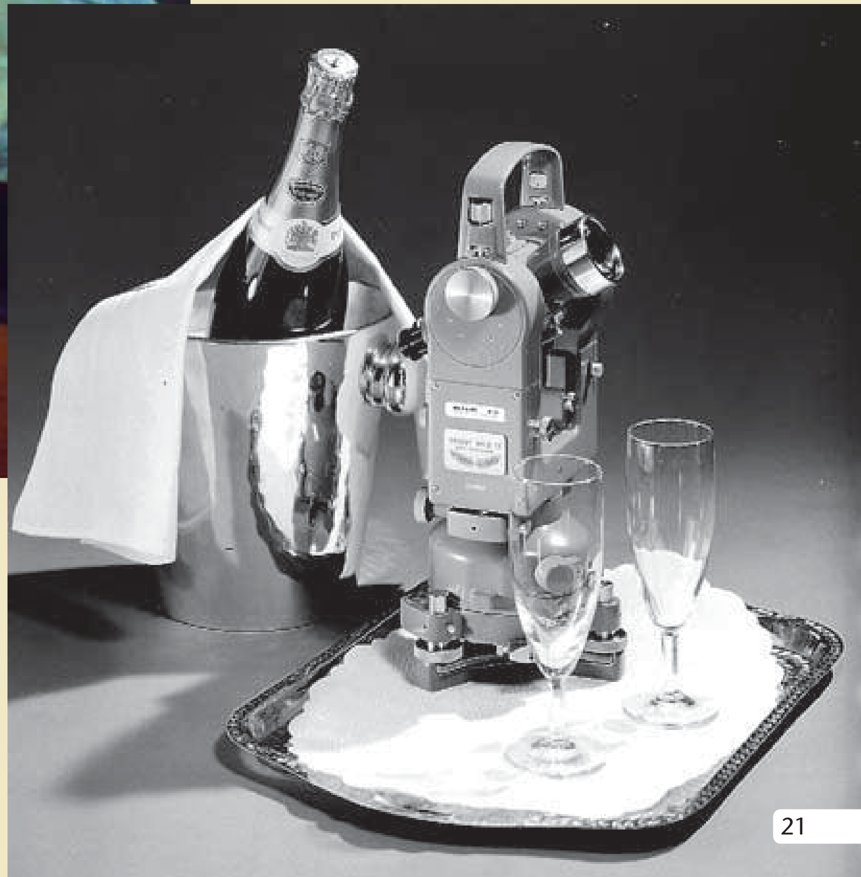
(Jakob Kern von Berlingen, Kanton Thurgau,
empfiehlt sich zur Ausführung von Aufträgen
und wird sich bestreben, durch schöne Arbeit,
prompte Bedienung und billige Preise
die Zufriedenheit derjenigen zu erwerben,
welche ihn mit ihrem Zutrauen beehren werden.)

In 1988 the venerable instrument makers Kern of Arrau merged with Wild Heerbrugg.

Far left: founder Jakob Kern. Far left: Kern's calling card or trade nameplate. Left and below: two views of Kern's factory, the engraving dating from the 19th century, the other from the 1930s.

Bottom of page: an array of Kern instruments at the time of the merger, many with advanced electronics.





Above right: the original Wild T2, serial number 004.

Above: T2 theodolite production at the factory in Heerbrugg in the 1960s.

Right: in 1956 the sale of the 50,000th Wild T2 was celebrated. The plaque on the instrument reveals that it was bound for South America and Venezuela.

that time extended way beyond our shores through the Directorate of Overseas Surveys.

Leadership honed in battle

Jack Simpson led the company for 12 years; and a leader he certainly was. Like so many senior people back then Major Simpson had been tested and not found wanting in the Second World War. He fought at Arnhem in 1944 (vividly recorded in Cornelius Ryan's film "A Bridge Too Far") and was one of only four soldiers from that battle to escape and return to England. He was awarded the Military Cross.

After the war Jack joined Military Survey and headed the Air Survey branch of Ordnance Survey from 1956-59. An ardent supporter of photogrammetric methods for mapping, Jack was an active member of the Photogrammetric Society and was its President between 1973-75. Jack had first joined Wild Heerbrugg in 1962 as a consultant two years ahead of the formation of the new company in the UK.

The choice of Kent as a base for Wild Heerbrugg UK must have made good business sense. The recently built M2 motorway was nearby with good links to the Channel ports for importing equipment as well as to London, then enjoying a construction boom. Within two years a sales manager was needed and Brian Snelling joined, also from Military Survey and later to succeed Jack as MD.

Jack Simpson grew the company during the 60s and 70s to the point where it commanded 30% of the UK market in surveying equipment. And it was not just traditional surveying in construction and civil engineering. The company was also supplying systems for dimensional control in manufacturing industry like aerospace.

Before the days of laser trackers, in the right hands a precision level and theodolite was an ideal way of maintaining accuracy to a few thou. One customer was Avco Engineering who used three Wild N3 precision levels in their business of re-jigging helicopter fuselages and precision aircraft components. Quality Manager Ray Startup for Avco summed it up well: "In an industry where measurements are calculated to 3 thou over 30 foot runs, and where everything has to be rigorously checked in line with ministry specifications, the N3 precision level and T2 theodolite. . . are ideal tools for initial setting up, alignment and diagonal cross-check procedures. They have enabled us to quickly achieve otherwise impossible accuracies."

In May 1969 Wild Heerbrugg UK was honoured to be invited to the opening by HM The Queen of Ordnance Survey's new headquarters in Southampton. Her Majesty and the Duke of Edinburgh were shown a variety of Wild equipment by MD Jack Simpson including the newly introduced DI10

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Jack Simpson (left and below) was invited to the opening of the Ordnance Survey's new headquarters in Southampton while HRH The Duke of Edinburgh learns about the T4 high precision theodolite.

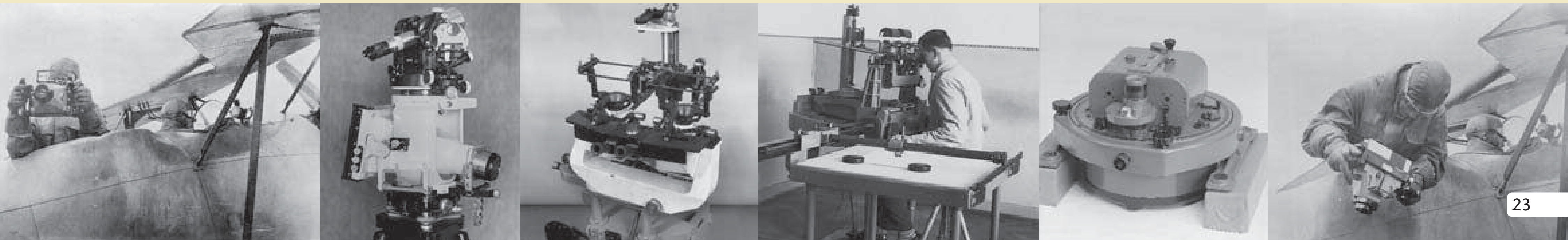
a remarkable instrument that has been a mainstay of surveyors for some 90 years. It has been hauled up mountains, bumped across the arctic wastes and guided explorers by the stars. It has also featured on some of the most amazing construction and engineering projects in the world, from bridges, dams to ship building and aircraft manufacture. In 1956 the champagne corks popped to celebrate the sale of the 50,000th T2 and when production finally ceased in 1996 some 90,000 had been produced. Today, although no longer manufactured, there are still thousands of T2's in everyday use around the world. So, after a hard days surveying when you're relaxing in the evening, raise a glass to Heinrich Wild.

In 1972 a cooperation began with the German company Leitz Wetzlar, makers of the world renowned Leica cameras, which marked its 100th anniversary in 2014. From 1988 the company was known as Wild-Leitz and following a merger with Cambridge Instruments, in 1990 becomes Leica. The move creates a company employing 11,500 worldwide with a turnover of £500m. In 1997 the company becomes Leica Geosystems and the following year is taken over by Investcorp where it remains until 2005 when it becomes part of the Swedish Hexagon Group with a raft of companies supplying measurement technologies. Today the group has a turnover of over 3 billion euros.

Right top: the making of an icon - the prototype Leica 35mm camera designed by Oscar Barnack in 1914.

Right: another icon - a surveyor at work with a Wild T2 atop the Grand Canyon.

Below: a selection of early photogrammetric equipment. From left to right: The first aerial survey camera, a photo theodolite, the Wild A1, the Wild A4 from 1932, the Wild RC3 aerial camera, aerial photography in action c. 1930.



Distomat, T4 Universal Theodolite and N3 precision level.

Jack Simpson's health began to decline in the 1970s and he reluctantly handed over the reigns to Brian Snelling. Jack finally retired from the company in 1979. In retirement he became a parish councillor in Weavering. He died in 1989.

Expansion and the first Total Station

By the late 1960s the Maidstone office was running out of space so the search was on for new premises. A piece of land was found in Chatham and a new headquarters planned and built – probably the first purpose-built headquarters for surveying equipment in the UK. It was opened in 1972 and six years later Brian Snelling, a former colleague of Jack Simpson's in the Royal Engineers and with experience in photogrammetry, took over as managing director, while Jack remained for awhile as executive director in charge of administration, finance and personnel.

Brian was a popular head for the company. He too had served in the Second World War, serving as a lieutenant in the Gibraltar Tunnel Squadron where they were responsible for the surveying of a vast network of tunnels that created a small town during the hostilities and under the safety of the rock. Later he was with Military Survey in East Africa and the West Indies and was Chief Photogrammetrist for the Uganda Government.

Many remember Brian fondly: an unerring capacity to out-drink anyone, never pompous, always personable. . . and often slightly scruffy, recalls Malcolm Draper, whose survey company Rentalength was the first in the UK to purchase the then state-of-the-art DI10 Distomat EDM. Malcolm recalls meeting with Brian and General Kelsey, head of Military Survey. The General asked if the Distomat was any good. Malcolm said it was absolutely brilliant but had he tried the Nipomat – half the price and twice the range? Snelling's jaw dropped for a moment before falling into a trademark Draper joke.

Brian Snelling was to play a pivotal role in growing the company before

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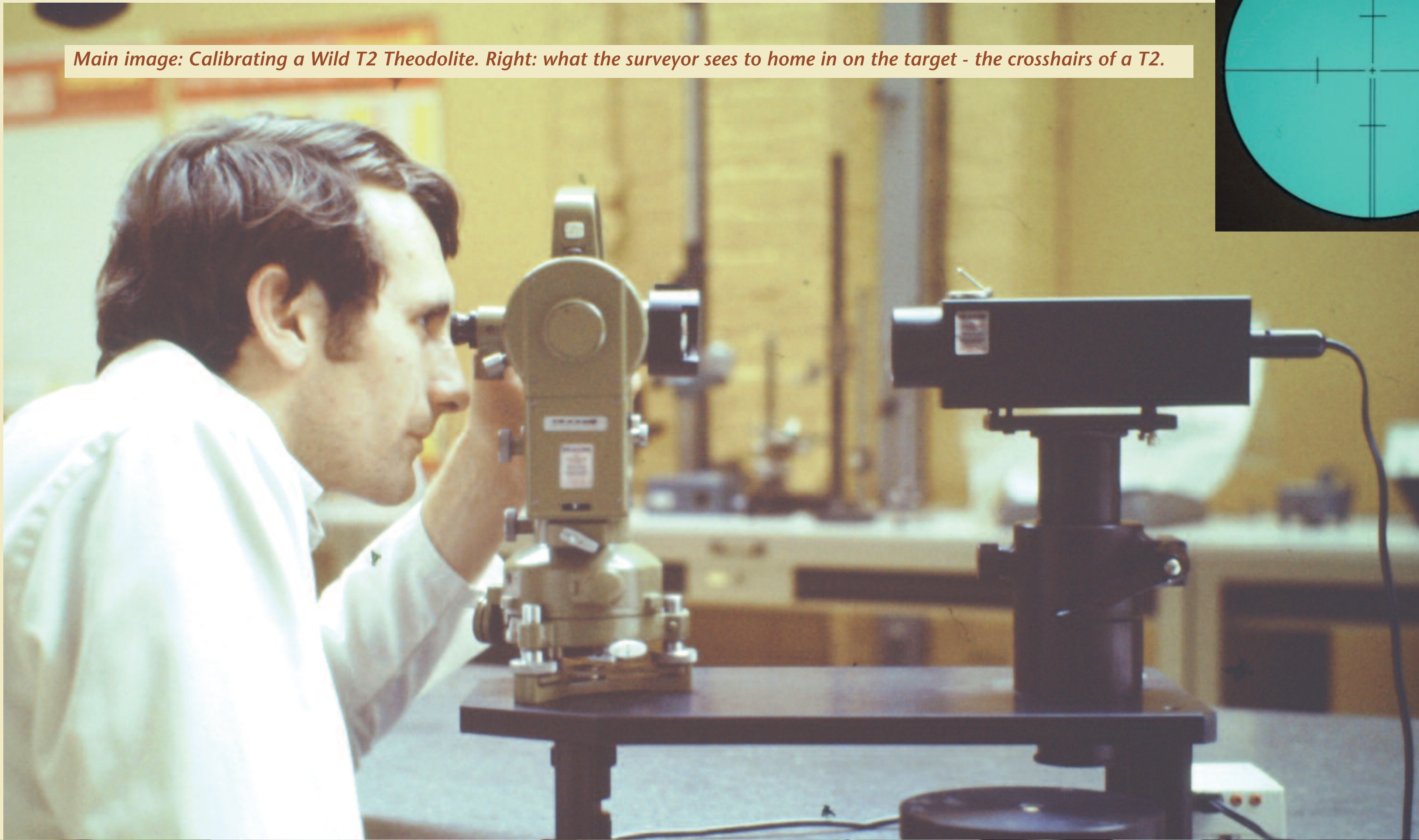
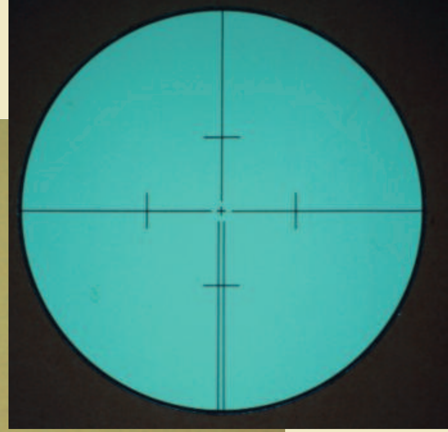
The electronic age had arrived! Below left, the Wild DI10 Distomat atop a T2 theodolite, the first EDM to be widely adopted by surveyors and which paved the way to the first total station. Below right: the TC1 Total Station, or electronic tachymeter as Wild preferred to call it.

Brian Snelling (left) was a popular leader, first as sales director then as MD.

Right: the new Chatham headquarters, the UK's first purpose built building for surveying instruments.





Main image: Calibrating a Wild T2 Theodolite. Right: what the surveyor sees to home in on the target - the crosshairs of a T2.

retiring in 1987. He developed the strategy and company strapline that invited aspiring customers to "make Wild your Measurement Partner". Under his leadership the number of employees grew from 30 to around 40. Brian was quite a character and there are several anecdotes about him. Like many busy salesmen he was forgetful of minor details. Announcing to his wife one day that he was off to Southampton to see the Ordnance Survey she asked to join him as she fancied some shopping there. A pick-up point was arranged for later. Comfortably back in Chatham, Snelling received a call from his wife still waiting to be picked up in Southampton!

Service to the power of three

The writer once asked a surveyor what three things he looked for in a total station. His reply was, 'Service, service and service'. In construction, despite the operator's care (or lack of it!), surveying equipment does not always fair well. Instruments occasionally get dropped or even hit by moving machines. One image from an early newsletter shows a selection of battered and dented instrument cases with their contents all requiring a health check.

It was therefore an early priority for Wild UK to establish a repair and maintenance facility to save the expense and extra time of returning instruments to the factory in Switzerland. Two early characters who had already been trained by Wild in Switzerland were Henri Buchwalder, service engineer for electronics and Joe Schindele, service manager who first joined Wild in Switzerland in 1958.

Others followed including Charles Collard (1969), a Wild factory trained photogrammetric engineer and married to a German girl and able to speak her language fluently. Paul Santo joined in 1970, then Arthur Lugg 1973 as workshop foreman for geodesy service and repair before becoming service manager in 1987. Martine Brosnan joined in 1972 and remains with Leica Geosystems today. Other team members at this time included Sirjit Marway 1973, Trevor Sudds 1975, Dave Francis 1975 and in 1988 Tony Poynter and Tim Knight, who is now the Service Supervisor, Workshops.

All helped contribute to the creation of a sound and multi-talented service department ready to deal with whatever customers threw at them. Indeed, that was exactly what must have happened to several instruments the department had to repair. Construction sites are tough places and a surveyor may only take his or her eye off the instrument for a few seconds and a machine or a careless worker can knock it over, or worse run over it!

Nevertheless, when an instrument goes down the owner wants rapid service response. Malcolm Draper, managing director of surveyors Rentalength, recalls how one of his DI3s EDMs went down on an important project in Dubai. The instrument was given to a UK engineer flying back to UK for delivery to Chatham. With pleading and a little gentle persuasion, the service team repaired the instrument and got it back to Dubai the next day.

Sales, education and training

From the UK company's early days it was seen as important to develop links with technical colleges and universities as well as offering dedicated training for users of Wild equipment. The company's team of technical support and sales personnel have always been selected for their technical qualification, with many being chartered surveyors or engineers. The key person who joined Wild during this time and who is still with the company today is Mark Concannon (joined in 1986 and became MD ten years later in 1996).

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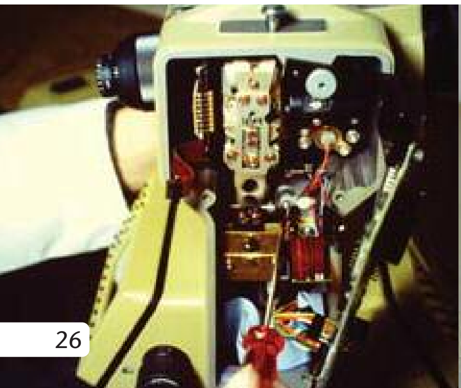
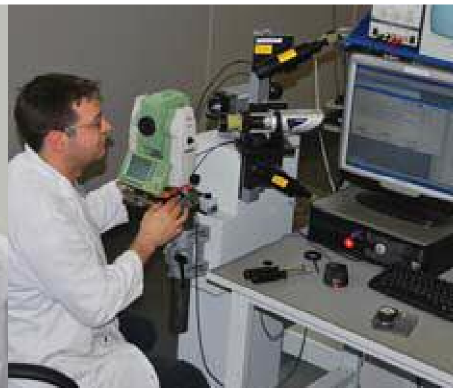
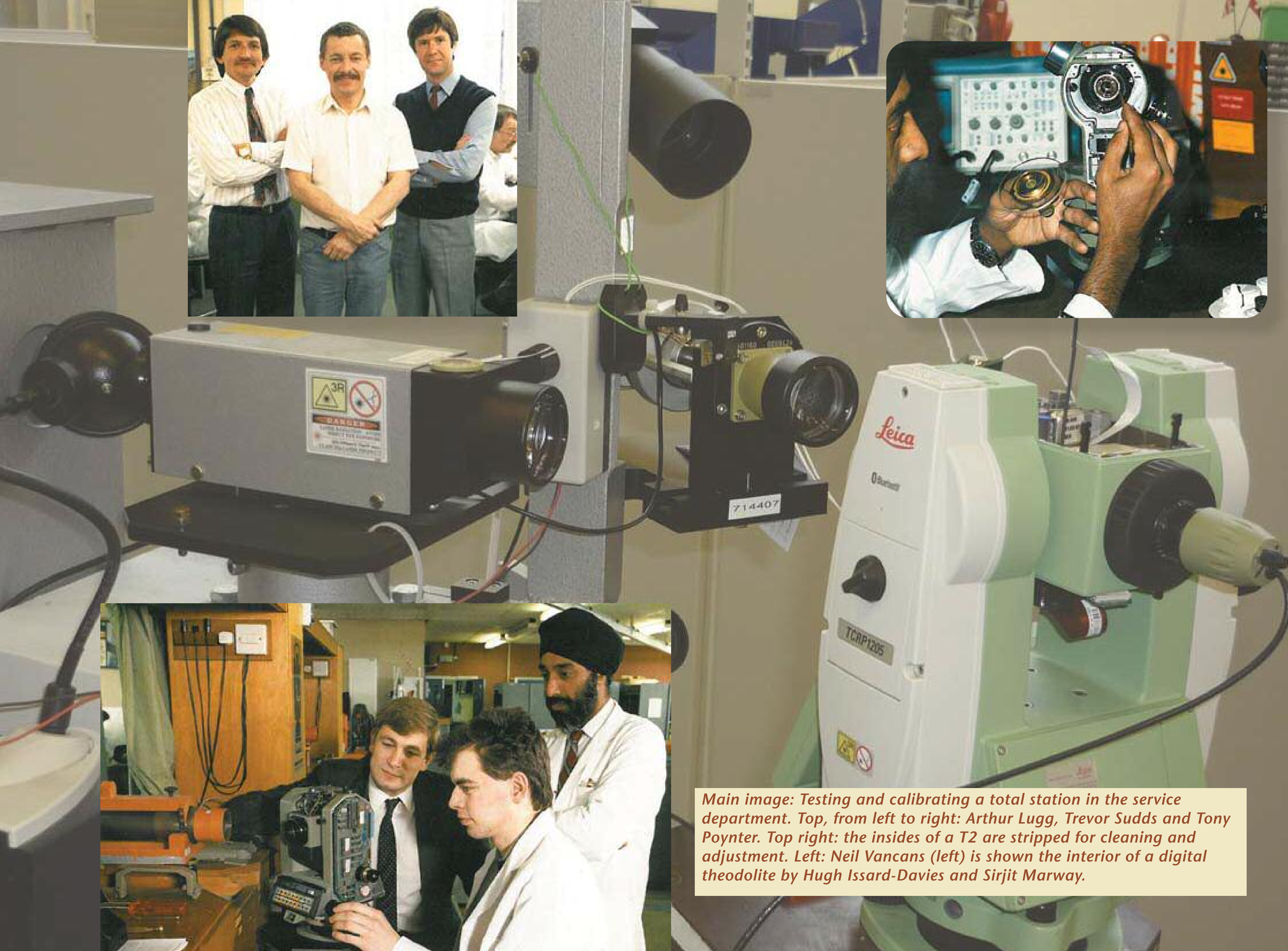
Below from left to right: a Wild T1600 is exposed for servicing; a total station is stripped down to the bear essentials; Henri Buchwalder, for many years the mainstay of the service department; a technician checks an instrument; Martine Brosnan; Service Supervisor, Administration, the longest serving member of staff.



Main image: Testing and calibrating a total station in the service department. Top, from left to right: Arthur Lugg, Trevor Sudds and Tony Poynter. Top right: the insides of a T2 are stripped for cleaning and adjustment. Left: Neil Vancans (left) is shown the interior of a digital theodolite by Hugh Issard-Davies and Sirjit Marway.

EDM and Total Stations

With the arrival of EDM (Electromagnetic Distance Measurement) surveying changed forever. Surveying and particularly mapping is based on triangles (the nearer equal sided the better) and spherical trigonometry. But to calculate the length of a triangle's side you first have to know the length of at least one other. Angles can be measured accurately by theodolite but before EDM there was no alternative but to carefully measure one side of the triangle (a baseline) using iron bars or steel tapes held in tension. It was a laborious task. To obtain the highest accuracy line and level had to be maintained. The tape had to be kept in tension and protected as far as possible from temperature variations. A baseline for a mapping project could easily be 10 miles long. It could take months through the bush of East Africa and engage hundreds in the survey party – cooks, drivers, bush clearers, guards etc to accompany the surveyors.

In 1947 distance measurement became possible using light and in 1959 using radio waves. Development during the early 1960s focused on infrared technology. Both technologies were embraced by Wild: the DI50 was radio based while the DI10 relied on infrared. By projecting a light wave in the infrared spectrum to a simple passive reflector (a prism) and measuring the time of the return signal, distance could easily be calculated. Radio based technology was more complicated and meant having a cumbersome transmitter/receiver at both ends of the line being measured. The DI10 was a runaway success for Wild. At last surveyors had something in their kit that was lightweight, could be mounted on a tripod and could easily and reliably measure distances. It was to pave the way to a new era for surveying that led to today's total stations.

In 1984 Wild began investigating reflectorless measurement culminating with the release of the DIOR3002 in 1986, an instrument that could measure distances without the need for a prism: simply identify the target and point the visible laser dot. This development led to the introduction of the TPS300 in 1998, the first co-axial total station with a visible beam. Today, reflectorless EDM is incorporated in most of Leica's total stations enabling the user to measure to inaccessible points up to 500 metres or more away from the instrument. In the case of the recently launched Leica MS50 Multi Station the reflectorless distance capability is a staggering 2000 metres!

The total station is ubiquitous for surveying but that has only happened during the last 25 years or so as production costs have

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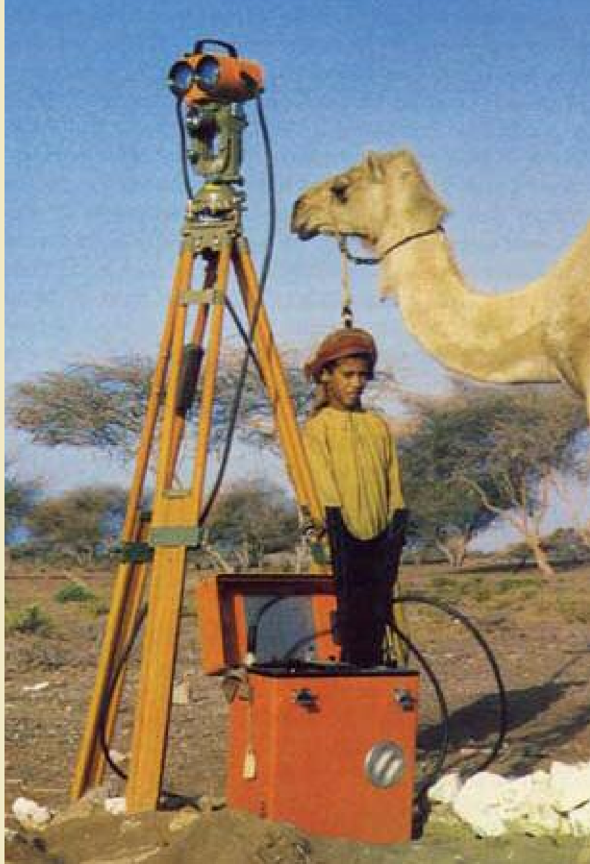
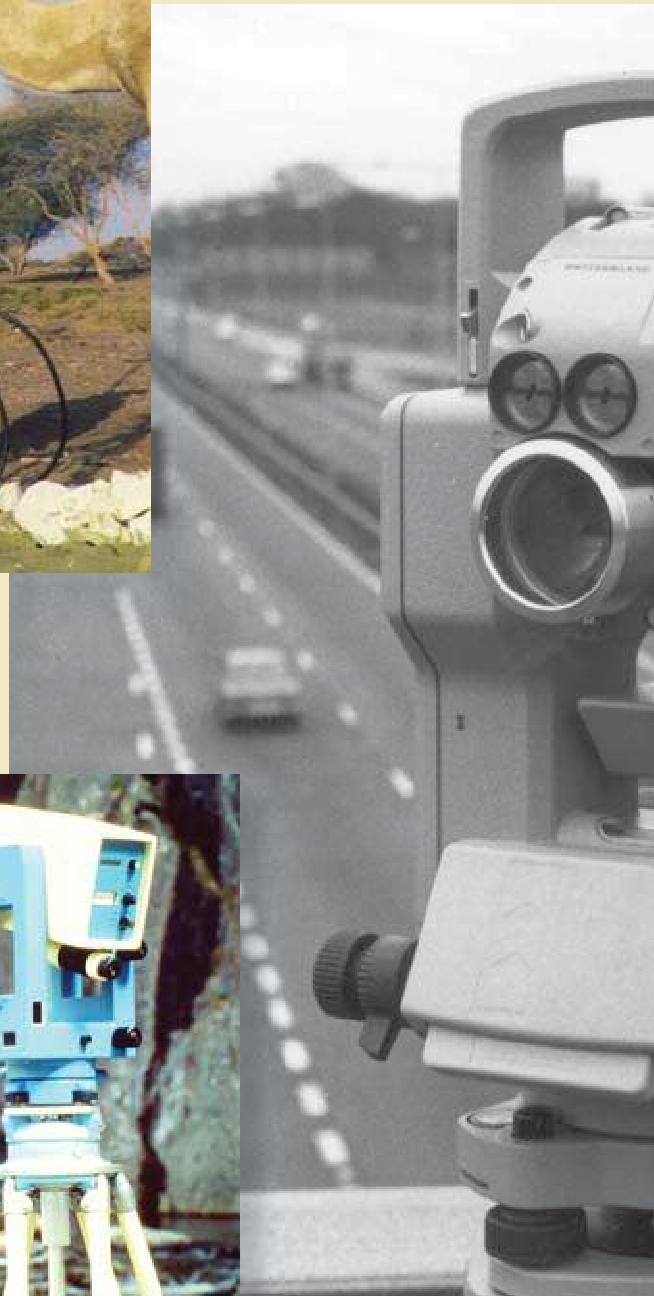
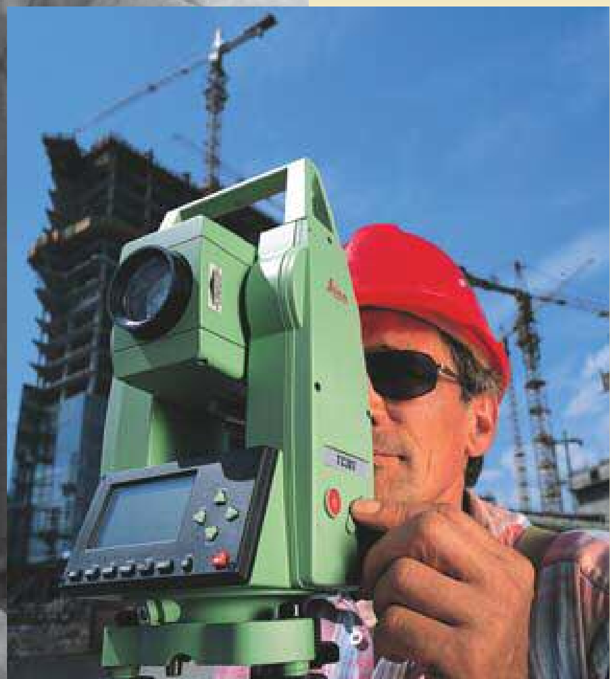


Above: an embryonic total station combines a T2 and DI10, while an inquisitive camel and puzzled boy look on. Below: the state-of-the art Kern Mekometer EDM.

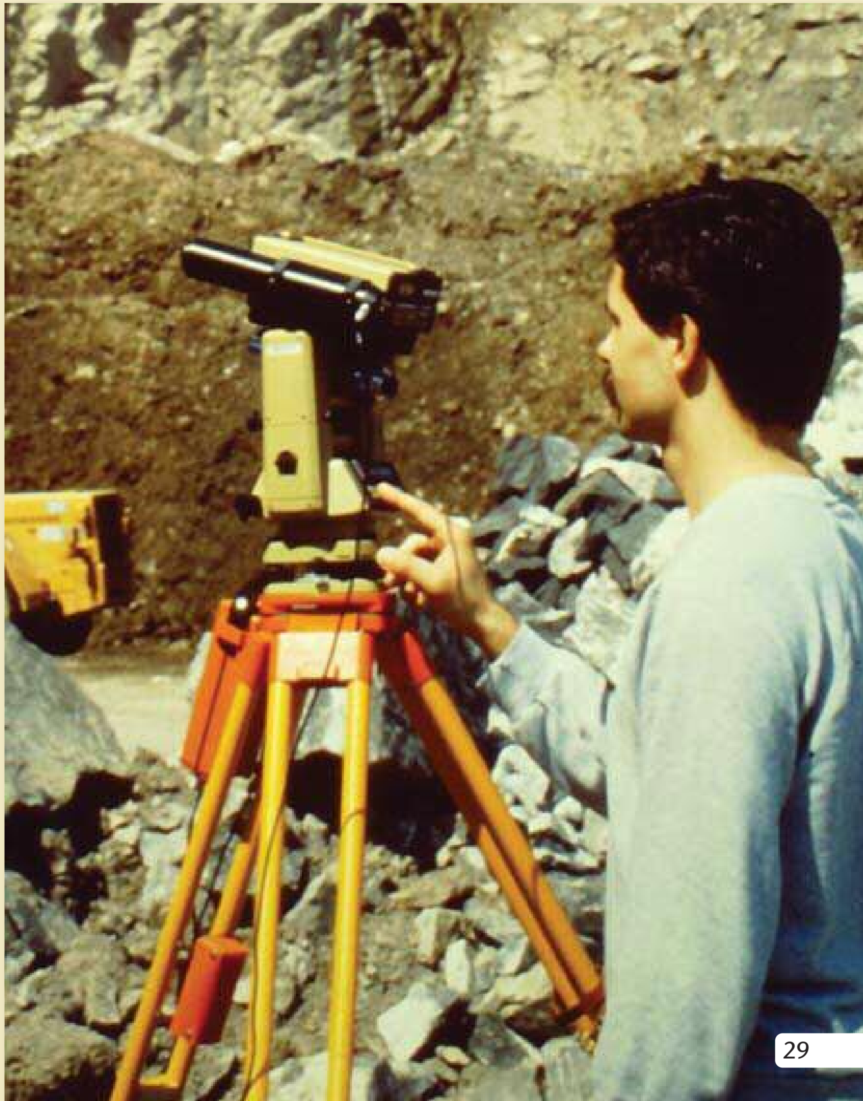
Below: At first, many surveyors opted for a digital theodolite and EDM combination for flexibility, rather than a total station.





Left: The Wild DI3 replaced the DI10 with a much smaller measuring head on top of the theodolite, but still needed a large box of tricks underneath, which had a digital read-out as well as a meter giving the strength of the return signal from the prism(s). But the data still needed to be hand booked as the unit did not log the data.

Below: The Wild DIOR reflectorless EDM was a true gamechanger. The Leica TPS300 total station range (below left) was one of the most successful ranges, offering many options including reflectorless EDM and laser plummets.



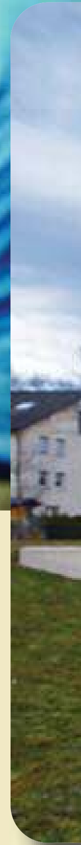
tumbled. As EDM matured from the late 1960s onwards surveyors were able to combine a theodolite and EDM Distomat together on a tripod. Once digital theodolites became available the path was open for the development of the total station.

In 1977 Wild became one of the first companies to bring a fully electronic total station to market. The TC1 combined, for the first time in one instrument, horizontal and vertical circles, a telescope, a distance meter and a digital recording system. Wild quickly recognised the role that electronic total stations could play in computer aided design (CAD) on projects by appointing senior personnel, some with military experience, to focus on this area.

The first sale in the UK was in 1978 to Survey & Development Services who soon deployed it to Saudi Arabia on a major contract for the oil company ARAMCO. Today that combination has become more compact and has been added to by Leica Geosystems' ingenious designers with additional sensors such as digital cameras, laser scanners, GNSS and colour video displays of the scene, to which the surveyor simply has to point to capture measurements.

Ever improving accuracy and precision have been at the heart of Wild's and Leica's research and development programme. For measurement you have to have benchmarks, reference points. Carefully calibrated and regularly checked baselines are essential and Leica Geosystems has its own baseline beside the Rhine near Heerbrugg. In addition, you need access to very accurate reference instruments. Over 30 years ago the Mekometer was developed by Kern (taken over by Wild in 1988). Ranged to a prism, it could measure distances of up to 8 km to an accuracy of ±0.2mm.

Above: at last surveyors had an all-in-one instrument. The Wild TC1 total station was launched in 1977.



Left: three of a kind. By the mid 1980s the Distomat range of EDMs had grown to three instruments, the DIDI1001, DI1600 and DI2002.

Right: a Wild T2000 theodolite bares all to reveal its complex electronics and sits alongside the Wild GRE3 data controller.

Above: a true state-of-the-art instrument. Launched in 2013 the Leica Nova MS50 MultiStation with total station technologies and laser scanning that can also incorporate GNSS as required!

Right: the heritage sector has become major users of surveying equipment. This Leica TS15 total station is seen at Byland Abbey.


Kern

On the path to the Leica MS50 MultiStation

Once the electronic total station arrived the path lay ahead towards the Nova MS50 MultiStation (above right) launched in 2013 and merging laser scanning and GNSS with total station technologies. Beginning with the Wild TC1610 (left, main image) surveyors at last had an affordable and fully electronic instrument from which they could capture measurements and transfer them to CAD and terrain modelling software. In 1998 the Leica TPS 300 series (above left) arrived and was to lead the way to a GPS option on the Leica TPS1200 SmartStation series (above) in 2005.

Other notable members of the sales and technical support staff in the 1970s and 80s included: Harry Armstrong, Ray Pendlington, Peter Range, Nick Price, Andy Perry, Gordon Anderson who joined in 1975 and became Geodesy Sales Manager in 1988, Alistair Ayres, Steve Thompson, Ralph Tiller, Neil Vancans who joined in 1982 and became MD in 1987, Alastair Williams, Nigel Ward (Survey Connection Tyne's first MD), David Ebbage, Tim Taylor and Paul MacArthur, who joined in 1985 and now runs SCCS, one of Leica's distribution partners. Mark Concannon succeeded Neil Vancans as MD in 1996, while Nigel Bayford joined in 1986 and Tim Badley in 1988.

In 1989 Survey Connection London is opened to serve the growing demand in the Greater London Area, Docklands, Canary Wharf and other key projects. Paul MacArthur and Mark Concannon were early managers of this venture.

Following the merger with Kern in 1988 key members of the sales team were, amongst others, Gordon Anderson (UK Sales Manager), Stuart Freeman, Mark Concannon, Tim Badley, George Harper, Alistair Williams, Peter Fittock, Ian Farrar, Duncan Redgewell and Peter Field.

Rapid technological change

The 1970s and 80s were a time of rapid technological development. Surveying instruments in 1964 still relied entirely on mechanical and optical engineering principles. But the first EDMs relied on electronics for their operation and it was a logical further step to incorporate electronics in a theodolite so the two could communicate with each other. What was missing was some way of recording the readings. The answer was the GEOMEM data collector. The days of the surveyor's field book were now numbered. By the late 1970s distance measurement and data recording had all merged into the Wild Tachymat TC1, the first modern total station, an instrument that surveyors could only have dreamed about in the first half of the 20th century.

Launched in 1977, the TC1 remained in production until 1983 when it was succeeded by the TC2000. With greater accuracy, better battery life and functionality, the TC2000 along with the TC1600 were to become a mainstay of professional surveyors and site engineers throughout the 1980s and well into the 1990s.

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Bottom, from left to right: Brian Snelling (third from right) briefs the sales team on the newly arrived DI3 Distomat and the Lawag landing angle indicator. The Wild TC1 was the first Total Station, here being used on a project in the Middle East. Total Station and EDM accessories. Meanwhile, the world was changing rapidly in the 1980s as survey companies introduced the PC to offices.

Left: the sales team in 1988 puckering up to the camera. Do you recognise anyone? And who's missing?





Above: the Wild Aviolyt BC2 mapping system was an early move towards digital photogrammetry. Note the size of the plotter on the right and data storage disks on the left for the system.

Below: Once electronics enabled the connection of a theodolite to an EDM the next stage was the capture of the data and export to a computer. The box atop the Wild TC1 total station (below left) was the data recording module, the GRE1. This evolved during the 1980s for Wild with devices like the GRE data collectors (below, second image from left), the REC module and reader (third from left) to the GPC series of data controllers SDC cards. Meanwhile many surveyors were migrating to proprietary devices like the Psion Organiser and the Husky Field computer.

LASERS & LASER SCANNERS

Back in the 1960s and 70s if there was one really “sexy” piece of technology guaranteed to excite it was the laser beam. Queen sang about it (“Killer Queen, cut by a laser beam”) and scientists predicted an exciting future for lasers, from slicing through steel like butter to military death rays. More prosaically the laser was to revolutionise distance measurement and offer a perfect way of staying on line and level.

First proposed by Nobel Prize winning physicists in the late 1950s, lasers were once, like many discoveries, described as “an invention waiting for an application”. Today, lasers are found in Leica’s total stations, levels, handheld Distos, Vector binoculars and of course the HDS laser scanners.

The word we casually use today is in fact actually an acronym. It stands for “light amplification by stimulated emission of radiation”. Light is emitted through a process of optical amplification based on the stimulated emission of electromagnetic radiation, according to Wikipedia. What this enables is a number of applications for surveying and measurement. A finely focused visible point helps a reflectorless EDM user to know exactly where their instrument is measuring to. While a laser beam that can be reflected back to the instrument, can be used to accurately calculate distance.

Construction is first use

Lasers were first used in the construction industry in the late 1960s to

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Left: the Wild GLO2 laser eyepiece. connected via a fibre optic cable to a T2 theodolite provided a visible laser dot to help the user target specific points.

Drainage and tunnelling projects were early applications for the laser. Seen here is a Leica Piper 100-200 pipelaying laser, the visible laser dot just visible.

Today Leica total stations can incoprorate as many as five different lasers for pointing, leveling and measurement.

Right: the Leica Disto has revolutionised measurement in the construction and building industries. Surveyors at last had a reliable and accurate handheld EDM they could use anywhere, anytime.

Machine control first became practical with the arrival of rotating lasers. Here a Wild LNA30 laser level guides a bulldozer to maintain level.

help maintain line and level for applications like pipe laying and for verticality applications like building a skyscraper. Encouraged by military developments, by the 1970s, lasers were in use in a growing range of devices including rangefinders and devices like the Wild GLO1 laser eyepiece, which when connected to instruments like a T2 theodolite or NA3 level via a fibre-optic cable or a Wild ZNL zenith and nadir plummet, projected a laser beam of light from the telescope that could be focused and thereby the point identified and measured to.

In the 1980s Wild developed a range of rotating laser levels that were popular aids on construction sites across the world in maintaining line and level during the construction. They were used in early machine guidance applications too. Construction machines like graders, dozers and excavators now had a reference grade point to which their operators could work to, saving time and materials. The Wild LNA range of laser levels launched in the 1980s evolved into today's ubiquitous Leica Rugby range.

Reflectorless measurement arrives

In 1986 an instrument was developed that was eventually to change the measurement features on a total station. The DIOR3002S was the world's first production reflectorless EDM. Under the right conditions the instrument could measure to a point some 350 metres away without a reflector. Within a decade reflectorless measurement was a standard

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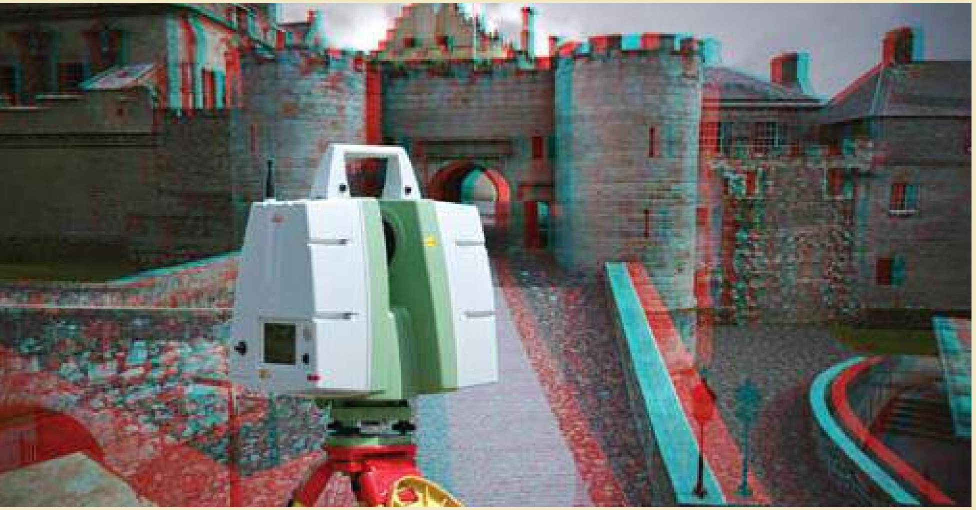
Right: one of the first applications for the Wild DIOR reflectorless EDM was in Longdin & Browning's Clear Cone road survey system, seen here capturing data on the motorway system with a TCRP1200 in the turret.

The reflectorless Wild DIOR 3002 EDM was a revolutionary distance measuring device that could simply measure to a targeted laser dot. Here it is seen mounted on a Wild T1600 electronic theodolite.



Left: the invention of the laser led to the development of the laser scanner. Seen here is a Leica HDS C10 scanner. You'll need to get your 3D specs on to view the background image which is a 3D anaglyph.

Today the Leica DISTO is available in several configurations and is more versatile than its predecessor, and it can store and undertake calculations and is a lot smaller.

Above: a caver uses a Leica DISTO D2 to capture data for a cave survey.

Right: Leica Vector range-finding binoculars.

Left: a Leica Rugby laser level at work on a railway project.

option on total stations and today's instruments can be equipped with three or more lasers – for pointing, as a plummet for accurate levelling, for reflectorless measurement and for long range measurement to a reflecting prism.

The next application for lasers came in the 1990s with the arrival of the laser scanner. As early as 1979 Canadian scientists had demonstrated an airborne laser scanning system. Their system operated in a similar way to reflectorless EDM but by using spinning mirrors to project a succession of beams very rapidly in rays to form a swathe. Aboard a moving platform like an aircraft, the device could emit hundreds if not thousands of beams per minute. The captured data could now be turned into a 3D digital model, if you had the computing power.

LiDAR adds a new tool

An advantage of LiDAR over the photogrammetric techniques being used at the time was that LiDAR was from a single source, so the point being measured did not have to be seen from two locations such as with stereo photography. This meant that terrain covered in foliage could be mapped, even if only 1% of the laser beams hit the ground it could still be accurately mapped and a 3D terrain model created.

Again, the technology was driven along by the military. The system has become known as LiDAR – light detection and ranging - with applications in geomatics, archaeology, geography, geology, geomorphology, seismology, forestry, remote sensing, atmospheric physics, airborne laser swath mapping (ALSM), laser altimetry and contour mapping. A new remote sensing tool had arrived.

Terrestrial laser scanning

But what if the technology could be adapted for terrestrial use? Set up on a tripod or a vehicle, such a device could quickly capture a detailed and accurate 3D picture that might be imported into a CAD system. By using this technology entire scenes such as buildings, or dangerously inaccessible locations like oil and gas plants, could be captured accurately in 3D.

The first portable laser scanning system, integrated with CAD and visualization software, was developed by Cyra Technologies co-founded in 1992 by Ben Kacyra. The first system relied on microchip lasers (acquired from the US Star Wars programme) and a pico-second timing board (acquired from the US National Los Alamos Laboratory. The first application for this technology was of a cooling tower at the Chevron Refinery in Richmond, California where Cyra's bench-top system was

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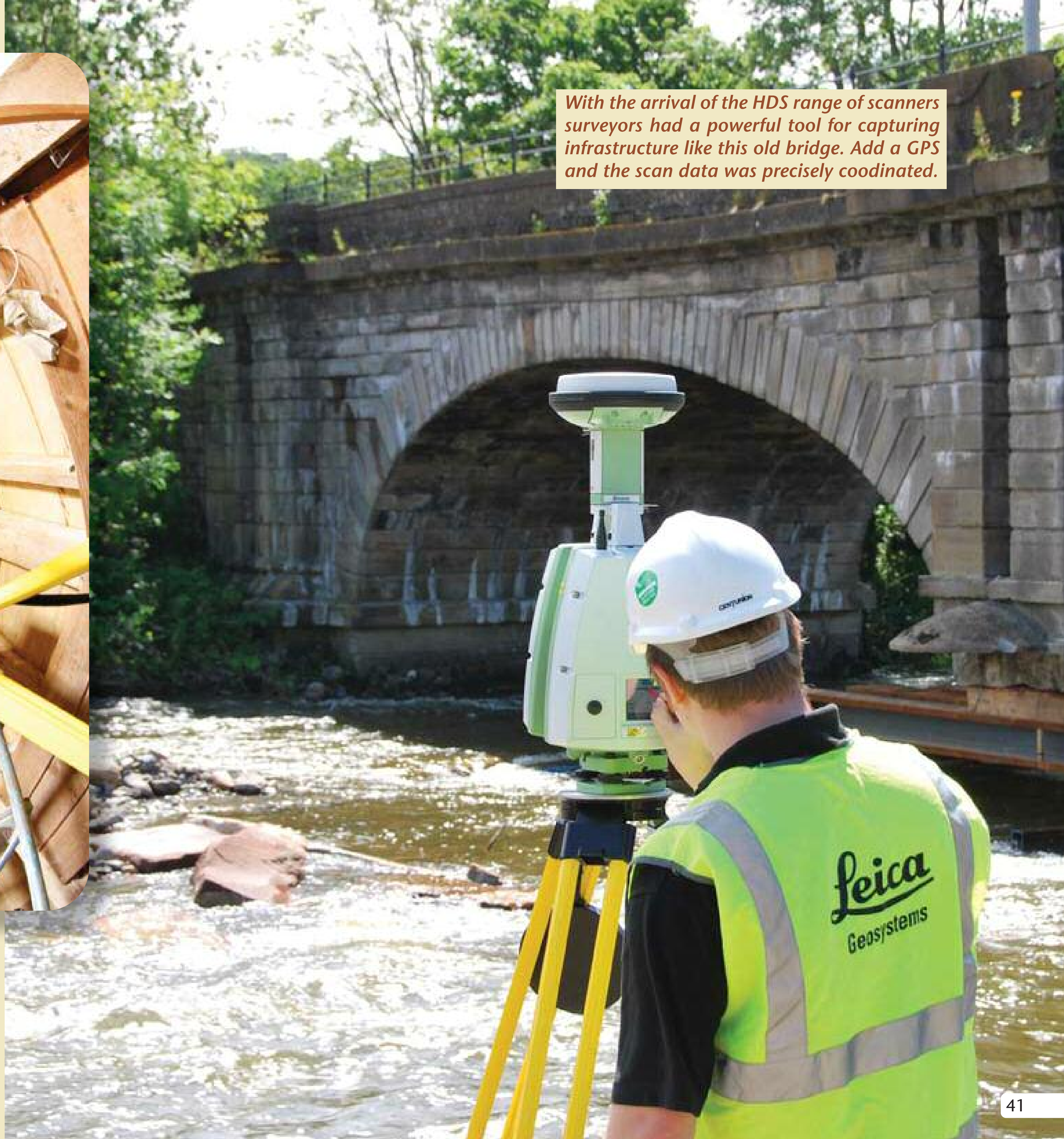
Left: the Cyrax 2400 laser scanner was a pioneering development for surveyors and engineers. In the early models however control from a laptop was essential as was an external battery.

With the arrival of laser scanning an old problem for surveyors returned: external batteries. Back in the 1960s when EDM first arrived surveyors were forced to use 6 and 12 volt car batteries for their power source. The early laser scanners were similarly power hungry until Leica Geosystems got on the case and developed smaller batteries and clever power management.

Above: this old windmill would have been a serious challenge to capture all of the detail in 3D and would have taken days of measurement. No problem now with a Leica HDS scanner.



With the arrival of the HDS range of scanners surveyors had a powerful tool for capturing infrastructure like this old bridge. Add a GPS and the scan data was precisely coodinated.

transported to site in a van. A fully man-portable system soon followed.

A black box heralds the future

In 1999 surveyors attending the World of Surveying exhibition at the Motorcycle Museum near Birmingham were startled to see a very large black box atop a robust tripod. What on earth was it? Delving further, one wag described it “as an EDM on steroids”. The Cyrax 2400 laser scanner had arrived.

As we have seen, one of the first companies to develop this technology into a commercial system was Cyra Technologies. The first Cyrax Scanner was released for sale in 1998 and by the millennium year 70 or more Cyrax Scanner owners were using the new technology on hundreds of projects. In March 2000 Leica Geosystems announced a major investment in Cyra with new models being introduced in October of that year. Leica Geosystems acquired Cyra Technologies in 2001 and the term High Definition Surveying, HDS, was introduced.

Since then the technology has evolved and today Leica offer a range of scanners for different applications depending on distance range and accuracy. Some have integrated digital cameras so users have accurate data from which to add texture and colour to imagery. The rate at which data can be captured has increased substantially. Scanners today can capture 3D data at up to one millions points per second enabling very fine detail to be accurately recorded and a 3D model created.

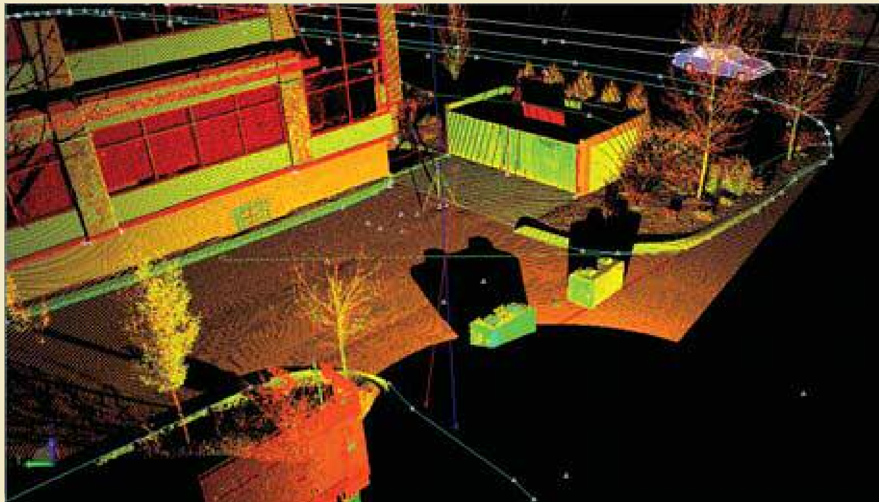
Applications for laser scanners have grown rapidly during the last decade. They are used in the film production industry where whole scenes and even the actors can be scanned and digitally manipulated to create the finished movie. Using this technique can save producers substantial costs from having to film on location.

In addition to topographic surveys, difficult to reach sites and street scenes, other sectors where laser scanners are having a major impact include heritage where highly accurate and detailed 3D models can be created of sites such as Stonehenge, providing archaeologists with new insight into the past of ancient Britain. The police and security services have also adopted laser scanning. Road traffic accident scenes can now be quickly and accurately recorded in 3D enabling quicker re-opening of roads.

Today, Leica has a range of scanners suitable for many different applications including vehicle-mounted systems like the recently introduced Pegasus, a mobile mapping system; airborne sensors that integrate with digital image capture technology and LiDAR (airborne laser scanning).

Above: the perfect solution to capturing this complex scene in 3D is the Leica C10 HDS scanner.

Below: the deliverable is now a 3D image from which dimensions and positions in 3D can be easily measured.



Police forensic and collision investigation teams soon realised that they had a powerful scene capturing technology in HDS surveying now powered by small internal batteries.

Significant new technologies appear

Two decades after Wild set up in the UK the world was a very different place. The office PC had arrived to replace the cumbersome mini computers and mainframes. There was an air of digital innovation throughout business and industry. Robots were building cars. Suddenly everyone was talking about computers and microprocessors. It was a time when computers were definitely saying "Yes".

Several significant technologies that we rely extensively on today for measurement first emerged in the late 1980s. In 1986 the DIOR 3002 reflectorless EDM was announced. Suddenly it was possible to measure to points without visiting or touching them. A decade later and the technology was available across much of Leica's total station range. Although initially expensive, reflectorless technology was to pave the way for several important applications including surveyors Longdin & Browning's Clear Cone mobile road surveying system and ultimately the rapid 3D scene capturing laser scanners of today.

Navigation and positioning by satellites

The next development was of much more fundamental impact; one that touches so many aspects of our daily lives today. Navigation, tracking, location, positioning, mobile phones. . . all now rely on GPS (or GNSS as it is correctly called).

In the early 1980s Wild had been watching the emergence of the first satellite receivers for surveying. Because of the relatively few satellites in orbit and weight of the equipment, applications were restricted mainly to long distance baseline measurement – an essential for accurate mapping and linear projects.

In 1984 Wild announced a partnership with US receiver developer Magnavox. The first Wild receivers were launched the following year and as the satellite constellation grew and electronics became ever smaller, the first practical lightweight GPS field survey system was launched to great acclaim in 1992.

Computers and electronics

We need to say a word or two about developments driven by IT. Many older surveyors

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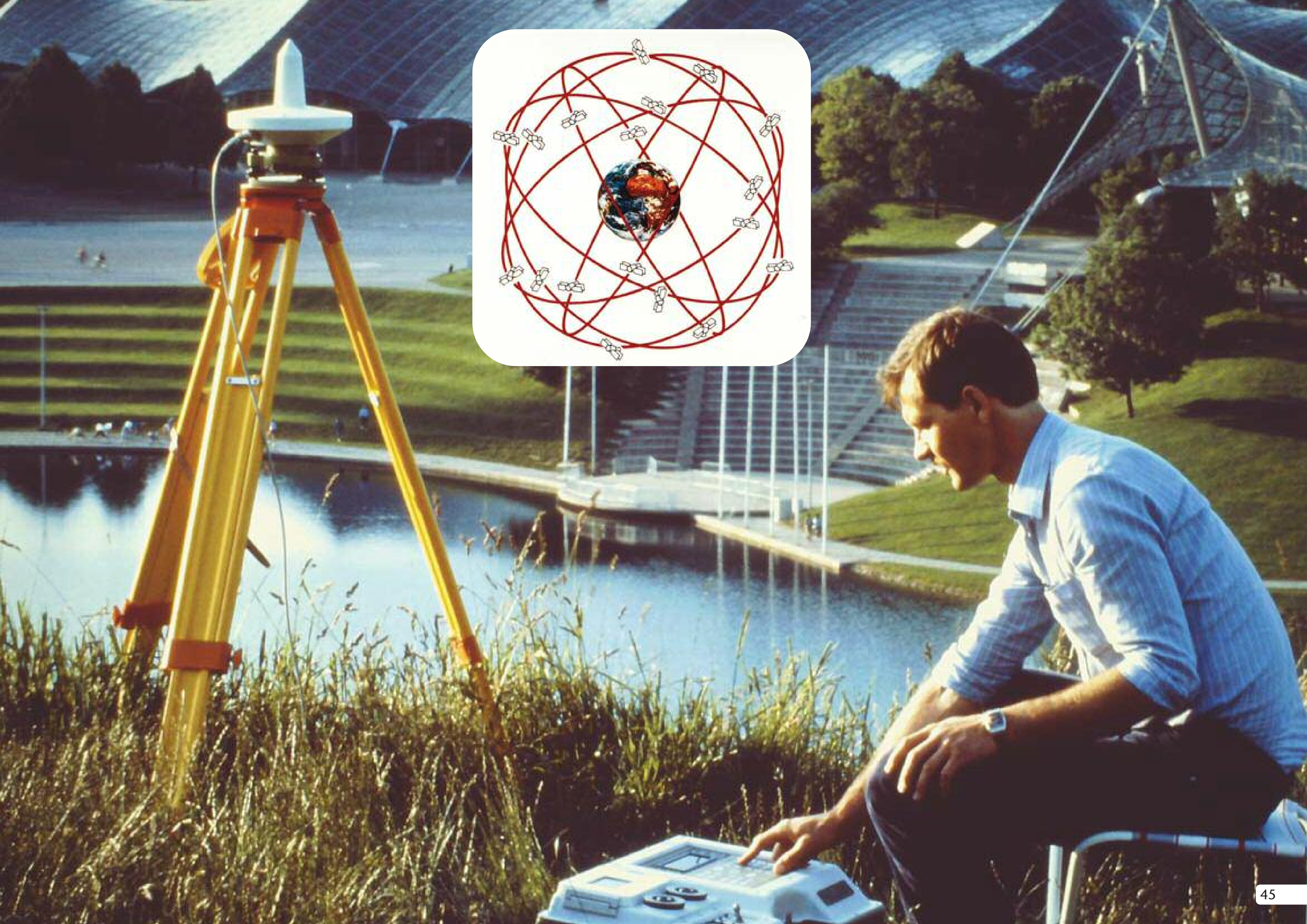
Left: By the end of the 1980s computers were firmly established in survey offices. This image shows a system running the Wild Geocomp software.

Right: Peter Jackson gets to grips with the first "on-the-pole" GPS system, the Wild System 200.

Images opposite: the first GPS constellation, while a surveyor operates an early Wild-Magnavox GPS receiver. Alas, GPS surveying was a bit like "Waiting for Godot" - it could take hours to get a fix.



SPECIAL PROJECTS

By the 1980s Wild instruments had been employed on projects as diverse as the Brighton Theatre (positioning of the seats during refurbishment), North Sea oil platform construction and Nimrod reconnaissance aircraft.

Right from the foundation of Wild Heerbrugg UK the company was keen to work closely with surveyors and engineers to solve measurement problems, whether on construction sites, fabrication yards or in factories where machinery will often need careful levelling and positioning. In 1973 the role was recognised with the appointment of Ray Pendlington, who was there to advise customers on the right instruments for industrial measurement, and in 1978 especially to support "Specialist Applications".

In 1974, with proposals beginning to firm up for the Channel Tunnel, Wild worked closely with the Royal School of Mines (RSM) to improve the accuracy of the GAK 1 gyro theodolite. Gyro theodolites are an essential item of equipment for mining and tunnelling. While conventional survey instruments can be used, it becomes difficult to maintain reference to a known point and soon the exact position within a coordinate, system such as National Grid, is lost; and while a gyro provides an answer they too have a habit of soon drifting off position so the best accuracy possible is important.

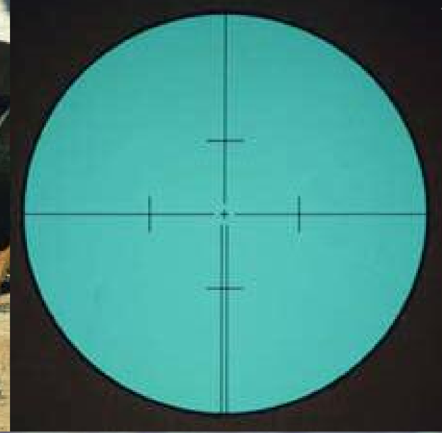
The solution proposed by the RSM was to change the instrument's reading scale for amplitude so that higher accuracies could be observed and to add a parallel plate micrometer to the optics. Following trials, it was found the changes improved accuracy from one minute of arc to 6" of arc – an improvement by a factor of ten. Disappointingly however, the modifications proved too sophisticated for normal field work especially in a mining environment – hot, busy and dusty. Nevertheless, a Wild gyro theodolite, the ARK 2 was used in 1981 for the precise harmonisation of new systems installed in a Nimrod maritime patrol aircraft. The reference axis of the aircraft's Inertial Navigator, IN radar and the Doppler radar systems all needed to be synchronised.

In the 1970s Britain was busy exploiting North Sea oil. Giant steel and concrete platforms were built onshore and towed into place. The North Sea oil construction boom introduced new techniques and demanded far higher standards of accuracy for steelwork fabrication than previously needed. The Nigg Bay yard on the shores of the Cromarty Firth was a vast site responsible for fabricating the enormous production rigs

Above: the Wild T2 was just as at home on the shop floor as it was on the construction site or mapping in the wilderness. The image shows an engineer using the T2 with the GAP1 prism for auto collimation. The image on the left shows a high precision industrial stand with the theodolite on top.

Opposite, background image: a surveyor uses a Wild T2 to check the assembly of components for a jet aircraft. Inset, top right: a surveyor checks the fabrication of units for shipbuilding. The cross hairs on the far right are a reminder again of the very high precision that has to be achieved in the engineering industries. Bottom right: a surveyor takes measurements to check the position of a major water crossing.





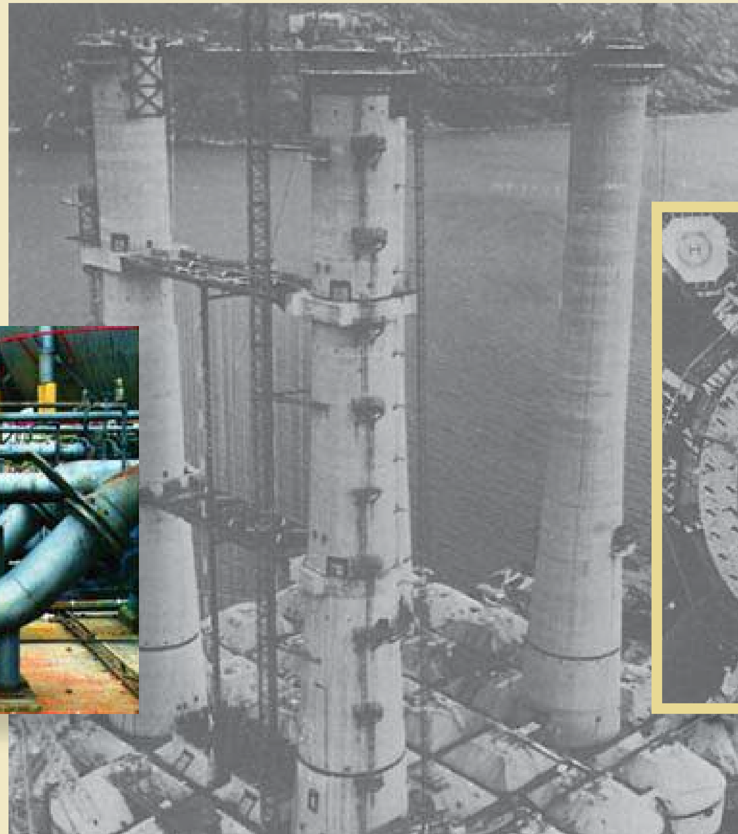

before they were towed to their resting place in the North Sea. Dimensional control was of paramount importance. No longer were surveyors and engineers using bubble levels, protractors and tapes; EDM distancers, electronic theodolites, lasers and levels were required. Wild supplied many of the instruments used in the yard by surveyors working for Highland Fabricators, a joint venture of Brown & Root and Wimpey.

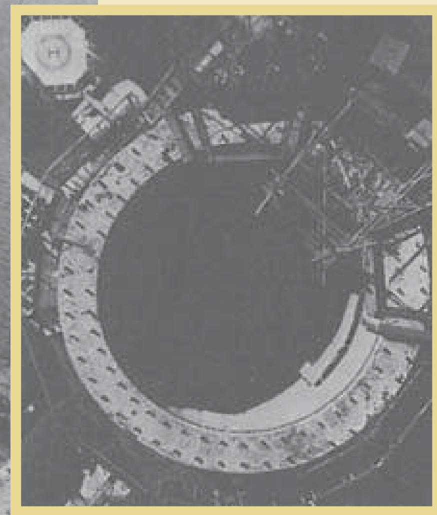
Typical projects at that time involved some very high precision measurement to align bolts cast into the top of a platform's legs so that they precisely matched the holes in a deck to be placed later, often being built in another country.

Argos Surveys faced just such a challenge on a giant four-legged concrete platform being built in Scotland. The platform was 160 metres high and required 400 bolts to be cast in, ready for the deck's peripheral mounting rings. Once the bolts were cast in, their position had to be recorded as precisely as possible so that the deck rings would fit but how do you do that for a horizontal surface 160 metres up in the air when the client requires a working tolerance of ±5mm over 40 metres? The answer was photogrammetry using a Wild P31 camera. When the deck, being built in Holland, came to be installed it fitted perfectly, much to the relief of the surveyors.

Over the years Wild instruments have been used for some unusual applications. In 1979 Albert Littley and Steven Reeves of Birmingham City Engineers Department used a Distomat DI3s EDM linked to a T16 theodolite for trial measurements of field events in the Guardian Royal Exchange UK athletic championships. Today, all athletic and field events use surveying equipment to check distances for accuracy; more often than not the total station will be a Leica one.

Above: the Wild ATMS Intersection Industrial Measuring System.





Right: A Wild P31 photogrammetric camera was used by Argos Surveys to capture the precise position of bolt cast in to the top of this vast concrete offshore oil platform. The far right view looks down on the platform top.

Right and above: Pioneering work by Albert Littley and Steven Reeves in the 1970s has led to EDM and total stations being used at sporting events like the Olympics. Here a surveyor uses a Leica total station to check the distance achieved of a discus thrower and a long jump specialist at the 1996 Atalanta Olympic Games. This software is now available as an 'App' on the latest Leica Viva range of instruments.

INDUSTRIAL METROLOGY

Almost from the earliest days of Wild Heerbrugg precision measurement in industry was seen as a growth area for the company. Designed by Heinrich Wild, the engineering levels N2 and N3 were launched in 1925 and 1928 respectively and from 1948 microscopy became part of the instrument portfolio with stereo microscopes appearing towards the end of the 1950s. During the 1960s and 70s the range expanded into photomicroscopes and special stereo versions on flexible arms to assist surgeons in operations.

Wild Heerbrugg UK's Industrial Department (now Hexagon Metrology) under Ray Pendlington became 'Specialist Applications' in 1978, working with major companies like British Steel, British Aerospace, British Coal. Peter Range too worked with these same companies and also, steelmakers and fabricators Redpath, Dorman & Long, utilising optical measuring instruments for industrial applications.

An Industrial Group was formed within Wild Heerbrugg comprising **Olaf Katowski** (Heerbrugg), **Don Waterman** (USA), **Peter Range** (UK) and others. The UK's Industrial Department office opened in Warmley Bristol in 1984-5. With the addition of the Kern Dual Electronic Theodolite System, RMS and ECDS systems applications developed rapidly with Wild becoming the supplier of choice in this area.

In 1980 an Industrial Measurement course was established at University College London, initially under the auspices of **Dr Arthur Allen** and in conjunction with Wild Heerbrugg UK and Rank Taylor Hobson. The course ran for many years and in 1997 a unique chair in Geomatic Engineering was endowed by Leica Geosystems UK under Professor **Paul Cross**.

With the joining of Kern to Wild Leitz and the subsequent merger with Cambridge Instruments (including Leitz Luton) the group became Leica UK Ltd with the new Industrial Metrology Division based in Luton and more recently in Milton Keynes.

Today the company is part of the Hexagon Metrology Division under **Duncan Redgewell**, who is a chartered surveyor and worked previously in the UK for Leica Geosystems. The Division supplies a range of advanced measurement systems to many high technology companies including the Formula One teams like Red Bull Racing, McClaren Mercedes and others. In this highly competitive sport where fractions of a second can mean extra or fewer points, the teams typically use laser trackers and other measurement systems like the Leica T-Scan 5 to help maintain their competitive edge.

Above: students, tutors and the irrepressible Dr Arthur Allan (right, kneeling) on the Industrial Measurement course. Kneeling on the first row with glasses (centre) is Brian Pearn from RTH, and next to him Peter Range (Wild). On the back row third from the right and wearing the red tie is Ray Pendelton (Wild) and the lady is land surveyor Mrs Tomlinson.

Right: Keep level and fly right - an engineering level is used to check the wings of an aircraft. According to the records, this image predates the founding of Wild UK by four years. The inset image (right) shows the same work today being done by a Leica T-Probe, similar to the one opposite above the Red Bull F1 car, for Airbus Broughton.

Background image: an engineer uses an Wild N3 precise level to check the alignment of a jig for aircraft manufacture. Left: Wild TC2000 and datalogger at work for the shipbuilding industry.

Below: Leica Geosystems now shares its new headquarters with Hexagon's Metrology division whose customers include the Formula 1 teams like Red Bull. Inset image shows the Leica Geosystems' Universal CMM, part of a coordinate measuring system.

will still recall that when they started out a computer was not an electronic device but a human being; indeed, a very important one who usually presided with much authority over log tables, Peter's tables, mechanical calculators and young surveyors who failed to book their readings clearly in the correct form. Since the late 1970s Wild had been working on mapping and data capture and processing systems.

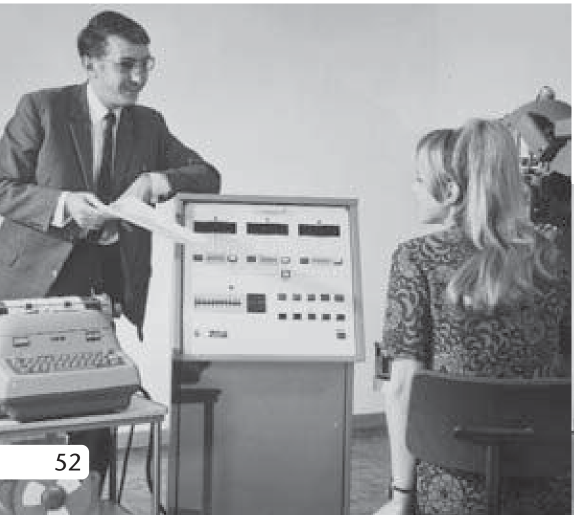
Electronics began to impinge on the surveying world from the mid 1960s onwards through instruments like the DI10 Distomat with electronics provided by the French Sercel company. But it was the 1970s when people became fully aware of the potential that computers held for survey. Suddenly we were in the age of the RS232 interface. So ubiquitous was the phrase that the satirical Not the Nine O'clock News team even had a song about it!

With the arrival of the world's first electronic total station, the TC1 in 1977 the way ahead was open to develop the transfer of measured data into a digital mapping system or to CAD, computer aided design. At that time is was estimated that a computer system could do design work in 8 hours that a traditional draftsman and drawing office would take 90 hours. Clearly there were big savings to be made even if the kit was horrendously expensive; typically a drawing plotter using ink-pen technology could cost £20,000 or more.

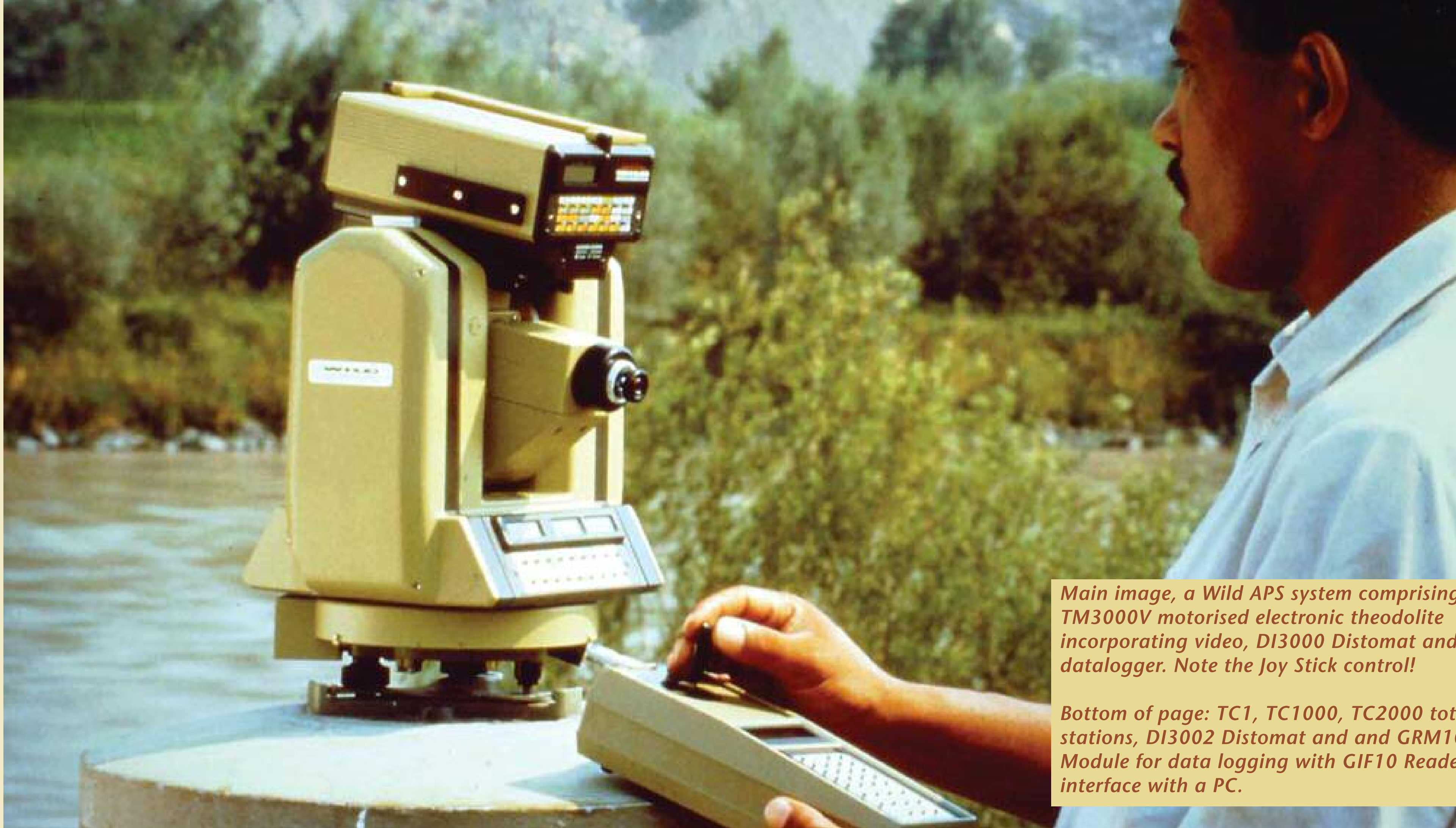
Several pioneering survey companies were active in this field, especially for road alignment and terrain modelling. Systems like MOSS and BIPS were early pioneers but an especially innovative system was developed by a Polish surveyor, Joe Cieslewicz. His CADACS system was featured in a Wild newsletter in 1978. Interestingly it was used for the planning and setting out of a certain new town in Buckinghamshire that was to play a significant part in the Wild-Leica story. Joe's survey company JTC Surveys were early users of the Wild GEOMEMO data logger to capture data from their DI3s Distomat.

It's worth recalling that the GEOMEMO could accept six-figure numbers and store them in one of five segments in its solid state memory; each segment could store up to 24k of data (memory hungry MS Windows was more than a decade away). Via a transfer module, data could be uploaded to CADACS. It was complicated and surveyors were having to learn new skills and all about RS232 interfaces. No easy Bluetooth back then!

Back in the office, surveyors needed terrain modelling software they could import their data to and process it ahead of giving it to the engineers and architects for their CAD systems. Wild's own Geomap software ran on a Tektronix computer with built-in screen and keyboard and supported the TC1 from 1981 to 1984. The 1980s were innovative times and there was emerging a wide range of different packages. Wild developed System 9 but it was aimed more at the mapping business. What was needed was a package for surveyors. Enter GEOCOMP, a "field to finish" software that could export easily to the industry CAD packages like MOSS, MicroStation and AutoCAD. GEOCOMP was succeeded in 1991 by LISCAD, which continues to this day as Leica's flagship modelling package.



Wild was using computers to solve surveying and photogrammetry problems from the early days but the arrival of computing power in the late 1960s drove many new developments. We shall learn more about photogrammetry in the next section of this history. Below from left to right: the Wild EK8 computer introduced in 1968, a Wild A9 stereo plotter, (1957-72), Wild AC1 Analytical Stereo Plotter and TA2 Plotting Table launched in 1980, the Wild BC1 launched in 1982.



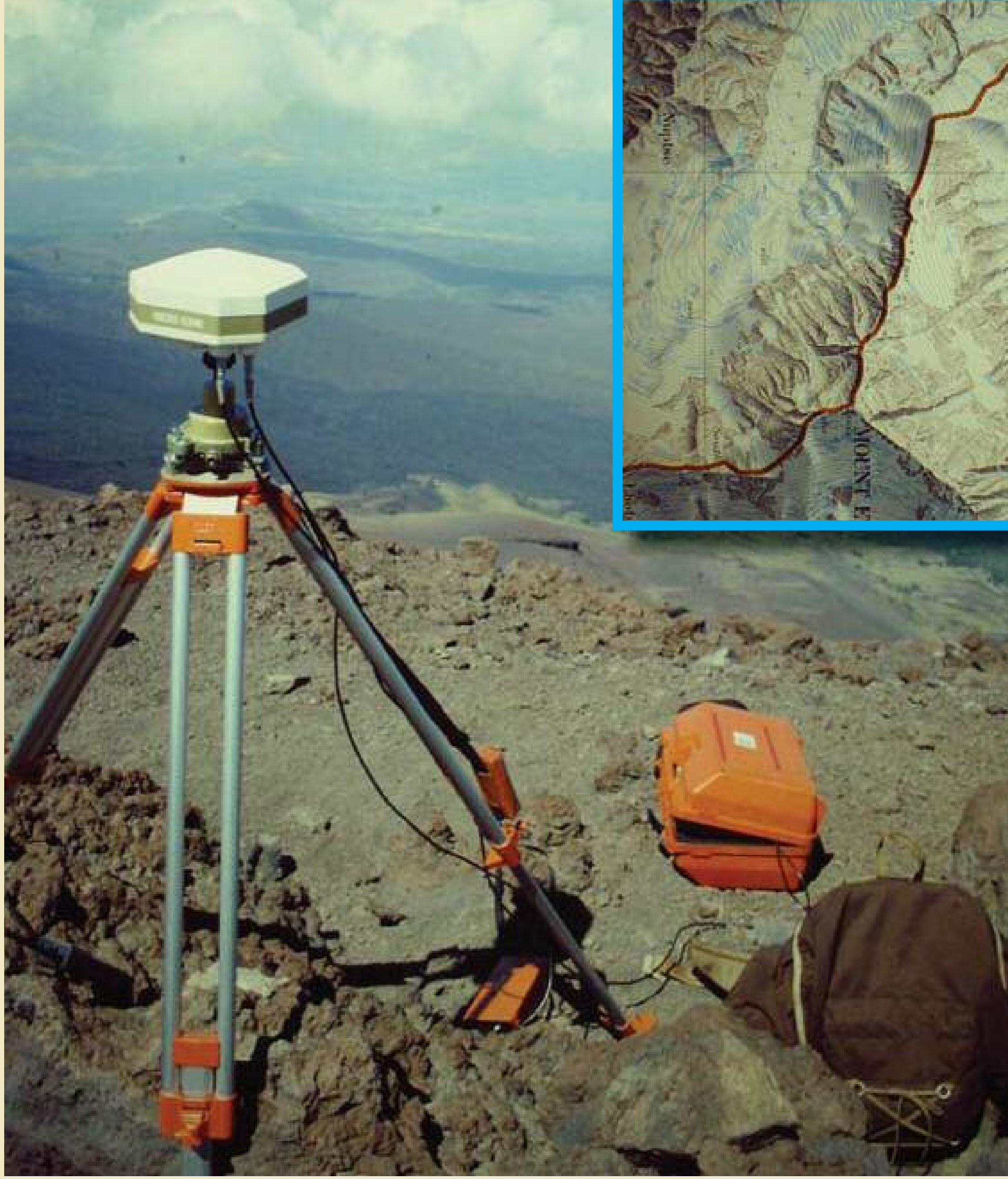
Main image, a Wild APS system comprising a TM3000V motorised electronic theodolite incorporating video, DI3000 Distomat and datalogger. Note the Joy Stick control!

Bottom of page: TC1, TC1000, TC2000 total stations, DI3002 Distomat and and GRM10 Rec Module for data logging with GIF10 Reader to interface with a PC.

EXPLORATION and MOUNTAINEERING

Surveying instruments have accompanied explorers and mountaineers for more than two centuries, indeed it was Heinrich Wild's experience with other makes of theodolites that inspired him to design the T2. Throughout most of the 20th century Wild or Leica instruments have invariably been the kit of choice for explorers and mountaineers. Whether crossing the Sahara Desert or trekking to the South Pole, before the arrival of GPS the trusty T2 was essential for navigation.

In 1978 a T2, complete with leather covers over the controls, accompanied the Transglobe Expedition that followed the Greenwich meridian from pole to pole and which included legendary explorer Sir Ranulph Fiennes. Navigation was by astro (the stars) fixes. To quote the team who used the T2 "The instrument was bumped and thumped for a hundred miles or more. Our breath frozen on the lens, and our eyelashes to it. Even the low temperature lubricants partially froze; despite this and the necessity for three pairs of mitts, we still achieved fine control for elevation and traversing."



Above: a Wild SR299 GPS positioned near the summit of a volcano monitors the state of the mountain.
Left: Explorer Sir Ranulph Fiennes takes an angle through his T3 theodolite somewhere in the Antarctic.
Opposite page, main image: the challenging Himalaya with Mt Everest the target for a theodolite and EDM survey. Inset bottom right: the summit of Mt Everest and how the GPS satellites need to be configured for Bernard Chamoux to set up his Wild GPS (inset top left)

Leica Geosystems new headquarters in Knowlhill, Milton Keynes, which the company shared with associates Leica Camera and Leica Microsystems.

A New Era arrives,

Part 2 ‘challenging the nineties’ in an age when it has to be right

A Chinese proverb says “May you live through interesting times”. Anyone who came of age or lived through the 1980s can attest to that. It was a period of great economic and social change; many prospered, some faltered. For Britain, the period began with high unemployment and decaying old industries and ended with the Poll Tax. Meanwhile the world saw the collapse of the Soviet Union and the end of the Cold War.

At work, most organisations were busy installing desktop computers. At home, families grappled with Acorns, Ataris, Sinclairs, the BBC’s Micro and setting the timer on the video recorder, all to the musical accompaniment of Michael Jackson, Madonna, Queen and many more.

Meanwhile the nation’s infrastructure continued to grow. The Thames Barrier, built to protect the capital against flooding, was opened by Her Majesty the Queen in 1984. While towards the end of the decade Britain’s construction industry was busy gearing up for the construction of the Channel Tunnel. Work had also begun on London’s derelict Docklands to create a new financial centre east of the City and soon to have the soaring tower of Canary Wharf.

The decade also saw a grim battle between Maggie Thatcher’s Government and Arthur Scargill’s coal miners. At the Stock Exchange something called the “Big Bang” (fortunately not caused by the IRA) introduced electronic and deregulated trading. There were two Royal marriages and the birth of an heir to the throne. And in France a young scientist named Tim Berners Lee was working at the European nuclear research centre CERN, developing something called hypertext for the world wide web. What on earth was all that about?

It was a time that saw the rise of the multi-national global company. Although Wild Heerbrugg had many companies around the world, including in the UK, it still had something of the friendly Swiss family business it began life as in the 1920s. But by the early years of the 21st century the Wild name was no more and Leica Geosystems was part of the truly multi-national Hexagon Group. But once again we’re getting ahead of ourselves.

On the move again

In 1987 Wild became part of the Wild-Leitz Group, which included as one of its products the world renowned Leica camera. A year later the group was joined by the venerable and long established instrument manufacturers Kern of Aarau, whose

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It was an era dominated by the convergence of technologies and the emergence of an entirley new one, the Laser Scanner.

Five important brand names came together at the new Milton Keynes headquarters: Kern Swiss, Wild Heerbrugg, Leitz, Reichert-Jung and Cambridge Instruments. For surveying equipment the most significant was Kern Swiss. Under the new name of Leica, the Wild brand continued. The addition of Kern added several important technologies including the high accuracy EDMs (above), the Mekometers Me-3000 and Me-5000 and the Kern Laser Tracker (right).

EDMs and photogrammetric systems and theodolite based coordinate measurement system were to lead to the Leica Laser Tracker system. Several of Kern's technologies were state of the art and were regarded at the time as being the equal of Wild's. The new group's portfolio now included the Kern Mekometer, a super accurate EDM that took distance measurement to new levels of accuracy and precision and could be used for reference and calibration of existing instruments.

A year later the Wild Leitz Group merged with Cambridge Instruments and in 1990 became the Leica Holding Group. By now the company had become more solutions based and moved forward adopting the Leica name and banner as manufacturers and developers of surveying and photogrammetry systems, cameras, microscopes, as well as optical-scientific instruments. Many products in the survey sector, however, retained the Wild brand in their name.

In the UK, the enlarged group of five companies urgently needed new premises. The Wild base at Chatham was no longer suitable so the search was on for a new headquarters.

The rapidly expanding new town of Milton Keynes in Buckinghamshire – located in the heart of England with easy links to the M1 motorway – was ideally placed for the company to service customers. The move came in September 1989 to the Knowlhill area and into newly built award-winning premises, which looked incredibly high-tech with more than a hint of the Centre Pompidou in Paris about it.

Milton Keynes proved an ideal choice for the company. Well connected to the motorway system as well as the West Coast rail route out of London and nearby Luton Airport, the location was perfect for a period of further growth, which continues today with the recent move in 2013 to even larger premises in Tongwell, Milton Keynes, barely a mile from the M1 motorway and now shared with sister company Hexagon Metrology.

Having settled the name of the new company, following a brief period trading as Wild-Leitz, Leica UK was now poised for rapid advancement across its various businesses. It was a time that would see a number of world firsts in the fields of vision, measurement and analysis. It was also time for a new man at the helm. Brian Snelling retired in 1987 and died peacefully on 30 August 2013. His successor for Wild Heerbrugg UK was Neil Vancans from 1987 – 1989. Then, through the transition to Leica UK, Neil initially became sales director for both Survey and Microscopy. Then in 1992 managing director of Leica UK Ltd.

First appointed by Snelling to join the sales team in 1982, the young and highly talented Neil Vancans by 1991 had already gained experience in most aspects of the company's activities at that time, including industrial metrology and a sales managerial role.

Neil was an accomplished leader with a knack for picking talent and letting them get on with it. He was an extremely personable managing director who could just as easily argue a complex technical brief or charm a demanding customer. Neil was also not above what one might call 'a bit of a lark'. In the early days at the new Milton Keynes headquarters in Knowlhill he noticed across the road from the building construction was underway on another office block. The builders were using a rotating laser level on a tripod but it wasn't a Leica one. Neil grabbed a Leica one from the stores and leapt across the road to replace the rival's instrument leaving the puzzled builder to discover the swap!

People tend to forget there was a recession in the UK in the late 1980s and early 1990s, with rocketing interest rates and wildly fluctuating exchange rates. Despite these tough trading conditions Neil Vancans grew the company until 1996 when he headed off to the US to run Leica's new GPS headquarters in Torrance near Los Angeles. He handed over the reigns to Mark Concannon of which more anon.

Further changes in the structure of the new merged group had followed in the early 1990s. The civilian GPS business of Magnavox was acquired in 1993 and in 1997 the name Leica Geosystems first appeared. At the same time several other business areas became independent with plotters going to Zund Systemtechnik AG and the camera company became Leica Camera AG. The production of optics and electronics, previously carried out in-house at Heerbrugg, became Wildtronic and Swissoptic respectively.

A new era of professionalism

During the 1960s and 70s Wild Heerbrugg UK developed the concept of "Your Measurement Partner". By establishing good links with clients to ensure a close relationship there was clearly mutual benefit. For Wild, the company's sales representatives and technical staff could gain a closer understanding of their customers' businesses so that they could provide the right equipment. For customers it meant they gained increasing confidence in a supplier who understood what they were trying to achieve. This approach was taken a stage further in the 1990s as the new company began to define itself as "a solutions provider", a company that would not just supply an instrument but could offer a turnkey solution – from measurement to deliverables.

This approach coincided with the rise in the company of a very professional and talented person. Joining the business in 1986, a young surveyor from Yorkshire with an inherent and personable knack for leading a team and making business succeed (he had previously run a series of discos on the Northern Soul circuit but that's another story!) was making good progress in the company. Three years later in 1989 **Mark Concannon** became UK sales and marketing manager.

Mark joined Wild Heerbrugg UK following experience in oil exploration

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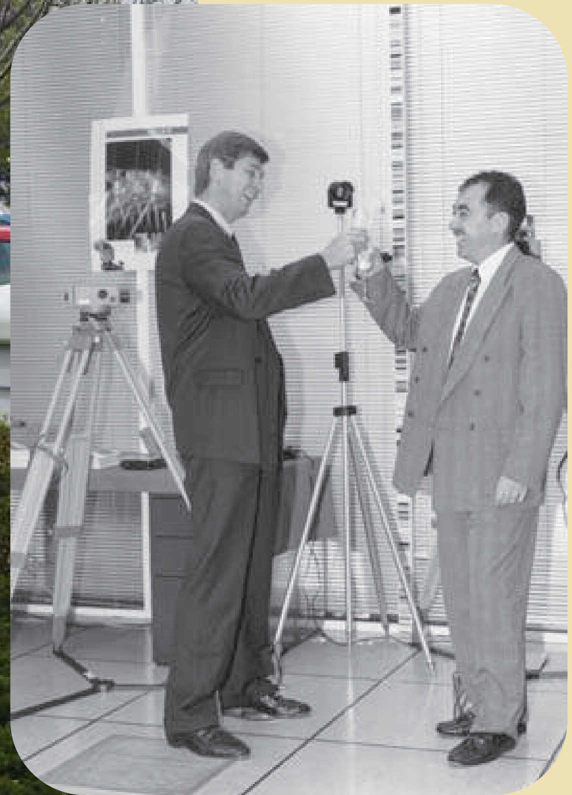

Installed in the new headquarters at Knowlhill, Milton Keynes and under the leadership of Neil Vancans (left) Leica was ready for a period of major progress that would see the launch of several important new survey technologies. Below right: Neil and sales manager Mark Concannon celebrate the successful UK launch of the Wild NA2000 digital level.

Left: the UK sales team in 1990 on a visit to Heerbrugg. Who do you recognise?

PHOTOGRAMMETRY

Surveying from photographs!

The principles and advantages of measuring three-dimensional scenes or objects from images or drawings have been known since at least the 17th century, as our picture opposite shows. However, it was in the late 19th century that the accurate measurement of physical objects from photographs became possible.

The capture of two offset images enabled stereo viewing and the calculation of height from aerial images or depth from terrestrial ones, was possible. In recent years the technique has not only been used for mapping but on projects as diverse as facial reconstruction, dentistry, Stonehenge and Mozart's piano. One day it may help restore the famous Bamiyan Buddhas destroyed by the Taliban in Afghanistan.

Given its mountainous terrain and the difficulty in creating a flat paper map, it is perhaps not surprising that mapping from stereo pairs of photographs advanced more rapidly in Switzerland than many other countries. Almost from the beginning Wild Heerbrugg Heinrich Wild turned his attention to designing precision cameras and photogrammetric plotters. The first dedicated survey cameras appeared in the 1920s with the P30 terrestrial camera and C2 aerial camera, and in the 1930s, the RC3 vertical aerial camera. The 1920s also saw the development of the first stereoplotters with the arrival of the Wild A2 model in 1926. The A4 and A5 models followed which were commercially much more successful. The emergence of this technology enabled the speeding up of map production from aerial photography – a process that was becoming more important in a developing world as well as a world that was at war between 1939 and 1945.

In 1938 the managing director of Aerofilms, the British company that specialised in aerial photography, was so impressed with the Wild A5 Autograph stereoplotter, which was shown at the International Society for Photogrammetry (now the ISPRS*) Congress in Rome that year, that he purchased the first production instrument. It was a prescient decision. Within a year Britain was at war and all civilian mapping ceased. But the demand for mapping rocketed as the generals planned their campaigns and the planners poured over aerial photography from enemy territory

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Left: a simple sketch from the 17th century shows how measurements can be made using two separate viewing locations.

Below: even before the second world war Wild had developed a stereometric camera, here shown capturing a seen from a road traffic accident.

Above: the plotting room at Ordnance Survey in the 1970s. In the foreground an operator is working at a Wild A10 Autograph.

Right: an operator controlling a Wild RC10 aerial camera.

Below: A Wild A9 stereoplotter.

to identify targets or the success of their bombing raids.

Stereoplotters are amongst the world's most complex mechanical devices ever created and are every bit as complex as an aircraft engine or a ship chronometer. They require skilled engineers and craftsmen to build and to maintain them. Their annual sales were measured in dozens rather than thousands as the sales summary opposite records:

Originally the stereoplotters manufactured by Wild and Kern were optical-mechanical instruments. They were the product of an analogue world. The development of analytical plotters only became possible with the arrival of computerised processing in 1964 with the prototype Wild B8 Stereomat.

Development continued during the 1970s so that towards the end of the decade the first analytical stereo plotters became commercially available in the form of the Wild AC1 and BC1 as well as the Kern DSR range. Just after the move from Chatham to Milton Keynes and the merger with Leitz and Kern the principle analytical plotters were the Kern SD2000/3000 range.

With these developments the creation of orthophotos was becoming easier and less costly. An orthophoto is a geometrically corrected photograph that has a common scale and corresponds in detail to a map. Reliable measurements can be made from orthophotos but before the computer age the creation of an orthophoto was a painstaking cut-and-paste process from stereo photographs and only justifiable for important aerial mapping projects.

With the arrival of relatively cheap desktop computers in the 1990s with fast processors and large VDUs, the need for specialist dedicated photogrammetric workstations declined. Now the focus was on the software. If digital stereo data had been captured the creation of orthophotos could be left to the software.

In the digital age pixels from imaging cameras and point clouds from laser scanners provide the raw data for analysis by a photogrammetric system with software that might even be cloud based. Today, the creation of very accurate 3D models is possible relatively cheaply once the raw data has been captured; and with the arrival of UAVs, (unmanned aerial vehicles) we can expect that many smaller mapping projects will rely on a photogrammetric solution from the images captured by the UAV's onboard camera or even LiDAR sensor (airborne laser scanning).

**International Society for Photogrammetry and Remote Sensing*

Above: in 1835 William Henry Fox Talbot captured an image of an oriel window at Lacock Abbey and thereby became the first person to produce a photographic negative that could be repeatedly reproduced as a positive image. His achievement was marked 150 years later by BKS Surveys Ltd who returned to the Abbey to carry out a photogrammetric survey of the same window using a Wild P31 camera.

Evolution of the Wild Stereoplotters

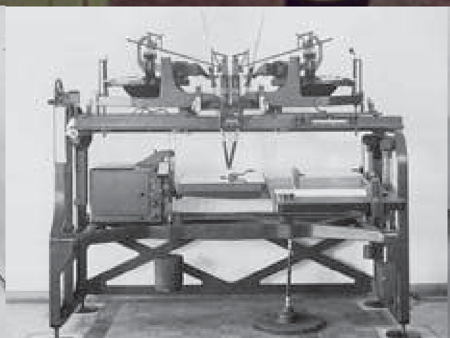
Wild A1, 3 prototypes built
Wild A2, (1926 – 1941), 28 sold
Wild A4, 1933 – 1963, 33 sold
Wild A5, 1937-1953, 90 sold
Wild A6, 1940-1953, 115 sold
Wild A7, 1952-1972, 412 sold
Wild A8, 1952-1980, 1035 sold
Wild B8, 1961 – 1972, 721 sold
Wild B8S, 1971 – 1982, 808 sold (making the total number of B8s sold 1,529!
Wild A10, 1969 – 1984, 308 sold
Kern PG2, 1960 – 1985, >700 sold

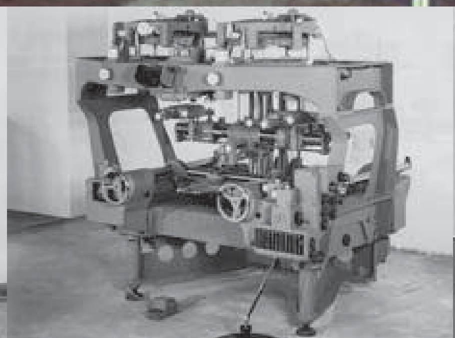
The source for the above information and much more is: http://www.wild-heerbrugg.com/photogrammetry1.htm

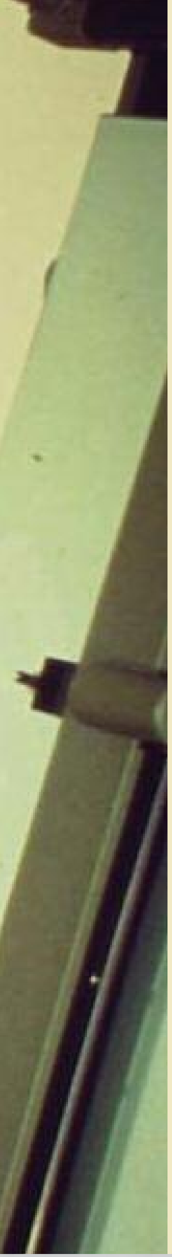
Right: English Heritage surveyors at work with a Wild P31 camera and Leica total station.

Below: Map production from stereo aerial photography. The heart of BKS Surveys before the digital age.

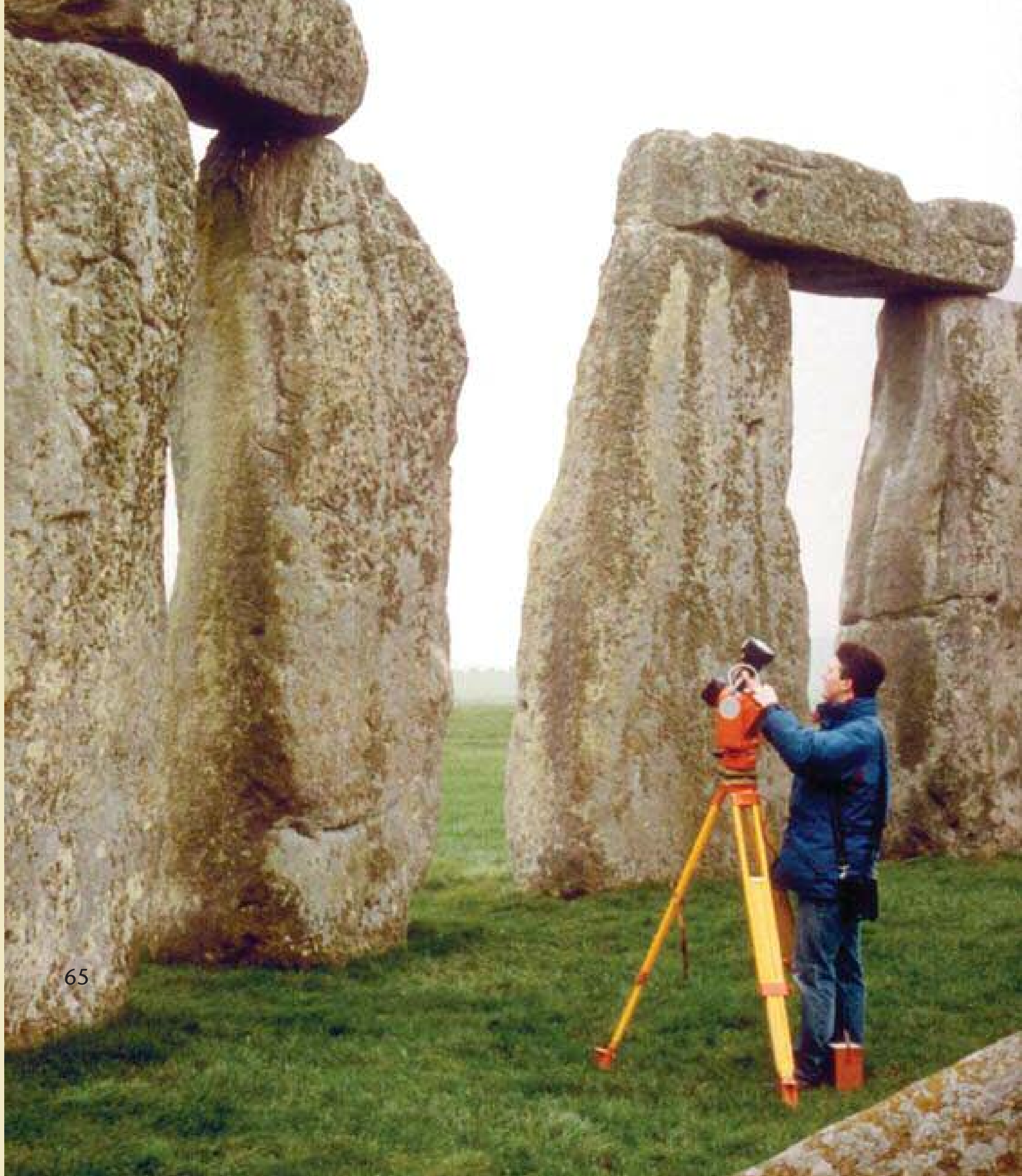
The Wild AMU Stereoplotter.



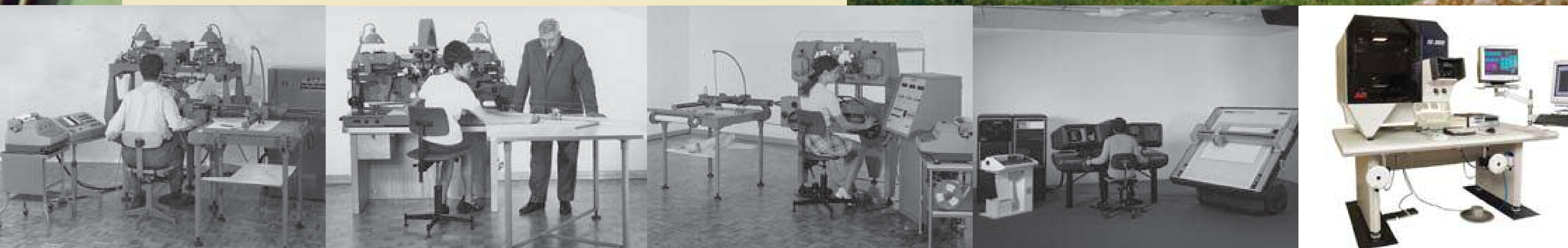




Right: a surveyor at work with the Wild P31 camera capturing close-up images of Stonehenge. This work continues today with even more detailed imagery captured by Leica's HDS laser scanners.



Below: an array of images that track Wild's photogrammetry history from early days to the first truly digital system. From left to right: a Wild Stereoscope (1937); a Wild A6 dating from 1940; Wild A7 (1949); Wild EK Computer (1949); Wild A8 Stereoplotter (1950); Wild A9 Stereoplotter; Wild B9 (1958); Wild A40 Stereoplotter (1964); Wild AC1 Analytical Stereo Plotter (1980); SD2000 Photogrammetric Plotter.



survey work in Bangladesh. He initially looked after the dealer network; then as area representative in the South East he had responsibility for major projects such as the Channel Tunnel, the redevelopment of Docklands and Canary Wharf, where he was manager of the Survey Connection Office, a purpose-built base to serve the Greater London area.

Mark was an experienced surveyor and an ambitious young man focused on winning. He had a clear vision and a strong ethos of leading by example. He was a team-builder and was ideally suited to take on and develop the Leica UK sales team to become a professional, customer focused and technically highly competent team of technical sales representatives. Mark was also responsible for introducing a new standard and style of presentation to customers for survey technologies in the UK market that began with the Leica UK 'New Era Tour' of 1992, a series of animated and lively roadshows. His energy and drive developed the culture that forms the bedrock of Leica Geosystems today.

In 1996 Andrew Young joined as senior accountant, became company secretary and is now (2014) the longest serving officer. In the same year Neil Vancans left the UK to head up Leica's GPS business in the US while Mark Concannon took over as managing director. Mark oversaw a period of very considerable growth and technological innovation. By 2000 Mark's responsibilities had increased to include an EMEA management role. At that time the "Leica Geosystems" brand name appeared for the first time following the de-merging of the Surveying and Microscopy divisions. The following year there was a change of ownership throughout the group with the arrival of Investcorp, a global fund manager. They took over a worldwide network of research, development, manufacturing, sales and service organisations employing in excess of 2300 people worldwide. The group was engaged in providing a comprehensive range of measurement technologies. A true "geosystem" of companies.

Partners

The 1990s and 2000s saw an expansion of new business outlets, some of them independent of the company but trading on a partnership basis as approved suppliers. These new Distribution Partners, as they were known, include M&P, Survey Connection, Zenith, Swift Surveying Services, SCCS and Opti-cal. Meanwhile, Speedy Asset Services and ESS Safeforce are rental partners.

The decade when GPS came of age

By 1992 it was time for a "New Era" and that was the theme behind a series of product launches that began with the Wild GPS System 200, the world's first RTK GPS system. As more satellites became available surveyors would no longer have to wait hours for a fix: they could survey on the move.

Many surveyors and engineers still remember the series of sell-out events that launched the Wild GPS System 200. Dry ice, dramatic lighting, impressive stage-sets and autocued presenters announcing the "New Era". So successful was the Heathrow event that four of the then £44,000 systems were sold that day.

A new era was indeed emerging and over the next seven years Leica sold over 1000 GPS systems in the UK. But although the GPS constellation was now complete (and the Russian GLONAS system was beginning to contribute to what was to become GNSS) it took until the millennium year for GPS navigation and positioning to take the next step forward. In 2000 President Clinton announced the removal of the US military's deliberate degradation of GPS signals (known as Selective Availability).

The removal, although significant, did not affect Leica's GPS receivers, which rely on advanced data interpretation and processing of the satellites' signals to achieve their high accuracy levels. What the move did achieve however, was to improve the accuracy of GPS for civilian and applications like personal navigation and hiking,

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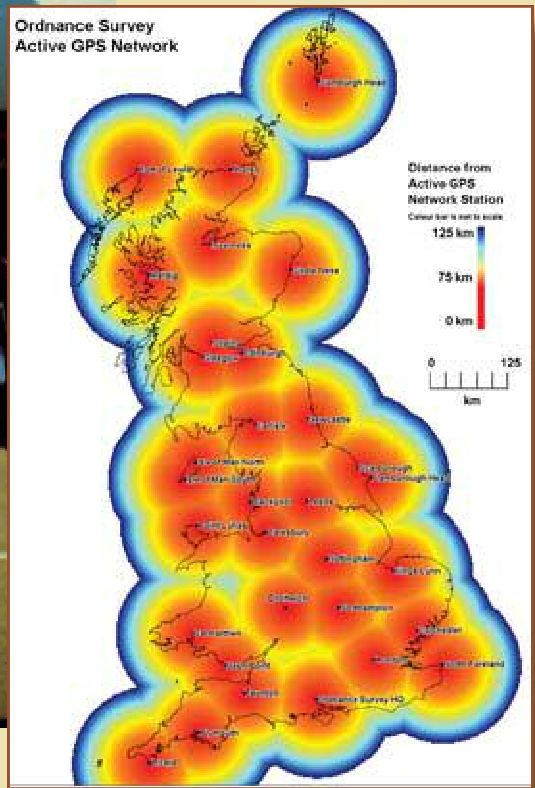
Below from left to right: GPS at sunset. A surveyor checks a position beside a railtrack. The GPS System 200 made it all the way to the roof of the world, Mount Everest. Leica GPS System 500 was a major step forward. An Ordnance Survey surveyor uses GPS System 500 to capture data.

Above: the marketing department got a little carried away with the possibilities for GPS.

Beginning with the landmark launch of the Wild GPS 200 System in 1992 at Heathrow, the world of surveying was on a path of change. Throughout the decade accuracies improved, driven by more statellites. But a major step forward came in 2006 with the launch of Leica SmartNet (above). The map shows the stations available at the launch of the service; since then the network has been extended.



Left: Ordnance Survey's network of passive continuously operating GNSS stations covers Great Britain and provides the key data upon which Leica SmartNet relies and has increased in number since the original distribution shown here.

SURVEYING BY SATELLITES

The modern world has become almost completely dependent upon navigation satellites. From tiny chips that cost only a few pence embedded in vehicles and containers to track their movements, to mobile phones, they have now become an essential utility like water, gas or electricity became during the late 19th and early 20th centuries. But like those earlier utilities satellite positioning and navigation technologies have taken awhile to mature and reach their full potential.

With the launch of the first satellites in October 1957 (the Russians just beat the Americans) it was realised that there was opportunity for accurate positioning and navigation. The first such constellation of six satellites was built between 1957 – 1963 and known as the US Navy Navigation Satellite System (more familiarly, the Transit system). In the 1980s this was gradually replaced by the 18-satellite Navstar Global Positioning System (GPS) which now, with further upgrades, is part of what we call the Global Navigation Satellite System (GNSS) comprising in addition to GPS, the Russian GLONASS, the Chinese Beidou (Compass) and European Galileo constellations. Together they can offer surveyors anywhere in the world positional accuracy down to a few millimetres.

Although it was realised that earth-orbiting satellites could provide accurate positioning, achieving that reliably and cheaply was a long way off in 1964 or even twenty years later in 1984 when Wild Heerbrugg in

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Above: Leica SmartNet provides positional corrections to surveyors and engineers from three or more satellite constellations.

Right: no, it's not a 1980's ghetto blaster with a handy antenna for better reception but the dawn of GPS Surveying, the Wild WM101.

Below from left to right: A sprightly Alan Murray tries out the Wild GPS System 200. It all fits neatly in a carry case. The Leica GPS System 500 controller and antena.

A surveyor puts the Wild GPS System 200 through its paces at London Heathrow. Note the ear defenders just in case Concord kicks off.

a joint venture with Magnavox Advanced Products and Systems Company of Torrence USA formed a partnership called WM Satellite Survey Company. This partnership introduced the world's first GPS receiver designed for land survey in 1986, the WM 101. Two years later Wild Heerbrugg UK made one of the largest sales to date for GPS receivers to Northern Ireland based BKS Surveys, now part of the Fugro group. In 1994 Magnavox's civilian GPS business was acquired by Leica.

To get an accurate fix on the ground you needed to be able to get data from at least four satellites as well as a ground station. Since the early 1990s with the completion of the GPS constellation, and the launch of the Leica System 200 a 'New Era' began for GPS survey techniques, satellite surveying has increasingly become the answer for many survey applications and especially control.

Today, Leica Geosystems offers some of the world's most advanced solutions for positioning and navigation, from simple handheld site surveying and GIS data collection receivers to embedded machine control systems for construction, rail, agriculture, infrastructure. A milestone in this development came in 2001 with the historic agreement signed with Great Britain's Ordnance Survey allowing OS surveyors to update maps on the spot. This close relationship facilitated the development of SmartNet, Leica Geosystems' real-time correction service available 24/7 available throughout the UK and Ireland, both north and south.

Right and above: the Wild CR299 GPS controller was the essential tool for GPS surveys.

Below from left to right: in the early days of GPS it was very much about the call of the wild as surveyors trecked over remote parts of the globe to ascend volcanoes and high points. With the arrival of Wild GPS System 200 surveyors at last had a useable GPS survey tool. Far right: a surveyor using the Leica Viva GS08plus Net Rover with GNSS technology.

Right: In 2001 Ordnance Survey Director General Vanessa Lawrence and Hans Hess, CEO of Leica Geosystems signed a partnership deal for Leica to supply CORS receivers for Ordnance Survey's new GNSS network of passive receivers. The network led in 2006 to the launch of the Leica SmartNet GNSS real-time correction service.

Below a surveyor struggles to find his pipe or possibly a screwdriver, who knows. Surveying was a lonely existence for many in those days.

easing the way for new commercial applications like satnavs, mobile phones, tracking devices and today's ubiquitous application of GPS across so many industries. But for the survey world one final move was necessary to bring the cost of GPS/GNSS positioning within the reach of all surveyors and engineers.

For accurate surveys by satellite positioning you need two receivers. One can only calculate its position to within 30 metres or so. To get the centimetre level positioning essential for construction, geometry dictates that you need two receivers, and that makes the equipment expensive. The solution to this problem was Leica SmartNET, a system based on broadcast positions from fixed continuously operating reference stations (CORS). In the UK the backbone to this system was provided by Ordnance Survey and enhanced by further reference stations provided by users. Now surveyors could purchase just one receiver and for a modest subscription to the service get accurate real-time kinematic (RTK) positioning. To see how this system evolved into today's Leica SmartNET system see "The shift to a new dimension" below.

Technology powers ahead driven by the microprocessor

The 1990s were times of rapid software advances but what was needed was a way of easily upgrading an instrument's onboard software. In 1992 this arrived with the first upgradeable software functions appearing on the TC1610 total stations, along with the VIP software suite. Two years later in 1994 the first of the TPS range of total stations arrived with software running under Windows and the "Open Survey World" concept, easing data exchange between instruments and office PCs by using the handy PCMCIA data cards.

The total station begins to merge with other technologies

Development of Leica's total stations continued apace during the 1990s and the first decades of the 21st century. 1998 saw the launch of the TPS range including the TPS300 and TPS1000, the world's first total stations fitted with coaxially reflectorless EDM. Ten years later the range had grown to include the advanced TPS1200 SmartStation with an integrated GNSS sensor that placed a receiver on top of the instrument.

Further major developments came in 2009 with the introduction of the TS30 and TM30 total stations equipped with direct drives based on piezo technology. They were aimed at high accuracy and monitoring applications which were growing in demand driven by projects like Crossrail. The following year saw the launch of the Viva range, a move that followed the introduction of the X-function in 2004 that had at last enabled surveyors to use the same file and database structure for total station and GNSS sensors. The Viva and Zeno ranges fully integrated the two technologies and also introduced features like image sensors and colour touch screens, enabling users to simply tap points on the screen to capture them.

By the second decade of the 21st century surveyors and engineers had a device that not only included reflectorless EDM but offered integrated GNSS, colour touch screens, scene capture from an onboard digital camera, see-as-you-go on-screen surveys and flexible build options like the Flexline range (over 60,000 units have been sold worldwide since 2004). The innovations enabled customers to define which features and accuracy levels they needed for their business and applications. In addition, users now had intuitive easy-to-use software that could easily integrate within a business workflow.

Today, there is a total station for every significant market sector, from construction (the iCON range introduced in 2012) to professional surveyors needing ultra high accuracy instruments for applications like monitoring or control surveys. The very latest development in 2013 sees a further merging of

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Below from left to right: Tim Badley puts a TC500 electronic total stations connected to a Grid tablet computer through its paces. The keyboard of a TC 2000. A T16, Distomat and data recorder sit atop a Triangulation Pillar. A Wild T2000 electronic theodolite connected to a Distomat and keyboard is the ideal combination for this crew capturing details for monitoring Ely Cathedral. The Leica TPS 300 launched in 1998 marked a new era for the total station..

With a Distomat connected to a Wild T1 theodolite and keypad the operator could simply reduce readings.

MAJOR PROJECTS

By the late 1980s and early 1990s a number of mega projects were underway in the UK. Accurate dimensional control was needed and clients were increasingly demanding finer tolerances, indeed the nature of the work required it, projects like Canary Wharf in London's reviving Docklands, the Channel Tunnel, the Dartford Crossing, the second Severn Crossing, Sizewell B nuclear power station, the London Water Ring Main, Broadgate (at the time Europe's largest office and retail complex) and even Alton Towers and its scary Nemesis ride!

Wild and Leica products all played a leading and critical role on all of them, ensuring that they were built to the increasingly finer tolerances specified by the engineers and designers. Several of these projects featured in Leica's advertising at the time under a strapline of "a day in the life of. . ." with a focused narrative from the project's senior surveyor. Let's look at how Wild and Leica instruments helped to keep some of these massive projects on line and level.

Sizewell B

Construction began in 1987 on Britain's only commercial single pressurised water nuclear reactor. Built by John Laing, it joined the National Grid in February 1995. Chief land surveyor for Laings, Mike Collier and his team used over 100 Wild and Leica instruments. The project was one of the first in the UK where the new pioneering bar-code reading digital level, the Wild NA2000 was used. On one survey it achieved a 0.2mm closure over 1.8 kms of levelling – way better than the instrument's stated specification!

Canary Wharf

In the early 1980s the London Docklands Development Corporation were charged with the redevelopment of the vast area formerly covered by London's docks, a major part of which was Canary Wharf. The project involved building some 14 million square feet of office space to create a new financial district East of the City. At its centre was to be a tower, which at the time would be the highest building in the country (dwarfed now by the Shard, see also page 92). Known as One Canada Square, the tower's primary control was provided by Wild T2000 electronic

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Above: Sizewell B nuclear power station.

Right: Tim Burton (on left) with Wild T2 and Distomat with colleague Mark Leggett at Canary Wharf Tower (One Canada Square). For 20 years until the arrival of the Shard (far right), the tower was the UK's tallest building at 235 metres.

theodolites and the Wild DI2000 EDM. The same equipment plus a special column instrument stand was designed to maintain verticality on the 800 ft tower as it progressed skywards.

The Channel Tunnel

Meanwhile on the Channel Tunnel chief surveyor **Eric Radcliffe** and his team were using 140 Wild instruments, including advanced gyro theodolites, to ensure that when break-through came by the French tunnelling team in early 1991 closure was to within a few millimetres. Eric recalled before his death in 2010 that there was a shortage of experienced tunnelling surveyors at the time. Fortunately help was on hand from an unlikely source. In the late 1980s the prime minister Margaret Thatcher was locked in a bitter dispute with the National Union of Miners and their leader Arthur Scargill. With the mines all on strike suddenly there were plenty of very experienced tunnelling surveyors available!

The project's instrument inventory in addition to the then state-of-the-art EDMs and total stations, included invar staves, optical micrometers and a gyro theodolite.

The Olympics and T5

More recently Leica Geosystems has supplied equipment for site wide GPS RTK correction network at the Olympic Park and similarly for Terminal 5 at Heathrow. The work at London's busy airport included an 87 metre high new control tower, the tallest in the UK.

It's worth just pausing on how vast a project T5 was. At the time it was Europe's largest building site employing 6,500 people. The project was not just the terminal building and new control tower but included two satellite buildings, 60 aircraft stands, extensions to the Piccadilly Underground line and Heathrow Express, an M25 spur road and multi-storey car parks to house 4,000 vehicles. Oh, and the diversion of two rivers!

To help ensure that all of this was built to the designers' specifications Leica supplied TCA2003 total stations to monitor tunnelling operations. The instruments were part of a fibre-optic network of data feeding into Leica's GeoMos monitoring software. GPS instruments played a significant role and included two System 500 reference stations to provide permanent survey control for the site. Also

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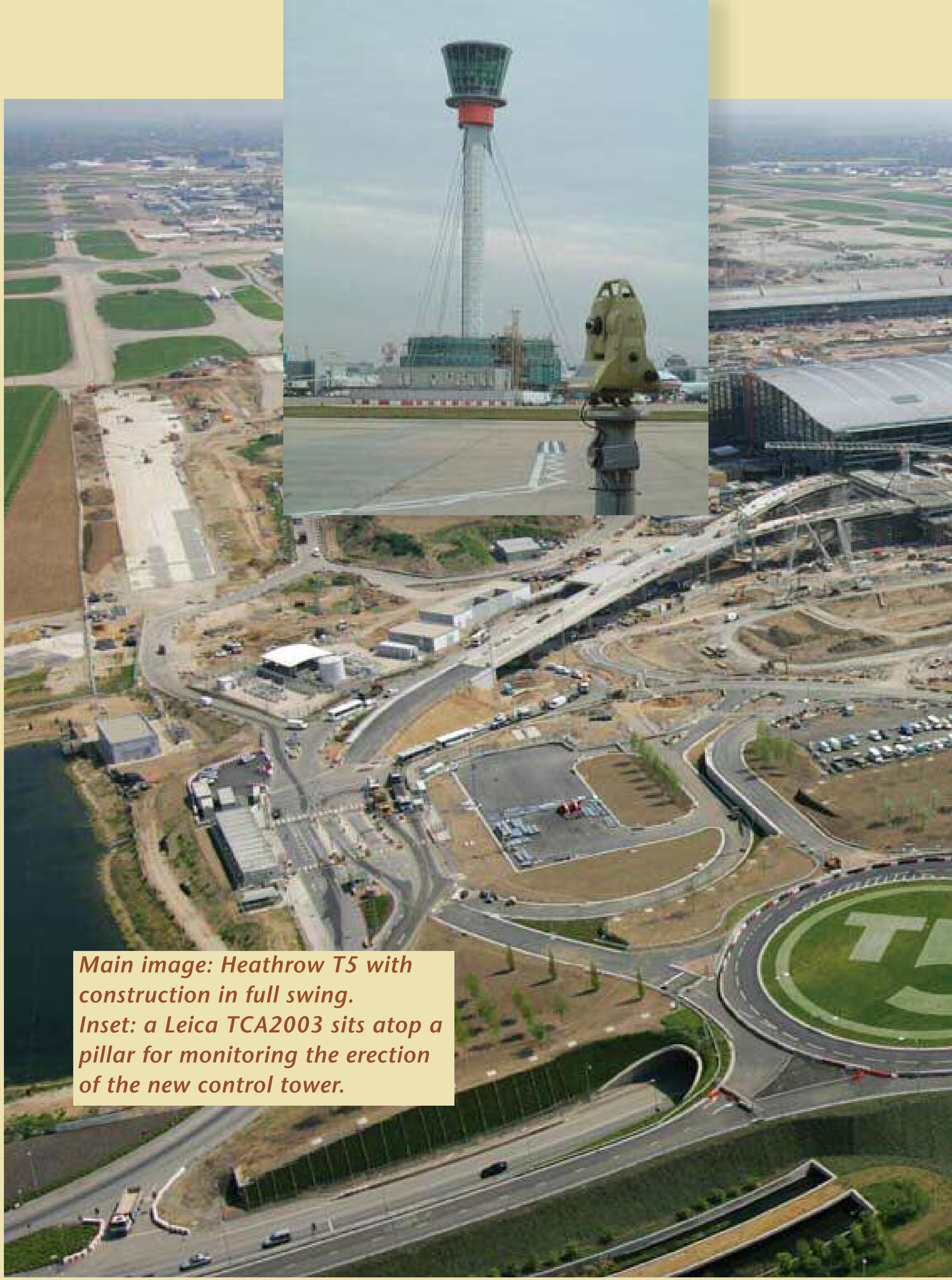
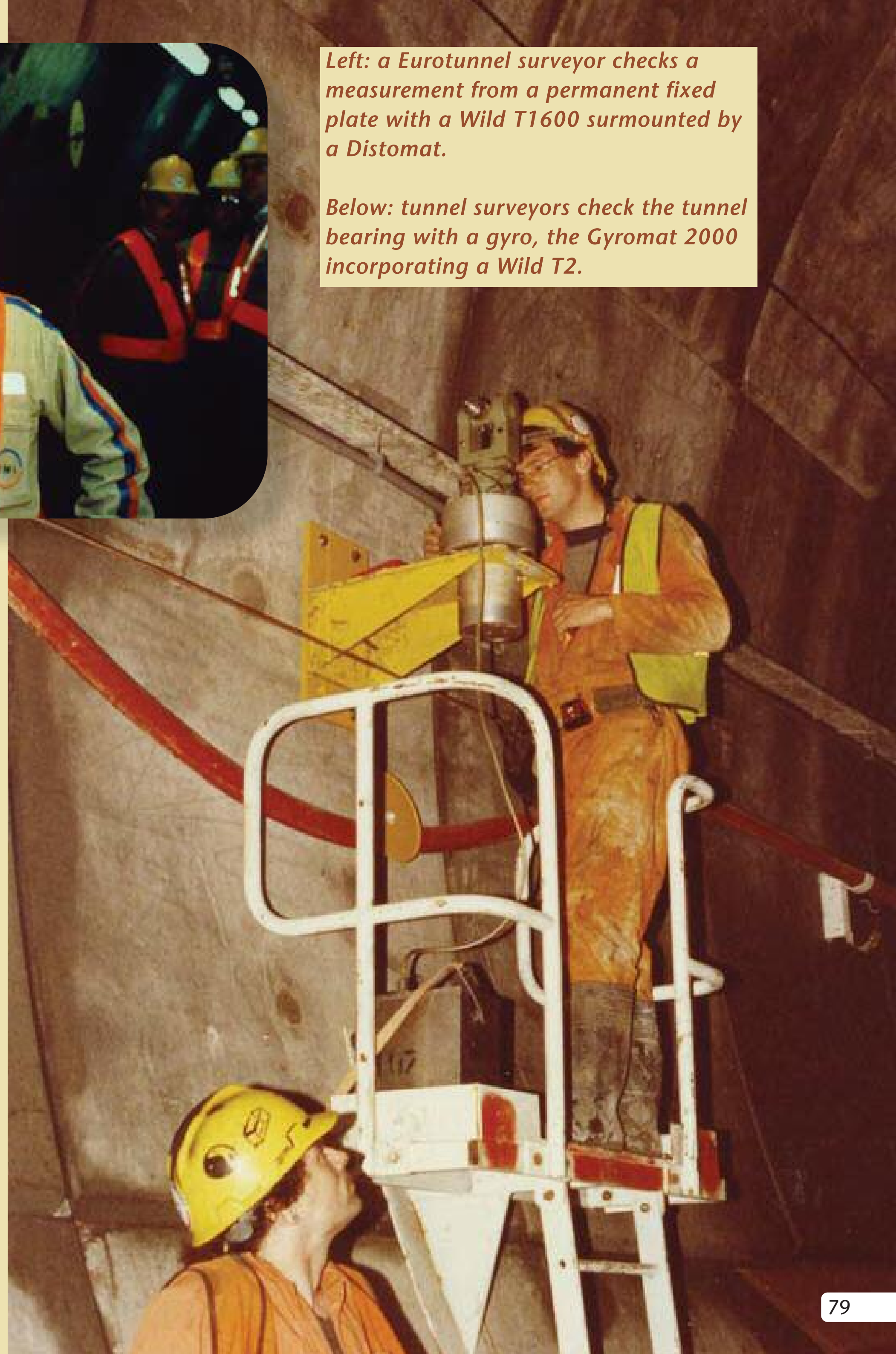


Main image: Heathrow T5 with construction in full swing.
Inset: a Leica TCA2003 sits atop a pillar for monitoring the erection of the new control tower.

Left: a Eurotunnel surveyor checks a measurement from a permanent fixed plate with a Wild T1600 surmounted by a Distomat.

Below: tunnel surveyors check the tunnel bearing with a gyro, the Gyromat 2000 incorporating a Wild T2.



supplied were 3D machine control systems for the paving machines laying tarmac and concrete, a Leica HDS laser scanner for as-built surveys and software.

The building and final positioning of the control tower was an especially challenging job for all involved and especially the Rolton Group, who were responsible for temporary works. The tower was pre-assembled some distance away from its final position. When complete the whole assembly was moved to its final location and the five-storey cab, lifting yoke and lifting towers weighing over 1150 tonnes, were strand jacked into position. Throughout, Leica GeoMoS software collected data from instruments to check that real-time accuracy was within the 10mm spec.

You can read more about some of the major and special projects that have used Leica instruments and software on page 90 Monitoring.

Above: BAM Nuttall engineers had just 101 hours to install a precast concrete box structure as a road bridge at Tipton under the West Coast Mainline over the Easter weekend of 2009. The rail track was continually monitored by two permanently mounted Leica TCA1201+ Total Stations measuring to 300 mini-prisms fixed to the rails, gantries and other relevant structures. Data from these Instruments was continually processed using Leica's GeoMoS software (for more on this project see page 93).

Left: a Leica TCA1201+ Total Station guarded by spiked steel fencing continuously monitors targets for the Tipton project.

Ground work commences for Europe's tallest building, the Shard. Can you spot the lonely (and vulnerable) tripod and level at the bottom left?

technologies: the Nova MS50 integrates laser scanning, video and a coaxial camera with conventional total station technologies.

Levels, cameras and a revolutionary handheld measurer

In the late 1980s the backroom team at Wild in Switzerland were working on improving a measuring instrument that had hardly changed since the 19th century. The humble builder's or engineer's level is the mainstay of survey work on construction sites. From 1990 it truly entered the digital age with the launch of the NA2000 bar-code reading level. Just over a decade later Leica sold the 10,000th digital level.

In the same year the world's first forward motion compensating aerial camera arrived. The technology adjusted the camera's shutter to take account of the speed of the aircraft, a development that was ultimately to underpin the emergence of the first airborne digital sensors at the end of the decade.

A novel step in reflectorless measurement came in 1993 with the launch of a little handheld device that has revolutionised simple surveys, especially inside buildings. The Disto back then was perhaps a little cumbersome (some unkindly referred to it as a house brick!) but for the first time surveyors, engineers, builders and others had a simple reliable handheld distancer that could accurately measure up to 30 metres to a visible laser dot. Back then the Disto was not cheap: £890. Today its descendants celebrate 20 years of the Disto and come in a variety of different guises, some costing as little as £100.

Machine control

With the emergence of lasers and GPS in the 1980s, coupled with short range radio data transmission technologies, the control of construction machines became possible. They could now accurately excavate, grade and lay materials just as good as the very best operator. Early systems relied on a static rotating laser level positioned nearby as a reference point to transmit data to a unit in the machine's cab to inform the operator whether he was on or off the specified grade or level.

Both Wild Heerbrugg and later Leica Geosystems had been quietly developing several of these systems to improve machine control. Following the acquisition of Leica Geosystems by the Swedish Hexagon Group in 2005, a major step forward came with the acquisition in 2006 of Scanlaser, a specialist already active in machine control. Coupled to GNSS, the latest systems allow very precise grading or placing of materials, bringing considerable savings in waste of both time and material. In 2007 Hexagon Machine Control Division was established with Mark Concannon as global president, based in the MIRA Proving Grounds, Nuneaton.

Changes and a tall young man

In 1995 a rather tall young man with a Masters degree in Civil Engineering from Leeds and a fondness for cricket joins the company. Working first in technical support, **John Fraser** had a particular competence in the LISCAD software but soon took on other roles. By 2003 he is UK Geomatics sales manager and in 2007, when Mark Concannon moves to develop and head up the machine group and the newly acquired Scanlaser, John takes over as managing director.

John continued the ethos and direction established by Mark and is a strong believer that all employees should feel engaged and enjoy working for Leica Geosystems. He is also focused on breaking down those barriers that prevent progress or make doing business difficult. Approachable, direct, fair with a 'fun style' but with integrity at its core, John never forgets that the customer is the one who pays the wages and realises the value of the equipment they buy from the company. John's ethos is: 'People buy from People, with relationship management vital for working with clients, with employees and with colleagues'.

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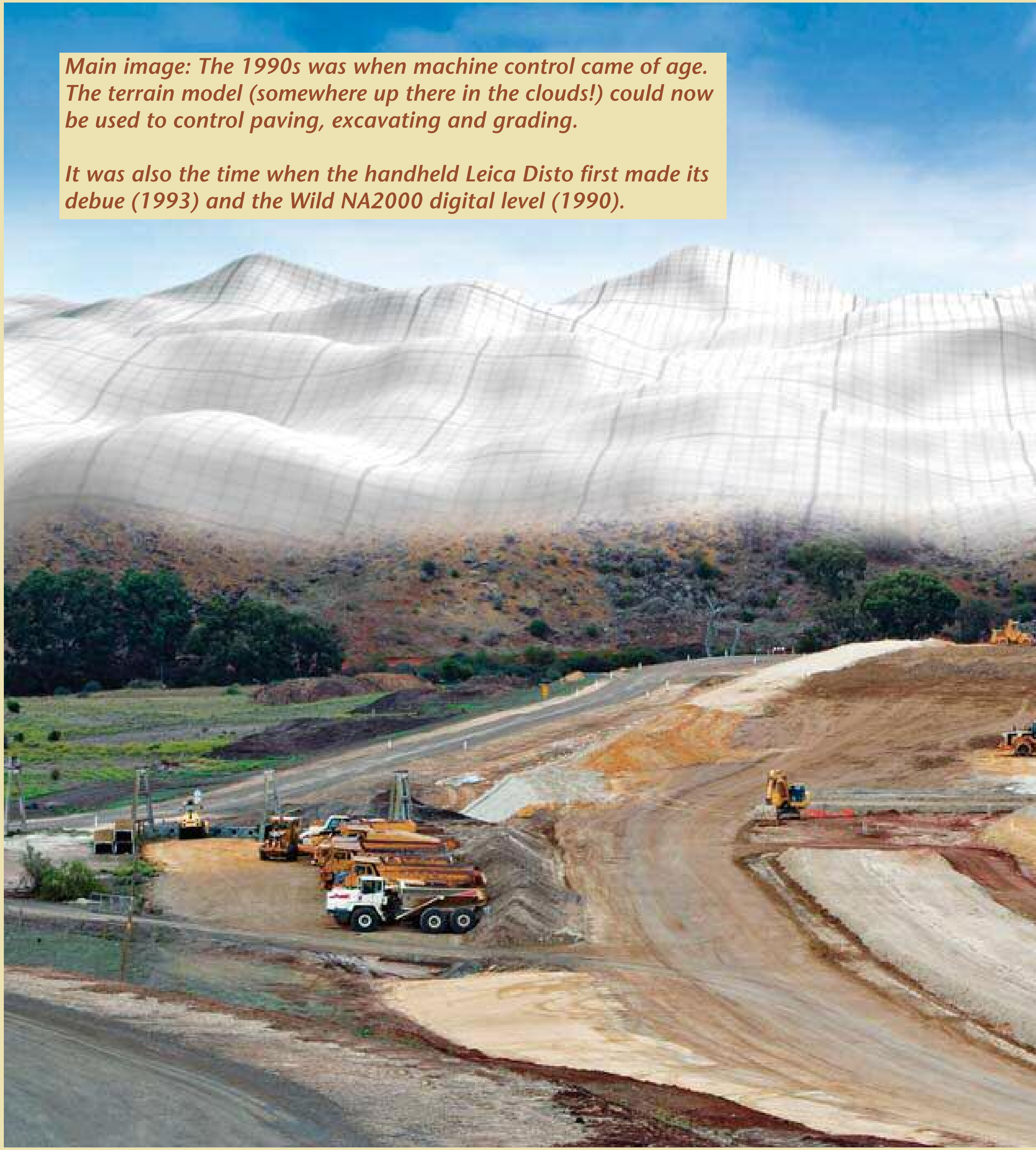
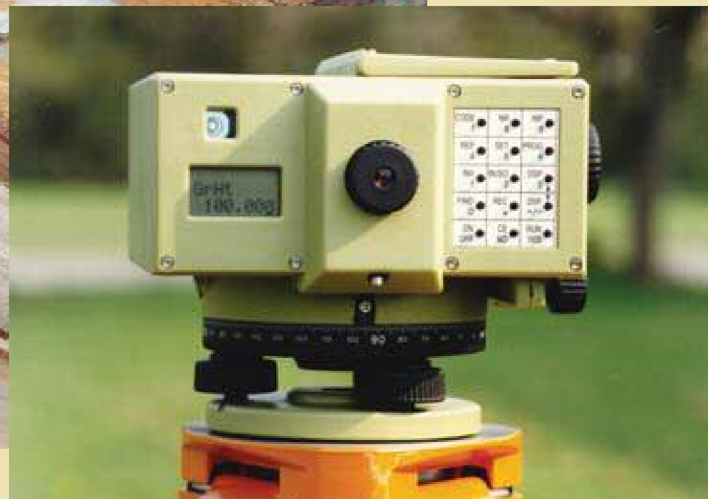
Below from left to right: David Price (left) and John Fraser present an award to Speedy director Keith Ferguson. Vanessa Lawrence, director general of Ordnance Survey present an award to David Price. Chilly and wet weather can't keep these surveyors from inspecting the latest laser scanner at a 2006 Roadshow. The point cloud was increasingly becoming the deliverable. Following track subsidence, the scene is captured by laser scanning.



Main image: The 1990s was when machine control came of age. The terrain model (somewhere up there in the clouds!) could now be used to control paving, excavating and grading.

It was also the time when the handheld Leica Disto first made its debue (1993) and the Wild NA2000 digital level (1990).



MACHINE CONTROL

Man has dreamt about automating processes since the first mechanical clocks. Automata, mechanical toys and devices that played music and had dancing figures, have been around since at least the 18th century. In the 19th century steam-driven fairground organs where the tunes were played automatically from punch cards were a popular sight in Victorian times. But by the late 20th century mechanical engineering had probably reached its peak. Some of the most complex and high precision devices ever made were those used in photogrammetry. Anyone looking at a Wild A8 analytical plotter for the first time cannot but be impressed by the instrument's complexity, intricacy and even beauty of the engineering. This was the pinnacle of mechanical engineering. The 20th century truly saw the rise of the machines.

But by the 1970s the future was clearly being mapped out not by cogs and pulleys, levers, clutches and pawls but by the microchip. Smaller and every bit as complex the microchip had the ability to be programmed to control processes. It could also be mass produced and did not need regular oiling, greasing and adjusting.

Lasers are the way forward

With the emergence of lasers in the 1980s, coupled with short range data transmission technologies, the control of construction machines became not only possible but a practical solution to a number of endemic construction problems. Controlled by the microchip these sensors could direct machines like excavators, bulldozers and especially concrete pavers where the savings in materials could be substantial. Now for the first time it was beginning to become possible to excavate more accurately, grade and lay materials.

Early systems relied on a static rotating laser level as a reference point. The laser beam could be captured by a receiver sensor on the machine then data could be sent to a unit in the cab to inform the operator whether the blade or bucket was on or off the specified grade.

Throughout the 1980s and 90s, both Wild and Leica had been quietly developing several of these systems to improve machine control. At that time machine operators had to rely on crude physical guidance

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Above: belt and braces - two robotic total stations provide control for a paving machine laying concrete while the airport is open for business as usual.

Opposite page: a bulldozer works on an embankment under GPS guidance.


swissair


D6N LGP
ASHBROOK
scanlaser
MACHINE CONTROL
CAT
FINNING

from batter boards for excavators and boning rods and wire stringlines for paving machines, all of which were easily damaged and kept surveyors and engineers busy replacing them.

Tracking total stations offer possibilities

With the arrival of the advanced automated TCA series of total stations that could track a target things began to move forward more rapidly. By now construction machine owners and civil engineering contractors were looking for onboard solutions that would make life easier for operators and deliver real savings on the job site. A major step forward came with the acquisition in 2006 by Hexagon of Scanlaser, a specialist already active in machine control solutions. Coupled to GPS, the latest systems allow very precise grading or placing of materials, bringing considerable savings in waste of both time and material.

Some of the drive behind the development of these systems has come from initiatives like the US's EDC programme ("every day counts") and the UK's lane rental scheme for highway projects. Today contractors have a major incentive to finish on time or earlier if they can, knowing that they will be charged thousands of pounds a day for an overrun; or gain similar sums for finishing earlier.

Scanlaser joins the team

Since 2012 Scanlaser has been part of Leica Geosystems Machine Control Division, with Scanlaser acting as the technology and

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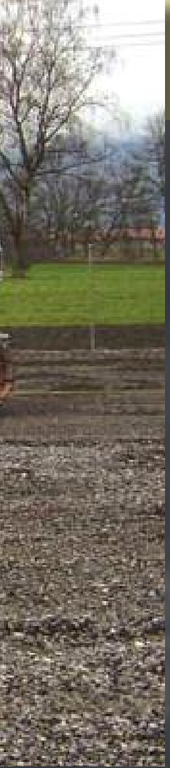
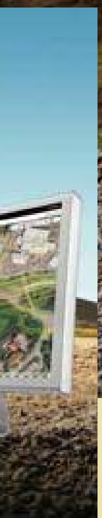
Above: a TPS1200 total station tracks the prism and communicates with the computer on the bulldozer to keep it on line and level. Meanwhile, is this the first of a line of Leica bulldozers?

Below: the evolution of machine control. From left to right: a Wild laser level, tracking total station, GPS, and direct communication with remote computers holding the project design data to control the machine.





Main image: a wheeled loader is controlled via GNSS signals captured by the antennas on the masts each side of the machine. Bottom right inset: an in-cab display provides the operator with design information.

distribution partner. They offer a full range of solutions for construction machine control. There are systems for excavators, bulldozers, graders and paving machines that range from simple in-cab on/off level displays to advanced satellite based GNSS controlled systems where the 3D terrain model has been uploaded. All offer guidance and control in what can be invisible environments such as a water-filled excavation.

A recent typical project was paving for the Nottingham Tram extension. A mechanised system for track construction Appitrack™ (Automatic Plate and Pin Insertion), developed by Alstom Transport and Leica Geosystems, guides a paving machine to place concrete and base plates to millimetre accuracy. Leica Viva TS15 total stations and Leica PaveSmart3D software position, guide and control the paver including the insertion of the base plates.

Solutions and integration is the focus

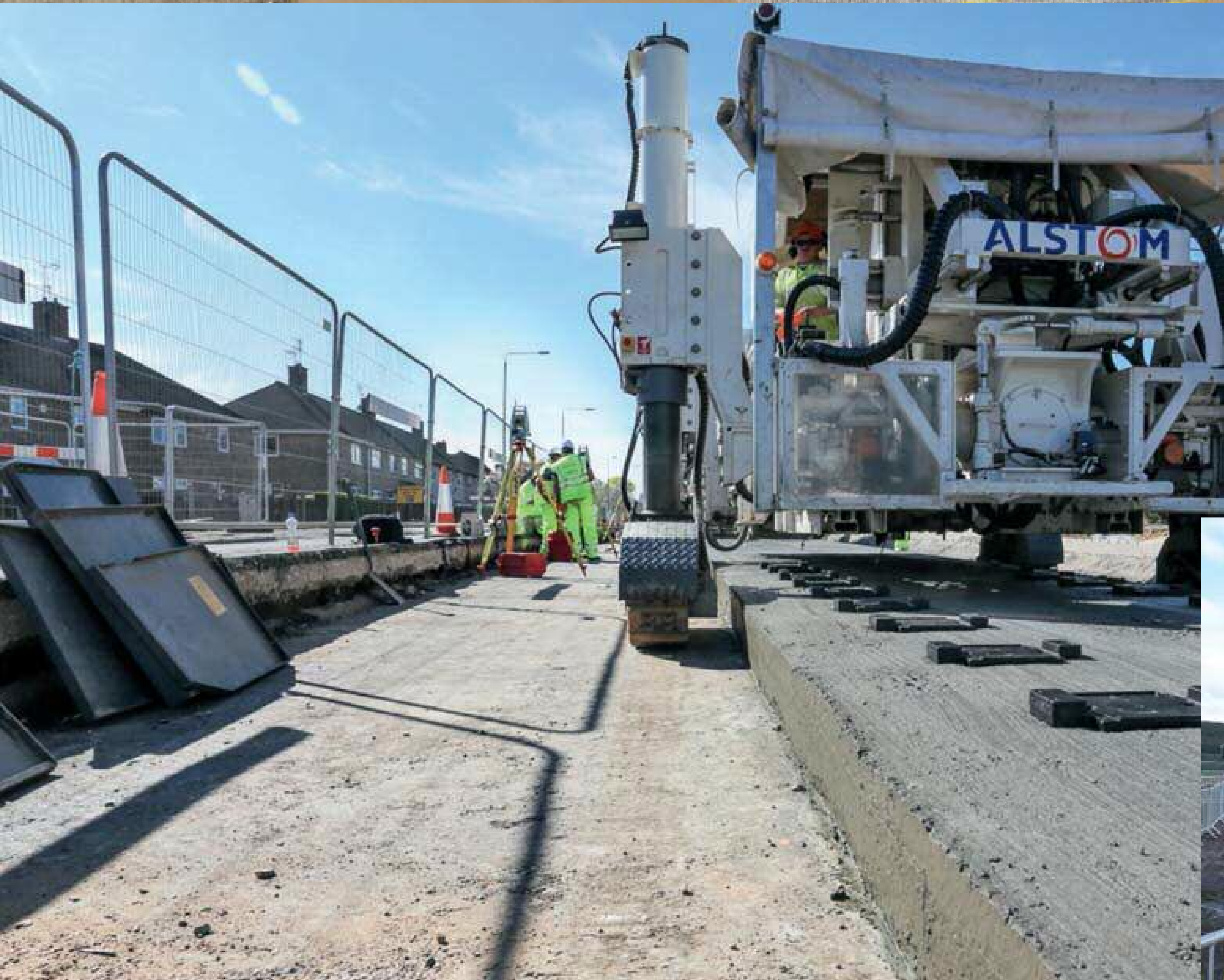
It is important to remember that this aspect of Leica Geosystems business is about system integration and providing solutions that work for clients. Components in systems are selected from world leading suppliers like Mikrofyn, SBG, D&PS and Cable Detection – not just those manufactured by Leica or Hexagon companies.

Customers can have systems installed on their machines and tested within a few hours at Scanlaser's dedicated facility that includes workshop, welding and fabrication facilities and stores that stock a full range of the highest quality hydraulic fittings, hoses and valves. There is even a test and demonstration facility nearby for training.

When Scanlaser became part of the Hexagon Group much of the initial success with machine automation and paving solutions can be attributed to the remarkable character of **Karl Soar**, who sadly died in 2013 at the young age of 45. Karl, began his career with Leica Geosystems in the UK in 1999 before moving to Switzerland in 2003. Paying tribute to him, **Mark Concannon** said, "Karl's passion, drive and practical understanding of the market was instrumental to the development and success of Leica Geosystems' concrete paving solutions and bulldozer guidance and grader systems. He had a rare ability to relate to people at all levels in the construction world, from bulldozer drivers to technicians, to company owners. He was adaptable and thrived on finding solutions to technical challenges".

Above: a surveyor captures a position and sends it to the bulldozer so it can commence work.

Below: Acquired in 2006, Scanlaser was at the heart of Hexagon's Machine Control Division. Today it sits within the Leica Geosystems portfolio. Below is their Hawk training facility for operatives



Above: Leica Geosystems iCON range reflects the company's vision of the fully connected construction site.

Left: Nottingham's tram extension project is guided by Leica Viva TS15 total stations and PaveSmart 3D software. Alstom's Appitrack™ places base plates to millimetre accuracy to ensure a smooth tram platform.

Below: a backhoe excavator takes its orders from a Leica GNSS unit, part of the iCON range, located nearby.

MONITORING

Many of the great infrastructure projects around us – tunnelled railways, deep excavations, dams and many more – would be difficult and even dangerous to construct without close attention to what their effect they might be having on the surrounding environment. Major tunnelling projects like Crossrail, currently being built under London, need careful monitoring of the existing buildings and structures above to ensure that the works below are not causing deformation – cracks, slippage, distortion, subsidence could all be a sign of imminent collapse.

Monitoring for deformation has been a major part of Wild Heerbrugg's and today Leica Geosystems' business for many years. Tunnelling is especially dangerous and not just for those at the workface. As tunnellers and engineers try ever harder to thread and build new structures around and in between the existing infrastructure of Britain's congested cities, they need to know what if anything is happening above and around them.

The Glasgow Subway, a narrow gauge loop serving 15 stations, opened in 1896 and is the third oldest underground railway in the world, beaten only by London and Budapest. A major modernisation programme began in 1977 and in 1979 consulting engineers Sir William Halcrow called for a scheme to monitor the stations and booking hall complexes. A Wild NA2 level with a GPM3 parallel plate micrometer and two invar staffs assisted in the work, which on one occasion involved preserving an existing Victorian booking hall whilst its foundations were raised and replaced. While pundits expected surrounding buildings to collapse, the surveying equipment proved otherwise as carefully recorded measurements confirmed that movement was in line with what could be expected in a heavily trafficked area. A similar combination was used to monitor the Thames Barrier, which became operational in 1982 and protects the capital from high tides and storm surges that might cause flooding.

But it's not just the surrounding structures of tunnelling or deep excavation projects that need monitoring. Building high-rise towers needs constant checking during construction to ensure that dimensions are controlled within the design requirements. This was the challenge that Leica Geosystems accepted for a monitoring system during construction of the central core of the Shard, Europe's tallest building

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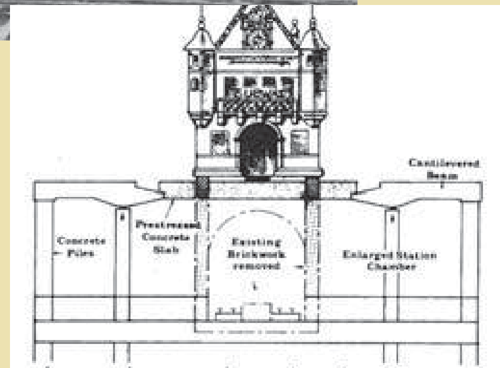
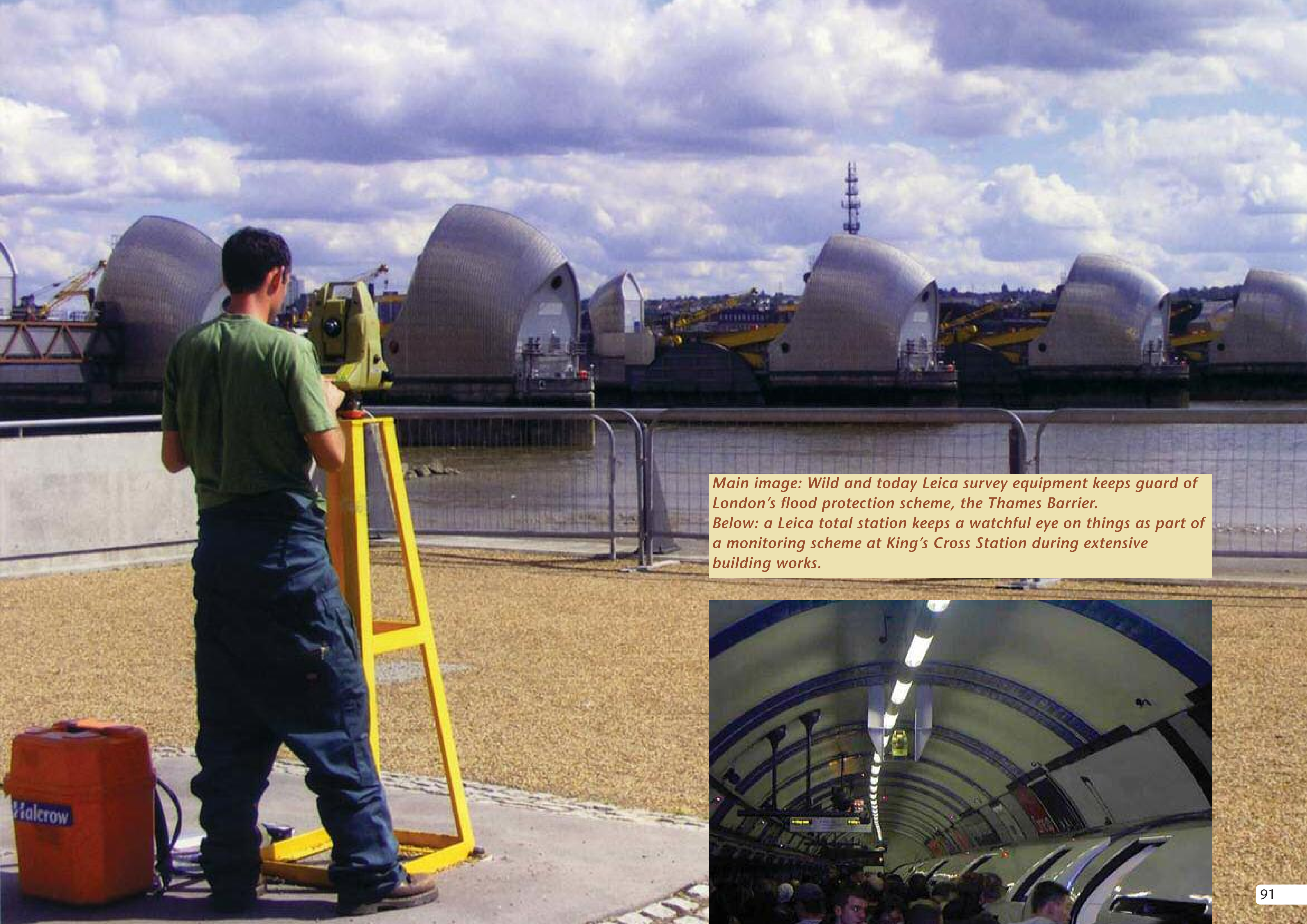
Above and right: tricky work on the modernisation of Glasgow's Underground at St Enoch's station.



Left: a Leica TPS1200 installed on a special pillar within a protective steel and glass box monitoring construction of the Tamar Bridge.



Main image: Wild and today Leica survey equipment keeps guard of London's flood protection scheme, the Thames Barrier.
Below: a Leica total station keeps a watchful eye on things as part of a monitoring scheme at King's Cross Station during extensive building works.

and now an icon on the London skyline.

The central concrete core of a skyscraper is usually built rapidly using a slipform system to encase the concrete as it is poured; it can advance as much as 8 metres a day. But dimensional control of the slipform rig is not easy. For the Shard's slipform rig contractors Byrne Bros, one of the UK's and world's leading formwork construction companies, the core's plan position had to stay within ±25mm of the design.

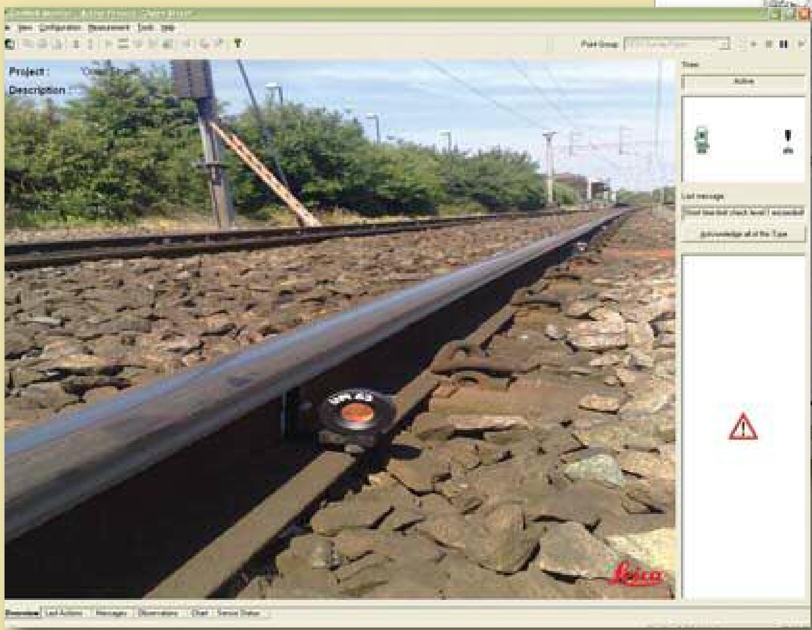
Following consultation with Byrne, Leica Geosystems proposed a system of TPS total stations, four GNSS receivers and four dual-axis inclinometers located on the rig. The system offered verifiable data from more than one system. The GNSS antennas were co-located with 360° prisms to give a constant check on GNSS positions against total station readings. The combined systems fed data into GeoMoS, Leica's monitoring software which can be installed offsite or over the web and provide early warning of any departure from design tolerances. So successful was Leica Geosystems' monitoring design that similar systems are now being used in the City of London for the dimensional control of high-rise buildings during construction.

Today, Leica instruments fixed on brackets can be seen in and around London Underground stations as part of the Crossrail project. They regularly check distances to fixed targets on buildings and structures to see if anything has moved beyond the carefully calculated and predicted amounts of the engineers. The instruments today are so accurate that they can detect the diurnal movement between day and night or between high and low tide if structures are close to the River Thames.

Above: local stations within the Leica SmartNet system enable the GNSS receivers on the slipform rig to provide the best possible positional data for the engineers.

Above: four GMX902GG GNSS Receivers inside the continuously moving slip form rig building the central core of the Shard. Right: Co-located with the GNSS receivers is a Leica AS10 GNSS Antenna, 360° prism and dual-axis inclinometer.

Left: At the Shard James Whitworth analizes data received from GPS and other sensors by the Leica GeoMoS software.



Rght: a Leica GeoMoS screen shot shows a line of targets installed on the track at Tipton ahead of the installation of a box structure for a road bridge on the West Coast Main Line. The image on the far right, also from Leica GeoMos, shows a plan of the site with the location of each target.

During the 1990s and into the new millennium the Leica Geosystems Roadshows became a "must attend" event. Below, Steve Ramsey presents details of the latest laser scanners and the geospatially accurate 3D point cloud data they capture.

Left: John Fraser and Lawrence Dixon in company colours discuss the finer points of the latest total station ready for the next roadshow.

Avid attendees at the GEO 9 exhibition and launch of the Leica TS30 and TM30 high end total stations with an EDM that can measure to an accuracy of 0.6mm + 1ppm and direct piezo noiseless drives suitable for monitoring applications. In the front row on the far right is the late Alan Wright, a pioneering user of GPS in the UK and around the world.

In 2008 John left Leica for a short sabbatical in the survey industry. He is succeeded between 2008 and 2012 by **David Price**, before returning to the company in 2009 to work initially with Scanlaser and the by now Hexagon machine control division before becoming Leica Geosystems regional director for Northern Europe and then taking up the role of managing director again of the UK company in November 2013.

David Price was the man who led the company through the turbulent and challenging years of the recession, which only now at the time of writing is beginning to recede. David first joined Leica in 2001 from a competitor as a specialist in the construction business. With the introduction of the TPS400/800 total station range he worked hard with product management to adapt and tailor the new platform for the UK market. In 2006 he became construction sales manager, EMEA rolling out the ethos and success developed in the UK to other dealer territories.

Invited to take up the role of managing director, UK & Ireland just as the worldwide economic downturn really hit the UK, for three years David and the management team worked extremely hard to minimise the impact and in the process made no compulsory redundancies. As a consequence the company was well placed and well-staffed to respond to the upturn. During this period Leica were successful with two large tenders for Ordnance Survey, providing both Reference Network and Field Surveyor hardware in the face of stiff and credible competition.

The shift to a new dimension

The first decade of the 21st century heralded another shift in approach for Leica Geosystems. The New Dimensions campaign introduced new technologies via a series of roadshows that attracted hundreds of surveyors and engineers. A major agreement with Ordnance Survey saw Leica partnering with Great Britain's mapping agency to provide a series of static and continuously operating GNSS reference stations (CORS) to create the backbone of a new reference network for surveyors and others that would replace the venerable stone and concrete triangulation pillars known as Trig points located at high points around the landscape of the British Isles.

The focus by now had switched for many customers. They were becoming "spatial data managers" and Leica Geosystems saw itself as the provider of choice for innovative solutions that could capture the spatial data for them. Although they probably didn't realise it, waiting in the wings was a device which they had all been waiting for.

A black box heralds the future

In 1999 surveyors attending the World of Surveying exhibition at the Motorcycle Museum near Birmingham were startled to see a very large and rather crude looking black box atop a robust industrial strength tripod. It was described by one wag "as an EDM on steroids". In truth, it was an instrument that could capture thousands – even millions – of accurately coordinated points within seconds. With the Cyrax 2400 laser scanner the point cloud had arrived to drive forward the 3D design and build concepts of today like BIM. Just over a year later Leica Geosystems acquired its creators, Cyra Technologies. With a new division in the company based in California, Leica Geosystems now began developing its own series of laser scanners beginning with the ScanStation and the HDS (High Definition Surveying) series.

Today, Leica Geosystems has a range of scanners suitable for many

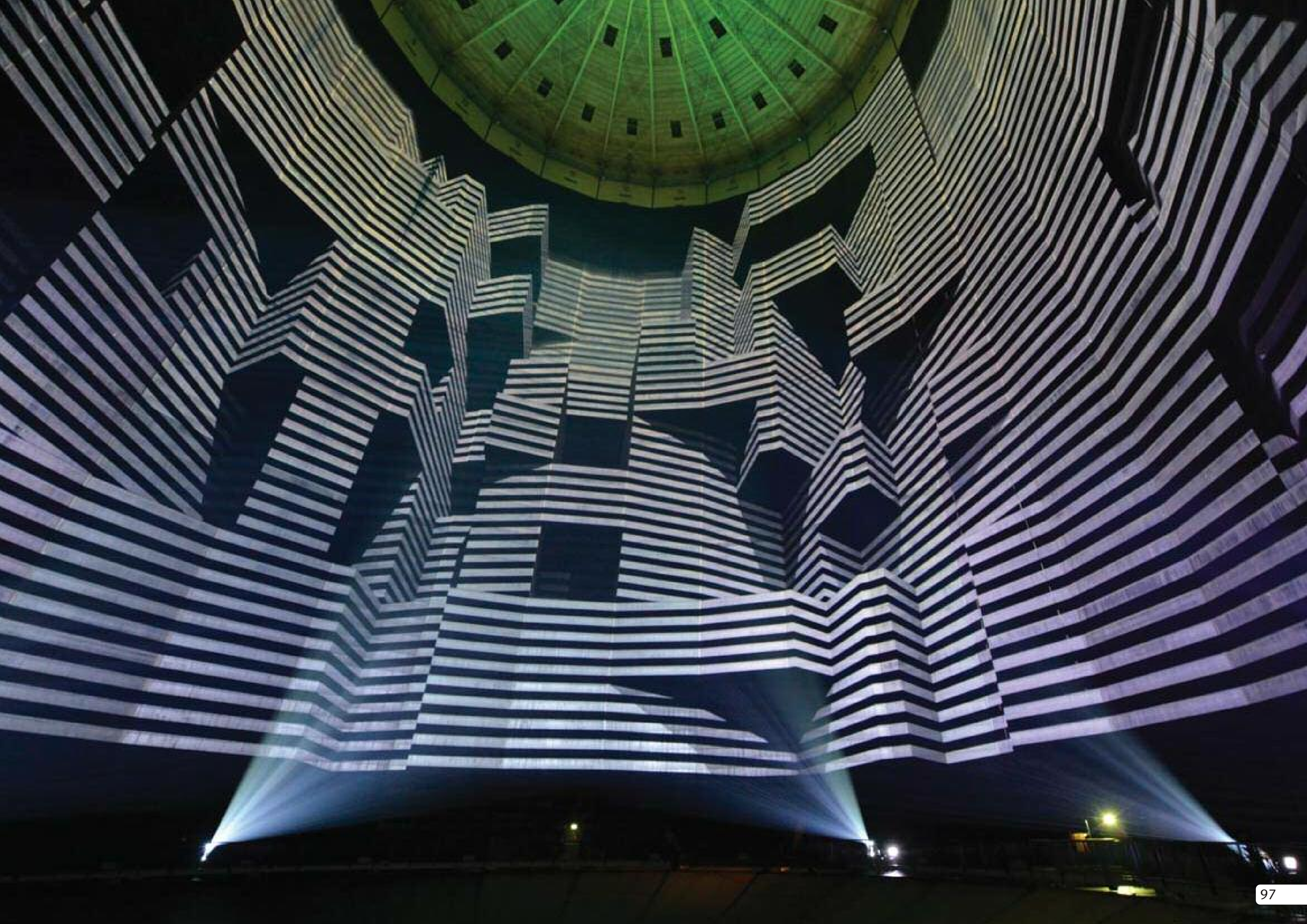
continued on page 100

Opposite page: Laser scanning has opened up entirely new areas for surveyors and their equipment. Using a Leica ScanStation P20, the image opposite was captured by a German artists group, Urbanscreen. The images captured by scanning are projected onto the interior of a former gasometer in Oberhausen and form part of a giant multimedia presentation called 360° Licht.

Below: some of the very latest products from Leica Geosystems range. Form left to right: the iCON range for intelligent construction. The Rugby 800 laser level. The latest digital level, the Leica DNA03 and DNA10. Survey kit in a case - Leica Viva CS15 controller and GS12 GNSS The Leica CS25 GNSS tablet controller is part of the Zeno range.







MICROSCOPY

As its name suggests, Microscopy is the technology of microscopes, devices for viewing things that cannot be seen by the unaided eye.

Leica Microsystems has a long heritage in this field stretching back to the mid 19th century and the foundation of the Optical Institute in Wetzlar by **Carl Kellner**, later to be taken over by **Ernst Leitz** whose company later became part of the Wild Leitz group. Meanwhile in Britain, in 1881 **Charles Darwin**'s son **Horace** established Cambridge Instruments, which over century later became the heart of Leica's Microscopy division. Cambridge Instruments thrived quickly, so much so that by 1907 they were able to present their 100,000th microscope to Nobel prize winner Robert Koch

Historically the technology has evolved through close cooperation with the scientific community. It is the key to Leica Microsystems' ongoing innovation, which also draws on users' ideas to create the right solutions.

Leica Microsystems is organized in three divisions, all of which are among the leaders in their respective fields: the Life Science Division, Industry Division, and Medical Division. Meanwhile, Leica Biosystems offers products for each stage in the histology process including the ultra fine slicing of specimens for microscopic inspection and investigation.

Over three centuries Leica and its predecessor companies have developed many world leading microscopy instruments such as:

- The first stereoscopic microscope (1958)
- The scanning scanning electron microscope (1965)
- The world's first photo microscope (1976)
- surgical microscopes (from 1985)

Today Leica Microsystems is a world leader in developing technologies for our complex world and is governed by a set of values that support microstructure professionals.

Right: The manual Leica IsoPro™ is the first crossstage specially made for stereo microscopes. The control elements, which can be mounted on both sides, allow you to pass over specimens quickly, with an accuracy of 2 µm – a precision that would be impossible to attain by hand.

Above: Multiple iPads can be connected to the same camera so that the user can share live images.

Below: the M series Leica Digital Stereo Microscope.

Above: The Leica DMS1000 digital microscope system with integrated high-end optics and high-performance digital camera.

different projects including for long and short range applications, vehicle mounted ones like Pegasus, a mobile mapping system, airborne scanners that integrate image capture and LiDAR (airborne laser scanning).

The future

Today, the company that became Leica Geosystems is part of the 3bn euros global Hexagon Group. It has grown from a turnover of 7.5m euros in the early 1990s with a staff count of 28, to approximately 100 today with a turnover of 50m euros. In November 2013 Leica Geosystems, along with Hexagon Metrology, relocated to new headquarters at Tongwell in Milton Keynes. The move also saw an international management team joining. From now on Leica's Middle East, Europe and Africa operations would be headquartered in Milton Keynes too. Commenting on the move, EMEA President Mark Concannon said: "This move to a new flagship UK EMEA headquarters represents an exciting new era for us and, most importantly, our customers, as we consolidate the range of essential services they demand from us as the market leader."

The move was triggered by several developments including a significant upturn in the demand for Leica Geosystems' products and services, a move which has driven the design of the new head office. The building accommodates a larger workforce, additional capacity and the most advanced technical service and training facilities in the industry. Intrinsic to the interior plan is to make all service and support operations visible to visitors and customers, highlighting the company's rigorous quality standards. In addition, the meticulous design includes an impressive and versatile auditorium for training seminars, product launches and industry conferences.

So what will happen over the next half century? We haven't mentioned the recent acquisition (2014) by Leica of a company manufacturing UAVs, unmanned aerial vehicles that have evolved from military drones. These platforms are bound to have a major impact on mapping and topographic surveys but with limited payloads they will require smaller and lighter sensors. Leica has also recently acquired a company specialising in multi-spectral technologies that from above the ocean can see through the water column or determine crop and soil types.

Feeding the world and monitoring the environment are big challenges for the 21st century. We can be certain that Leica Geosystems products will be playing a major role in these endeavours through its agricultural systems that can drive farm machinery and log crop yields that show where in future a field may need extra fertilizer. Similarly, the measurement and analysis of the oceans currents and water temperatures may lead to early warning of changing climate.

Let us conclude by stating that predicting where measurement technologies will go over the next 50 years is beyond the crystal ball gazing of this history. But one thing is certain, Leica Geosystems or its successors will be at the forefront.

Sources

There have been many sources for this history. In addition to internal company documents and personal recollections, they include:
Wild Heerbrugg UK Newsletters from 1978 – 1988
Leica Reporter
Civil Engineering Surveyor journal 1976 – 1993
Surveying World 1992 – 2001
Geomatics World 2001 – 2014
Engineering Surveying Showcase 1992 – 2013
The historical website: www.wild-heerbrugg.com

Below : some of the exciting new technologies recently added to the Leica Geosystems portfolio. From left to right: The Pegasus Two is a vehicle mounted system that can be equipped with a variety of sensors to capture geospatial data at street level. Hexagon company AHAB's HawkEye airborne bathymetric multi sensor LiDAR. The Swiss Unmanned Aerial Vehicle (UAV) developer Aibotix was recently acquired by Leica Geosystems. The Leica DISTO 110 is just 110mm long x 37mm wide but includes Bluetooth and a sketch app. The Leica DMC IIe with PAV digital airborne sensor.



Left: Hexagon House, the new headquarters for Leica Geosystems in the UK and for its EMEA operation. The building is shared with the Hexagon Metrology group. Below right: Mayor of Milton Keynes Cllr Brian White was welcomed by EMEA President Mark Concannon to open the new headquarters on 12 November 2013.
The point cloud image below was captured by laser scanning the new headquarters.

The Wild-Leica Technology and History Timeline

Over the years one aspect has characterised Wild and Leica instruments: only after rigorous testing and market assessment is a new product launched by the company. The process is always driven by what the market wants. Through its close customer relationships, Leica is constantly talking to surveyors and engineers about their needs.

While others may claim some "firsts", Wild Heerbrugg and today Leica Geosystems, would only introduce a new instrument when they were convinced it is right and there was a ready community of potential users. The subtext to the Leica Geosystems strapline confirms this: "- when it has to be right".

Below are some of the significant moments in the history for Wild and Leica, including several world firsts, which have driven the development of the company in the UK.

The Wild Heerbrugg era

1921 Heinrich Wild opens his instrument business in the village of Heerbrugg, Switzerland with backing from the Schmidheini family.

1923 Wild T2 theodolite in production. T2 is unlike other theodolites at the time. It is lightweight (6kgs) and for the first time has fully enclosed circles protecting this critical aspect of the instrument from both the elements and careless users. Wild's T2 is ideal for use in harsh environments like construction, mountain or arctic surveys. By 1956 50,000 had been made. The T2 is in production for over 70 years. Altogether 95,446 were produced.

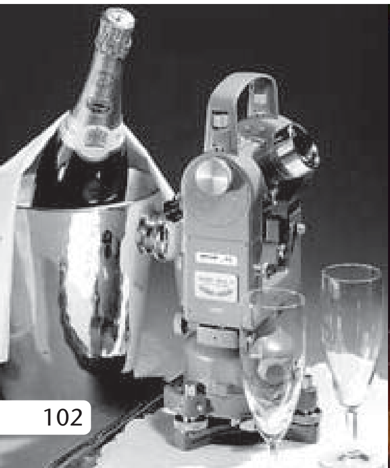
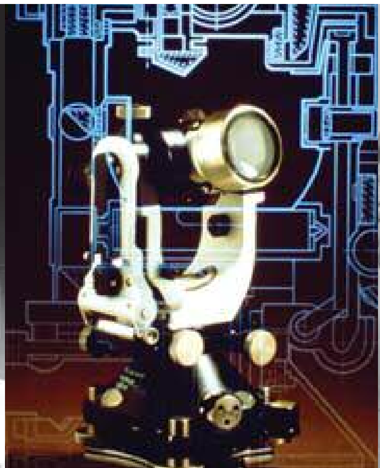
1914–1924 The world's first compact 35mm camera is designed by Oskar Barnack on the eve of the First World War. His updated design finally goes into production nine years later for Ernst Leitz II and is known as the Leica 35mm Camera. It becomes a huge commercial success worldwide and is widely used by professional photographers and photo journalists. It remains a true icon amongst cameras.

1930 First Wild aerial camera, the C25.

1950 The Wild RDS1, a fully-fledged mechanical theodolite and direct scale-reading tachymeter that gave directly the horizontal distance and height difference.

1957–1963 US Navy Navigation Satellite System known as Transit is launched. The system evolves into GPS and eventually becomes part of today's Global Navigation Satellite System (GNSS).

1964 Wild Heerbrugg UK Ltd formed with offices in Maidenhead under the managing directorship of Jack Simpson.



1950–1969 Distance measurement becomes possible using microwaves or gallium arsenide diodes. Systems are cumbersome and far from reliable.

1969 Wild launches the DI10 Distomat, a lightweight easily portable system using infrared technology to accurately measure distance to a prism reflector up to 1 kilometre. Subsequent models during the 1970s and 80s evolve into smaller and lighter models with longer range such as the DI3s and DI4.

- In May 1969 Her Majesty The Queen opens the new headquarters in Southampton of the Ordnance Survey and is shown a variety of Wild equipment including the newly introduced DI10 Distomat, T4 Universal Theodolite and N3 precision level. In attendance was Jack Simpson, MD of Wild Heerbrugg UK.

1972 Building work commences on a new headquarters in Chatham, Kent.

1970–77 Various manufacturers offer the first total stations but they rely on heavy car type batteries and paper punch-tape for recording the data.

1977 Wild launches the Tachymat TC1, an electronic reduction tacheometer (to give its full title!). For the first time a surveyors has an instrument that can measure distance and angles with high accuracy and data can be stored on a solid state device.

1979 Wild supports the Transglobe Expedition led by Sir Ranulph Fiennes. The expedition is equipped with both a T3 and T2, which is used for navigation over the Arctic and Antarctic.

1980 Wild introduces GEOMAP, a digital mapping system launched at the 1980 ISPRS Congress in Hamburg. Wild AC1 analytical plotting system with TA2 plotting table launched.

1981 Longer range versions of the TC1 total station and DI4 distance measurer are introduced by Wild and prices fall for existing models. From now on the TC1 costs £13,288.

1982 Wild BC1 analytical plotting system launched.

1983 Wild replaces the TC1 with the T2000 and TC 2000 electronic instruments.

1984 Launch of the Wild ZNL plummet. DI4S and DI5 EDMs join the range of distancers available and a joint venture with US GPS receiver developers Magnavox is announced with a prediction that an 18-satellite constellation will be available by 1988 allowing cm level accuracy.

1985 The first GPS receiver designed for land surveying is announced. The WM 101 is designed and built in association with Magnavox.

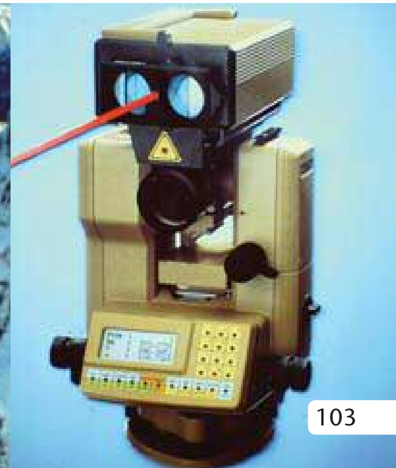
- The Wild Aviolyt BC2 analytical plotter is announced as a "computer controlled mapping system that plots to micron accuracies". The DI1000 EDM and TC2000 total station join the equipment portfolio.

1986 Launch of the Wild DIOR 3002, the world's first reflectorless distancer that could measure to 300 metres or more without a prism.

- A new and highly successful total station is launched, the TC1600
- Magnavox announce a miniature GPS receiver 2" × 4" × ¾" with an





accuracy of 10-35m.

• System 9, a surveying and mapping system, is launched at Auto Carto. CAT2000 industrial measurement system announced based around T2000 theodolite and HP 9920 computer using software developed by Wild USA and Boeing, achieving accuracy better than 0.001 of an inch.

1987 Improving exchange rates help sales of Wild kit in the UK: £2300 comes off a TC2000 TS. A review in *Civil Engineering Surveyor* of the Wild T1000/DI1000 combo by Mike Fort finds “a smart uncluttered electronic theodolite” and excellent value for money with “an assurance of quality and reliability.”

• The Wild TC1600 is announced with a plug-in data capture module (enough for about half a day’s work). Another debut is the DI2000 EDM weighing only 0.7kg with accuracy of 1mm + 1ppm over 2 kilometres to a single prism. Other significant new arrivals include the GRE4 field data recorder and the LNA2 laser level offering an accuracy of ±2.5mm over 100 metres.

1988 Wild Heerbrugg announces a merger with fellow Swiss long-time rivals Kern of Aarau and integrates with the Leitz Group, manufacturers of the renowned Leica cameras. In the UK the combined Wild-Leitz group now has a turnover of £20m and 175 employees. Kern joins Wild at Chatham but industrial metrology units of both companies join E. Leitz in Luton. Long-term plans are to house all three under one roof.

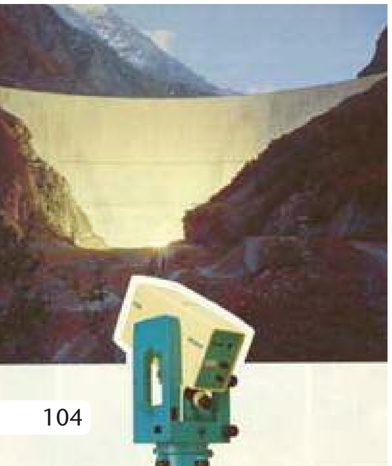
• In the same year the Wild T2002 electronic theodolite is launched offering 0.5” of arc accuracy. It features a dual-axis compensator and a keyboard to access 12 major onboard computational functions. An even higher accuracy instrument follows: the T3000 reading to 0.1” of arc and a standard deviation of 0.5” with a telescope developed in association with the European Space Agency.

1989 From the beginning of the year the company promotes itself as Wild Leitz whilst retaining the Wild name to prefix individual instrument models. A further merger is announced with Cambridge Instruments. The move is seen as a way to “strengthen competitive position. . . against Japan and to take full advantage of the opportunities offered by the single European market in 1992”. The merger creates a worldwide company employing 11,500 and turnover of £500m.

• The year is also marked by major sales on projects like Canary Wharf where control is provided by 12 primary points provided by Wild T2002 and DI2000 EDM. Meanwhile Ordnance Survey buys 14 Kern DM504 EDMs. GEOCOMP ‘field-to-finish’ software with input to MOSS and AutoCAD announced; available for £2750.

• “Survey Connection” opens in London E2 under the management of Mark Concannon.

• August the three companies - Wild Heerbrugg UK, Kern and E.Leitz - move from Chatham to Milton Keynes and a new era begins.



The Leica Geosystems era

1990 UK launch of world's first digital level using a bar-coded stave, the NA2000 debuts at ICES's Satellites & Systems conference. Now Wild's advanced technology shares bar code technology with a tin of beans!
Launch of DI1600 and BC3 photogrammetric workstation with 19" high-res colour monitor.

- Leitz becomes Leica following completion of the merger with Cambridge Instruments. Wild and Kern product names continue to be retained.
- First sale in UK of RC20 forward motion compensation aerial camera to Aerofilms.
- Over 100 Wild instruments are working on the Sizewell B power station project including the new NA2000 digital level which achieves a 0.2mm closure over 1.8 km, way better than the instrument's specification.

1991 Break-through of Channel Tunnel. Chief Surveyor Eric Radcliffe and his team used 140 Wild instruments including the DI2000 EDM, invar staves, optical micrometers, gyro theodolites and T2002 first order theodolites.

- Launch of CRC-2 terrestrial microprocessor controlled camera.
- Leica replaces GEOCOMP with LISCAD as their in-house terrain modelling software.
- Closure announced of Kern's Aarau manufacturing facility. The staff and their developments are moved to Unterentfelden, also in Switzerland.
- Launch of DVP "low cost" PC based photogrammetry system along with the SD2000 analytical plotter.

1992 One man GPS system launched in the UK. Wild GPS System 200 debues to great acclaim at a series of "New Era" roadshows in Birmingham, Edinburgh and London Heathrow.

- With the arrival of GPS Leica increases its focus on training with the launch of special courses aimed at understanding the new technology and how it can be used in practical survey applications.
- Also announced is the VIP Survey System. The Wild TC1610 and T1610 instruments now have upgradeable software functions and the GRM10 internal memory module that can store 2000 points.
- Launch of the Wild GPC1, the T-shaped handheld data controller and field computer. The unit is IBM PC compatible and is the platform for Leica's VIP software.
- In the autumn the restructuring of the survey business is announced under one division called Survey, Photogrammetry & Systems under Mark Concannon, who spearheads the launch of the new Wild GPS System 200 and the VIP software.
- An entry level total station, the 6" TC500 with an EDM range to 700 metres and outlets for data recording is announced priced at under £5000.

1993 Leica GPS System 200 and other Wild instruments are used to measure height of Mount Everest. The GPS is carried to the top of the world's highest mountain by climbers Benoit Chamoux and Agostino Da Polenza.

- Launch of the revolutionary Disto handheld distance meter. It is robust and reliable and widely welcomed by the construction industry.






- Launch of Leica Vector range-finding binoculars with EDM and compass.
- Creation of Building & Construction division.

1994 Leica acquires US GPS manufacturer Magnavox.
- An upgraded digital level is announced, the NA3000.
- The Disto GSI with an RS232 interface is introduced.
- TPS range is announced featuring the TC400, TC 500, TPS 1000 and TC600 instruments. In total the range has nine theodolites and total stations plus motorised options allowing robotic control. and the TCM range. A roadshow launch using "multi-media equipment" is a huge success. The Open Survey World concept is also introduced to ease data exchange between instruments and office PCs using PCMCIA cards. The software is now running under Windows.

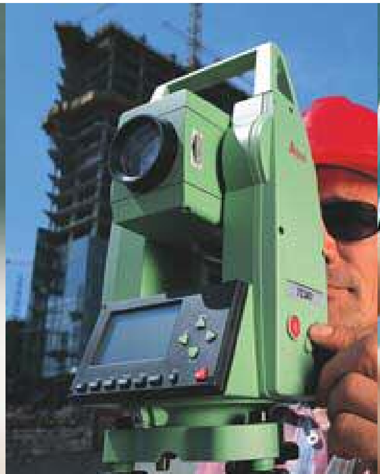
1995 The TC460 6" total station is announced aimed at builders. Two new Distos are also introduced, one has RS232 interface; GSI version can measure to 100m with a target. Also, a pipe-laying laser, the Wild PLA20 (a development of the Stolz range).
- Launch of the dual-frequency Leica GPS System 300, offering P code on L1 and L2 bands, improved radio links, PCMCIA cards for data capture and transfer, initialisation on the fly and the new RTK SKI software.
- A major upgrade for the Leica LISCAD software is introduced. Version 3 is all Windows based.

1996 Automatic target recognition is now available on TCA 1100 and 1600 range of total stations. The system uses CCD camera technology to lock onto a prism.
- A machine control system for tunnelling applications based on motorised theodolites that automatically locate the position of a road header tunnelling machine is announced.

1997 In April the de-merging of Leica Microsystems and the Surveying Division is announced. The latter is now to be known as Leica Geosystems under the managing directorship of Mark Concannon.
- a laser plummet is launched for some total stations enabling quicker setting up.

1998 Launch of the TPS300/1000 range, the world's first total stations available with coaxially reflectorless EDM. Aimed at professional users, they feature endless drives on tangent screws, dual-axis compensation and laser plummets. Options include reflectorless EDM with a coaxial beam, motorised, automated and fully automatic with target recognition.
- The second generation Disto arrives, a leap forward in technology that wins prizes for its design.
- Investcorp buys Leica Geosystems Holdings AG.

1999 The Cyrax 2400 laser scanner, developed by Cyra Technologies, is shown at the World of Surveying event at the Motorcycle Museum. Described as an "EDM on steroids", the device will change the nature of 3D data capture for ever.
- Upgrades for the Leica GPS range are announced. The new Leica GPS500 System is lighter and features a modular design.The controller and data storage on the detail pole, known as "Unipole".
- A poll of total station users in a leading UK industry journal finds Leica top at 37.7% share with the next manufacturer trailing at 24.6%.
- The sale of the 1000th Leica GPS system is made in the UK. Marketing


at this time features surveyor in a space suit floating above the earth. At least one person enquires whether GPS can work in space.

2000 US President Clinton announces end to intentional degradation of GPS signals. From 1 May selective availability is removed. The move is expected to boost navigation, tracking and positioning applications.

- Two new ranges of total stations are announced. The TCRA1100 Professional series offer automated, robotic and reflectorless options and an automatic target recognition system. The TPS700 range is part of the Performance series and features alphanumeric keyboards on both faces.
- Leica announces a “major investment” in Cyra Technologies.
- A GIS data collector is launched, the GS50.

2001 Leica Geosystems buys Cyra Technologies.

- Leica Geosystems acquires Watts Optronics and re-structures into six divisions.
- A major partnership agreement is announced for Leica to supply GPS equipment to Ordnance Survey Great Britain. The deal is sealed at Greenwich Observatory between Vanessa Lawrence, Director General of OSGB Hans Hess, CEO of Leica Geosystems.
- Leica Geosystems acquires ERDAS, a developer of image processing and analysis, and acquires LH Systems by buying out joint venture partner BAE Systems. The moves strengthens the company’s offering in photogrammetric and airborne digital sensor technologies.
- The 10,000th digital level is delivered.

2002 GPS and total station technologies begin to merge with the launch of the TPS1200 total station which can integrate a GPS antenna atop total station.

- GeoMos, a new software for controlling monitoring applications is announced.
- For laser scanning, now part of Leica’s instrument portfolio, Cloudworks software is launched to help exploit the point cloud data in CAD packages.

2003 Leica Geosystems launches the HDS3000 3D laser scanner.

- Leica sells Watts Optronics to Speedy Hire, which becomes Speedy Asset Services. The move, together with other partners, creates significant growth in the construction and civil engineering markets.

2004 The “X-FUNCTION” is announced which uses the same file and database structure for both total station and GPS sensors.

2005 Leica Geosystems Holdings AG is taken over by the Swedish Hexagon Group.

- The SmartStation is announced, further integrating total station and GPS technologies

2006 Hexagon acquires machine control specialists Scanlaser who will operate with Leica Geosystems as part of the Hexagon Machine Control Group. Leica launches SmartNET, the UK’s first RTK network of real-time GPS corrections. From now on surveyors need only one GPS receiver.

2007 The Leica SmartPole is introduced, a lightweight, all-on-the-pole cable-free RTK GPS system.

- Hexagon Machine Control Division is established as a global entity.






• The next generation laser scanners arrive. The HDS6000 can capture points at up to 500,000 per second. A second instrument, the ScanStation is aimed at surveying applications and has many features found on Leica total stations.

2008 The ScanStation 2 laser scanner is launched with a range of 300 metres.

2009 Two new Leica precision total stations are given their worldwide launch at the 2009 GEO event in Coventry. The TS30 and TM30 feature Leica's PinPoint technology, an EDM that can measure to an accuracy of 0.6mm + 1ppm and direct piezo noiseless drives suitable for monitoring applications.
• Leica ScanStation C10 is added to HDS scanner range. A high accuracy long range scanner, it features major productivity improvements including a tilt sensor, laser plummet and Smart X-Mirror technology enabling users to rapidly conduct full dome scans.

2010 Launch of the Viva range, a fully integrated series of total stations, GPS and data controllers that feature image assisted surveying.

2011 HDS7000 phase based laser scanner announced with scanning speeds up to 1 million points per second, a tilt sensor and compensator and a new graphical control panel.

2012 Launch of iCON integrated total station, GPS, software and support services for construction applications. Yellow is the colour!
• The Leica Geosystems Machine Control Division is announced with Scanlaser acting as the technology and distribution partner.
• An ultra high-speed scanner is added to the HDS range. The P20 can capture a point cloud of xyz data at up to 1 million points per second and a check and adjust facility enabling users to check the accuracy of their scanner.

2013 Leica Geosystems worldwide sells the 60,000th TPS Flexline total station. Launch of the MS50 Nova Multi Station with "Mergetech" integrating scanning and GPS with total station technology.
• Launch of Pegasus, a mobile mapping system with integrated optical, inertial navigation and laser sensors. The system is vehicle independent and can be mounted on a variety of platforms.
• November 2013: Leica Geosystems moves to new headquarters with Hexagon Metrology. Mark Concannon, Hexagon's EMEA President, comments:

> *"This move to a new flagship UK EMEA headquarters represents an exciting new era for us and, most importantly, our customers, as we consolidate the range of essential services they demand from us as the market leader."*

A significant increase in the demand for Leica Geosystems' products and services has led the design of the new head office. The building accommodates a larger work force, additional capacity and the most advanced Technical Service and training facilities in the industry. Intrinsic to the interior plan is to make all service and support operations visible to visitors and customers, highlighting Leica Geosystems' rigorous quality standards. In addition, the meticulous design includes an impressive and versatile auditorium for training seminars, product launches and industry conferences. Hexagon now has a worldwide turnover of over 3 billion euros.

2014 Leica Geosystems celebrates its 50th anniversary of trading in the UK and marks 25 years since the move to Milton Keynes.






The Leica Geosystems Team from 2014

EMEA* UK Headquarters
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Richard Benner
Mike Cooper
Richard Davies
Rachel Devenny
Lawrence Dixon
Jen Dwyer
John Fraser
Charlotte Godwin
Richard Ostridge
Antonio Rueda
Tahir Sharif
Andrew Young

*Europe, Middle East & Africa

Right: The Senior Management Team, from left to right:
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John Fraser

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David Ellis
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Acknowledgments

The author and publishers wish to acknowledge the assistance of the following people in preparing this book:

Nigel Bayford, Hugh Anderson, Tim Badley, Mark Philips, David Wallace, Mark Concannon, John Fraser, Natalie Binder, David Price, Neil Vancans, Malcolm Draper, Dr Arthur Allan, Peter Range, David Ebbage, Simon Mears

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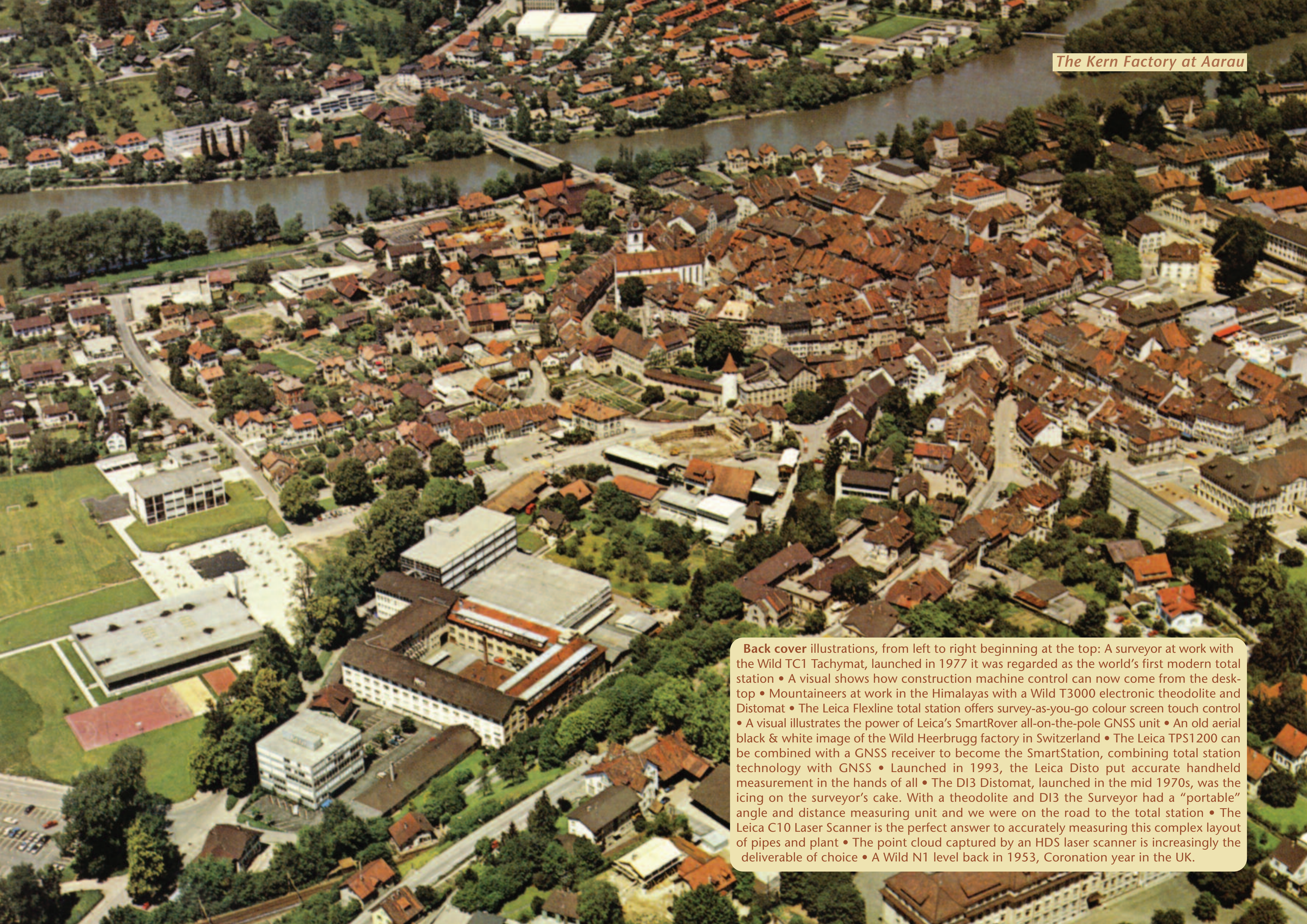

The Kern Factory at Aarau

Back cover illustrations, from left to right beginning at the top: A surveyor at work with the Wild TC1 Tachymat, launched in 1977 it was regarded as the world's first modern total station • A visual shows how construction machine control can now come from the desktop • Mountaineers at work in the Himalayas with a Wild T3000 electronic theodolite and Distomat • The Leica Flexline total station offers survey-as-you-go colour screen touch control • A visual illustrates the power of Leica's SmartRover all-on-the-pole GNSS unit • An old aerial black & white image of the Wild Heerbrugg factory in Switzerland • The Leica TPS1200 can be combined with a GNSS receiver to become the SmartStation, combining total station technology with GNSS • Launched in 1993, the Leica Disto put accurate handheld measurement in the hands of all • The DI3 Distomat, launched in the mid 1970s, was the icing on the surveyor's cake. With a theodolite and DI3 the Surveyor had a "portable" angle and distance measuring unit and we were on the road to the total station • The Leica C10 Laser Scanner is the perfect answer to accurately measuring this complex layout of pipes and plant • The point cloud captured by an HDS laser scanner is increasingly the deliverable of choice • A Wild N1 level back in 1953, Coronation year in the UK.








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