The story of the Lightgate dot-matrix hologram mastering system

The Lightgate 1270 - B system, 2004.

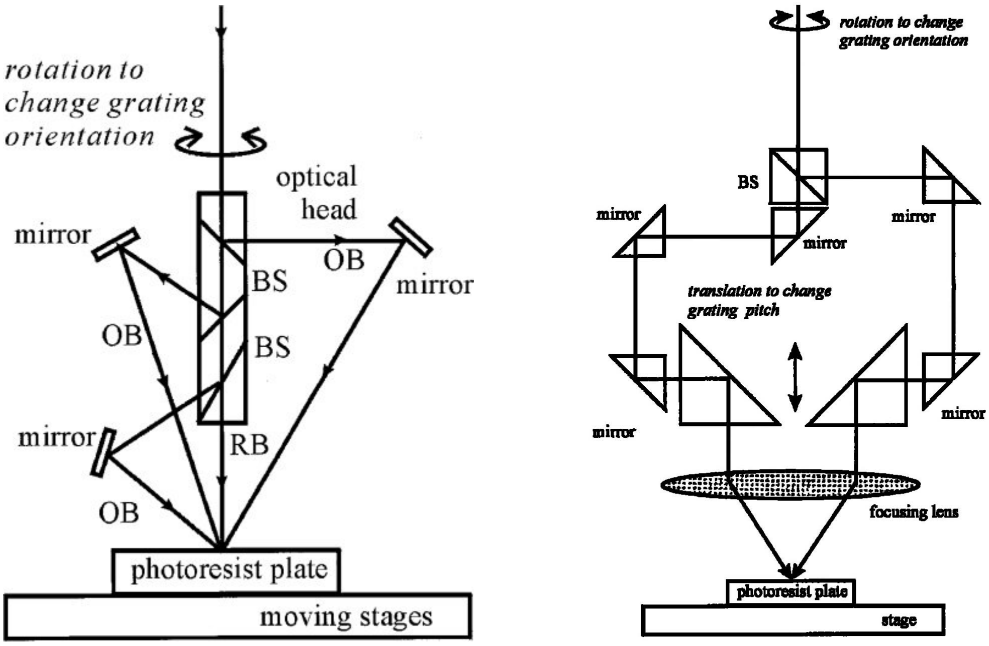
On the evening of Boxing Day, 26 December 1996, while relaxing in the bath at my home, Roseville, Free Prae Road, Chertsey, Surrey KT16 8DX, I experienced a eureka moment that would shape the technical side of my holographic career and drive the business of my company, Spatial Imaging Ltd., for the next thirty years.

I had been tasked by Walter Clarke, a Canadian Irish investor, and owner of Global Images Inc. to design and build a 'dot matrix' hologram mastering system. Walter had previously purchased two of my DI-HO digital holographic stereogram mastering systems for his security hologram companies in China and India, but he had recognised the potential and advantages of dot-matrix technology for security-hologram origination.

In 1996, only four dot-matrix mastering systems were known to exist, and of those four, only one was available to purchase commercially. The earliest, the Light Machine, was developed by Frank Davis in 1988, with later technical input from Kenneth (Ken) Harris of Dimensional Arts Inc. The second and third were proprietary systems developed by Craig Newswanger for Applied Holographics plc in 1990, and Fujio Iwata for Toppan in 1994. The fourth was produced by C. K. Lee at National Taiwan University in 1995/96, later commercialised as the Sparkle system by Ahead Optoelectronics, Inc. In 1996, only the Light Machine was commercially available, however.

Little is known about the Toppan system, however, both the Dimensional Arts and Applied Holographics systems were relatively slow and produced only low-resolution holograms, limiting them to making simple diffractive patterns. C.K. Lee’s system offered a somewhat higher speed and resolution, but it did not become commercially available until 1998. Only the Light Machine, however, could be purchased at the time and yet was incapable of making advanced security holograms and digital stereograms. As discussed in more detail below, both the Light Machine and the later Sparkle system relied on an assemblage of cumbersome optical components to split and then recombine the interfering beams, whereas Craig Newswanger’s system used a spinning diffraction-grating/lens assembly.

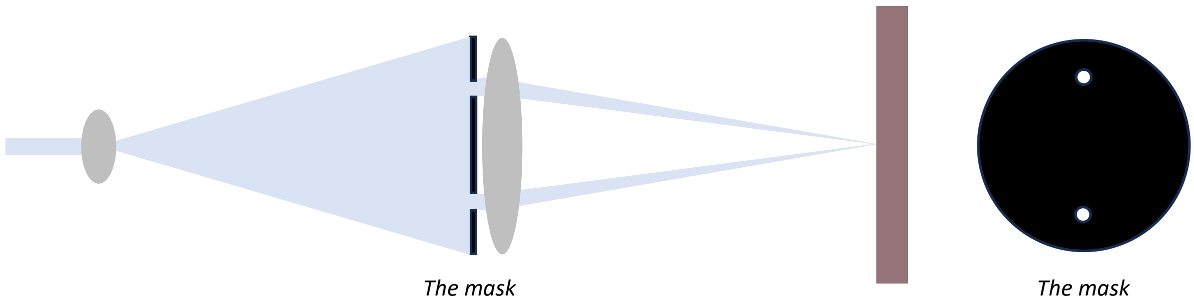
For comparison, below are diagrams of the optical configurations for the Light Machine and the later Sparkle system. As can be seen, these systems comprised of a multitude of glass beamsplitters (BS) and mirrors, to split and then recombine pairs of beams. In the case of the Light Machine, only three object beams (OB) were arranged at different angles relative to the reference beam (RB) to allow for the selection of only three grating spatial frequencies (colours). The entire assembly of optics for both systems then needed to rotate, stop and settle before recording each diffractive pixel, resulting in ungainly, difficult to align, and slow machines.



Left: A diagram of the optically complex 1989 Light Machine by Dimensional Arts Inc.
Right: A diagram of the even more complex 1995 C. K. Lee / Sparkle system by Ahead Optoelectronics, Inc.

Keen to avoid replicating any of the existing technologies, I spent several weeks trying to invent an alternative approach. Then, on 26 December, as I relaxed in the bath, an idea struck me - so simple that I was convinced there must be a reason it couldn’t work. By the next morning, having failed to think of one, I cut my Christmas holiday short and went over to my studio at 8 Wheatash Road, Addlestone, Surrey, to test the idea.

The concept couldn’t have been simpler: make two holes in a thin piece of cardboard and place it in a diverging laser beam. The mask would block all but the light passing through the two apertures, creating two spatially separated beams of light. A single lens placed in front could then bring those beams to a common, overlapping focal point. At that intersection, the beams would interfere, and the resulting interference pattern could be recorded as a diffractive pixel.



The Lightgate optical principle.

Arriving at the studio, I realised that I could use my DI-HO system's optical recombiner to translate a photoresist plate in X and Y directions, so I quickly wrote a simple software routine on my Amiga computer to step it in very small, pixel sized increments between exposures. I then set up the optical components seen in the diagram above, an expanding lens to diverge the beam, a thin piece of cardboard with two holes, and a large lens to reconverge and focus the resulting pair of beams onto the photoresist plate. With excitement I exposed a small single-angle patch of diffractive pixels, roughly 2 mm square.

At that time, the highest-resolution, and indeed the only commercially available system in the world was the Dimensional Arts Light Machine, with a resolution of only 100-200 diffractive pixels per inch and a speed of only 1-2 exposures per second. After developing my very first test, and seeing bright rainbow colours diffract from its surface, I placed it under the microscope and, to my utter surprise and amazement, discovered a near-perfect dot-matrix hologram with a resolution of 1,270 dpi - some six to twelve times higher resolution than the Light Machine. What's more, and with further testing, a speed of 20 pixels per second was ultimately achieved, 10-20 times faster than the competition.

The rest is history. The idea worked, no one else had conceived it, and that single eureka moment resulted in fastest and highest-resolution dot-matrix hologram mastering system, the bestselling dot-matrix hologram mastering system ever built, and the first dot matrix system to be able to make complex security holograms, spawning a whole new security hologram industry worldwide. Walter Clark suggested the name Lightgate, and I added 1270 to reflect its resolution, thus the *Lightgate 1270,* later to be renamed the Lightgate B, was born.

It is often quoted that the simplest ideas are the best ideas, and this simple idea earned millions of pounds Stirling in revenue for Spatial Imaging Ltd. over subsequent years.

Significant advantages of this optical configuration included:

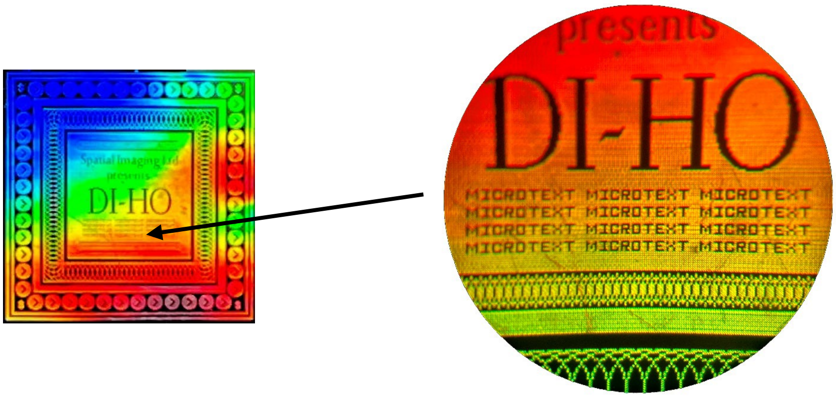
- The two interfering beams are two parts of a single beam, and thus always have identical path lengths, enabling the use of very short coherence length lasers.

- The two interfering beams are two parts of a single beam and thus are in perfect alignment, each with the other, with their focal points always perfectly overlaid.

- There are no moving optical components, and thus nothing to cause instability in the two interfering laser beams.

- The only moving part is a simple, lightweight mask (later two masks) which can be rotated at high speed, thus significantly decreasing the time to record a dot-matrix hologram.

- The compact size of the optical system enables it to be placed within an open-frame XY table and underneath the photoresist plate being exposed. This, in turn, provides for a highly stable system, prevents dust from falling onto the photosensitive surface, shields the photosensitive surface from ambient light, and enables simple visual alignment (focussing) of the combined focal point to the photosensitive surface.

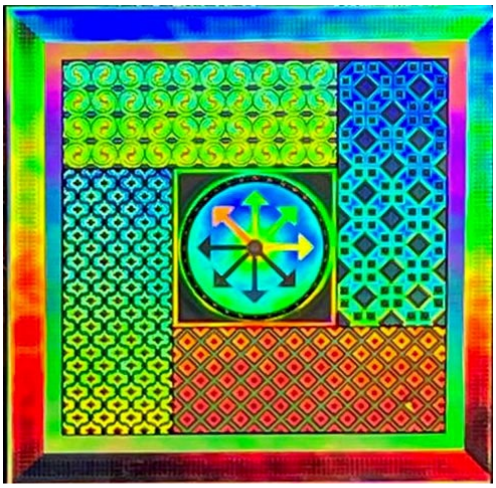


The second hologram test made on the 28th of December 1996.
Thought to be the first dot-matrix hologram to record microtext. The microtext is just 100um high.

Having now proven the system, the next step was to build a simple mechanical system to rotate the mask, and hence the two interfering beams to any angle. This was simple enough. I made a more rigid mask, this time from a thin sheet of aluminium, drilled two 1mm diameter holes in it, and mounted it in such a way that it could be rotated with a belt driven stepper motor under computer control. It was at this point that my Lightgate Control software program was born. The program needed to rotate the mask, and hence the two interfering beams, in accordance with the grey level of the pixel in the computer image (or bitmap) being recorded – see below for a full explanation of the dot matrix principle.

This simple technique, whereby the grating orientation, or angle of diffraction, is rotated for each diffractive pixel, creates a moving colour effect as the hologram is tilted, and so I termed this kind of dot-matrix hologram a 'kinetic' hologram.

Having written the software, I then created the first embossed kinetic hologram to be made using a high-resolution Lightgate dot-matrix system, see below:

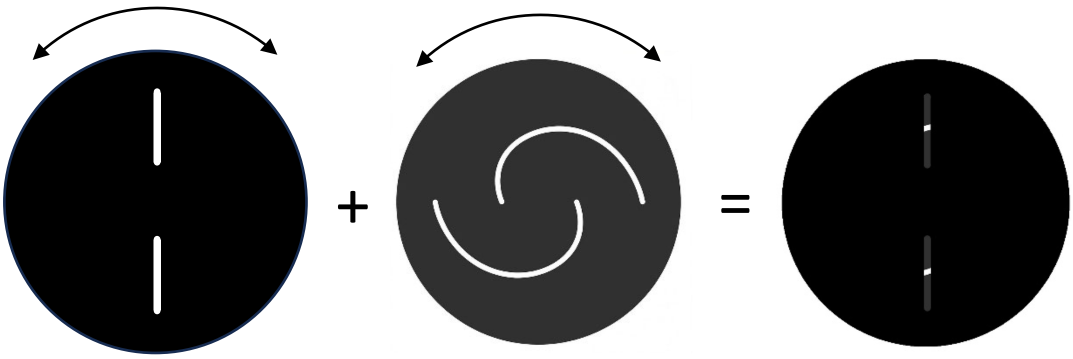


The first 'kinetic' dot-matrix hologram made using a Lightgate in early January 1997.

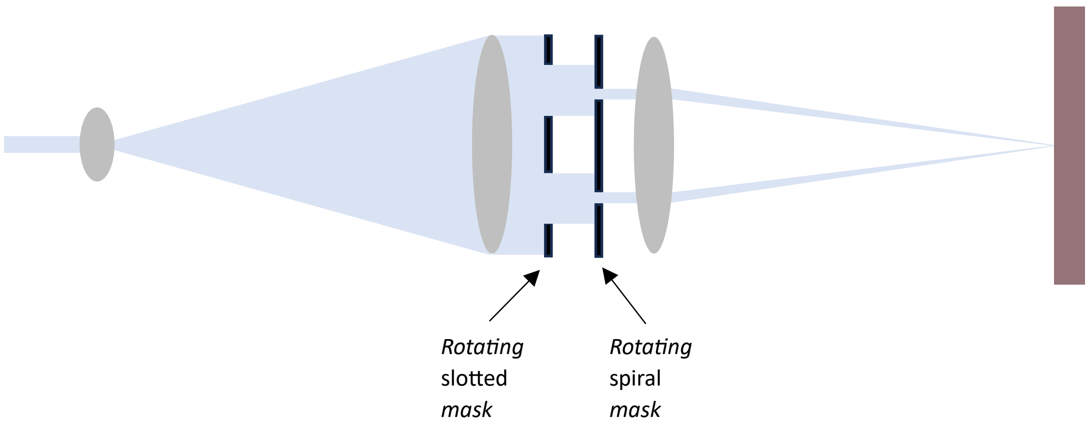
The next significant development followed very quickly in early January 1997. Whilst it was now possible to create high-resolution, single frequency (single colour) kinetic holograms, the final challenge was to invent a way to additionally move the two beams closer together or further apart, i.e. change the angle between them. By doing so, it would then be possible to also change the spatial frequency (relative colour) of each diffractive pixel on the fly.

Not only that, but by being able to continuously change both the grating orientation and the grating spatial frequency at the same time, it would be possible to diffract the light from any given pixel in the hologram though any angle and thus to any point in space. This would ultimately lead me to develop several highly sophisticated optical features including the first dot-matrix covert laser projected hidden images and the first dot-matrix full colour, wide-angle holographic stereograms, for which I won a coveted International Hologram Manufacturers 'award of excellence' in the year 2000 – see *LPI* and *3Digital* below.

It occurred to me that, if I used a pair of masks next to each other, one with two slotted apertures and one with two spiral apertures, used in tandem, two beams could be created with any orientation and spacing between them. The slotted mask would select the orientation of the resultant diffraction grating and the spiral mask would select the spatial frequency.



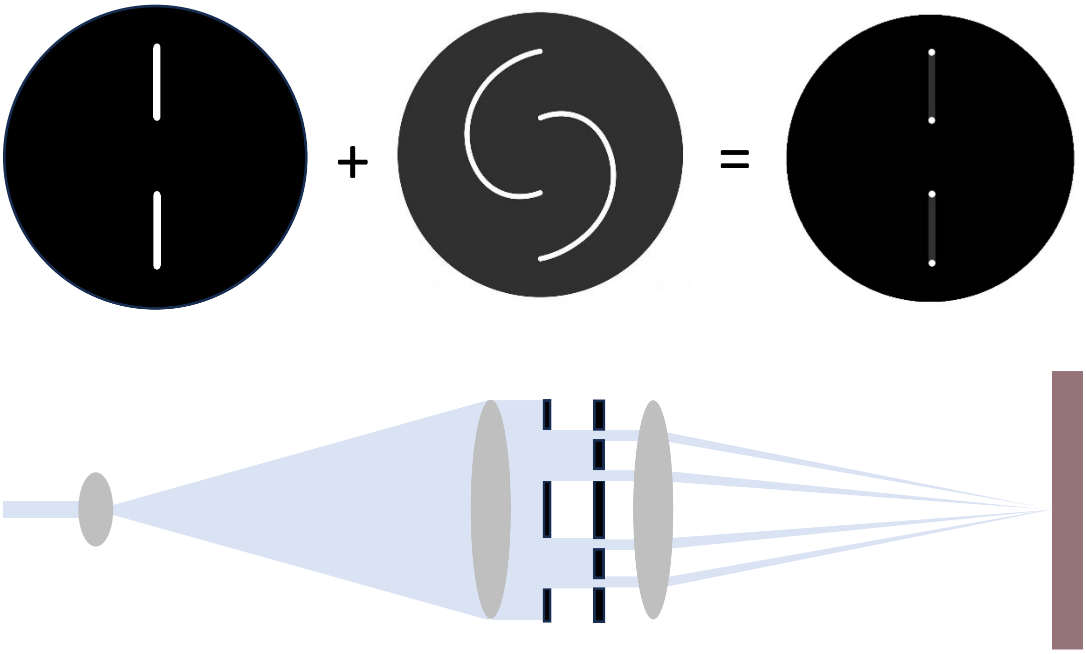
Twin masks for the selection of both grating orientation and grating spatial frequency on the fly.



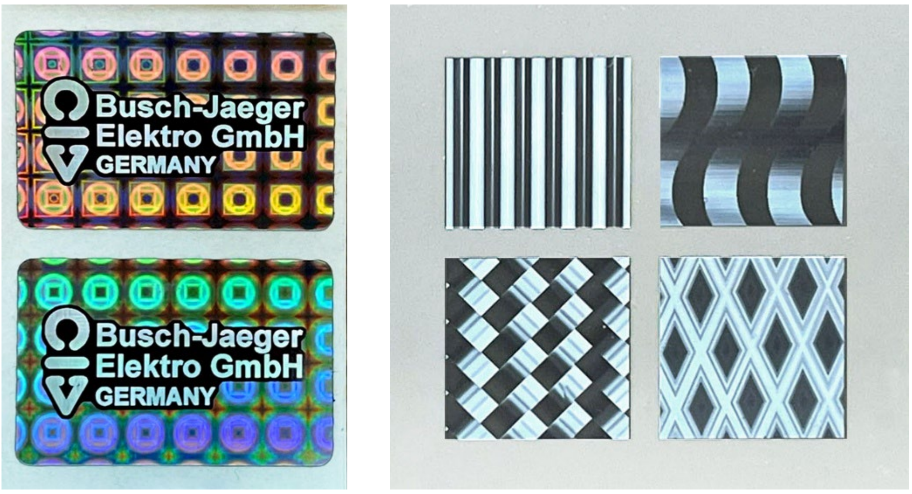
The final optical configuration for the Lightgate 1270, and Lightgate B series.

A brand authentication hologram for Disney made using the Lightgate B system, comprising of kinetic, guilloche, laser projected covert hidden image, and full colour 3D holographic stereogram optical features. The latter feature, christened 3Digital, won the ***IHMA 'New Holographic Technique' award in 2000.***

Whilst designing the two masks that controlled both grating orientation and spatial frequency, I realised there was one final, significant possibility. By arranging the apertures on each mask so that, at a single position, they overlapped to generate four beams of laser light rather than two, all four beams would interfere to form six mixed-frequency gratings, producing an achromatic, or white, diffractive pixel. The ability to create achromatic pixels was exclusive to the Lightgate system and a unique selling point, enabling the creation of achromatic kinetic patterns, achromatic 3D stereograms, mixed white and coloured elements, and many other exclusive security features.



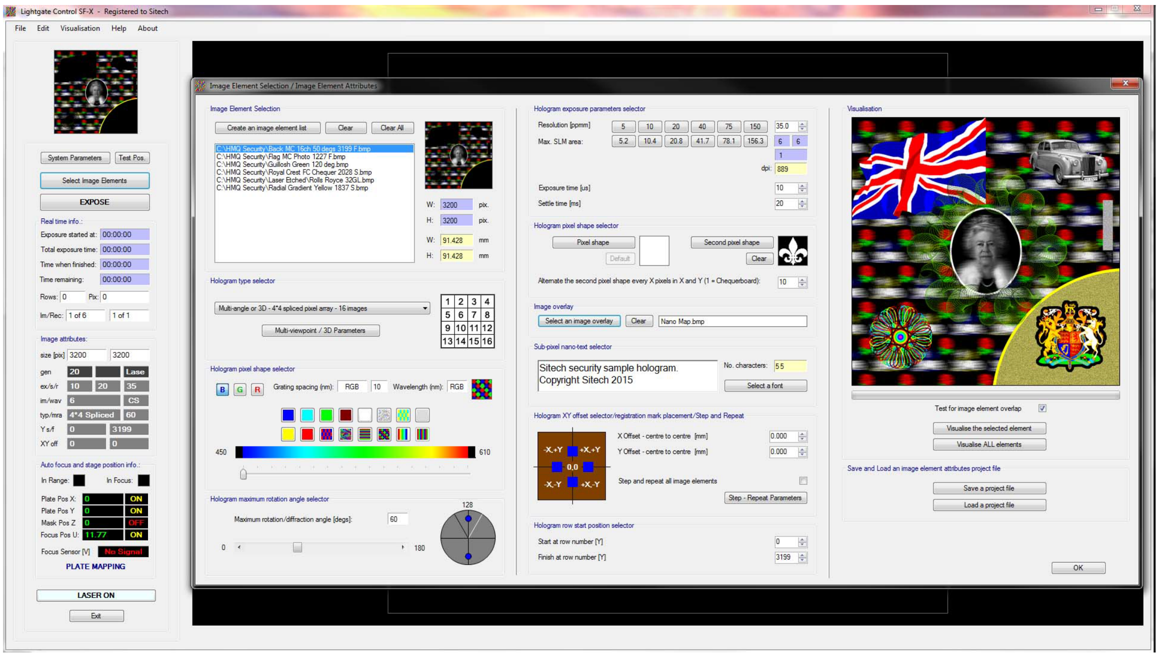
A mask configuration that produces four beams for the creation of achromatic - white diffractive pixels.



Left: A Lightgate 4-beam achromatic logo on a rainbow diffractive kinetic background.
Right: Achromatic kinetic diffractive patterns made using the Lightgate four-beam technique.
One application was the simulation of carbon-fibre effect.

Originally named the Lightgate 1270, and later the Lightgate B, the Lightgate system was also the world's first fully computer-automated, light-based, dot-matrix mastering platform capable of producing sophisticated security holograms and wide-angle 3D stereograms with parallax, surpassing traditional techniques. Crucially, its exceptionally user-friendly but sophisticated design and recording software, *Lightgate Control*, allowed operators with little or even no holography experience to create complex holograms at the touch of a button for the very first time.

Lightgate Control, the software I began developing in 1996, enabled the assembly, composition, and visualisation of complex multi-element holograms and automated their exposure, including full optical recombination. Eventually ported to VB.net, it was continuously enhanced for almost three decades and was the most capable hologram-mastering software available on any platform until the arrival of *PicoHLD* for the 4Pico B.V. PicoMaster system in 2022.



Lightgate Control, circa. 2018.

Between 1996 and 2006, over forty Lightgate 1270 (Lightgate B) systems were sold worldwide, an exceptional penetration for what was, at the time, a relatively small holography industry.

In 1996, only a handful of large companies dominated the security hologram market, but the cost-effective, simple-to-operate, computer-automated Lightgate system enabled many smaller firms and start-ups, particularly in the Far East and Asia, not only to compete, but to produce superior, next-generation security holograms. The Lightgate 1270 was instrumental in the rapid expansion of the security hologram sector during the late 1990s and early 2000s, a period in which it grew into a billion-dollar industry.

The platform then evolved through successive generations of what have been more recently termed 'interference lithography' systems - Lightgate S - an ultra-fast system, Lightgate P – the world's first large format dot-matrix mastering system for packaging applications, Lightgate X, Lightgate P-UV, Lightgate D, and recently the Lightgate U system, introduced in 2025.

Billions of holograms have been produced from Lightgate-originated master holograms, including for some of the world's largest security hologram projects. Even today, three decades after its invention, original Lightgate systems remain in active use for security hologram mastering. The Lightgate 1270 and its successors sustained my companies, Spatial Imaging Ltd. and Sitech Ltd., funded artistic work such as my holographic portraiture, supported Spatial Imaging's lenticular division, 3D Print, and provided long-term employment for several staff for over twenty years.

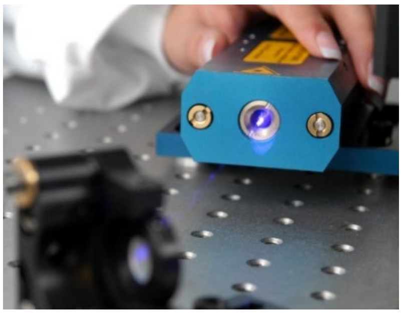
Lightgate dot-matrix holograms for the UEFA EURO 2000 Football Championships, used on all merchandise.

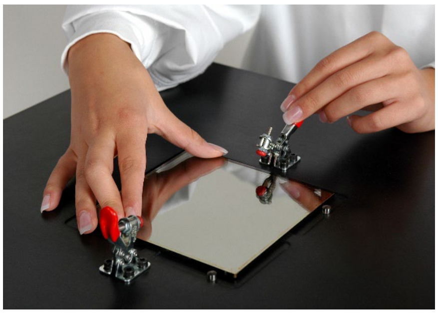
The Lightgate system was followed by the KineMax system, developed by Pawel Stepien of Polish Holography Systems. The KineMax employed an equally innovative but fundamentally different digital mastering technology called '*image matrix'*, and became the leading system from the mid-2000's until it too was surpassed by the truly groundbreaking PicoMaster platform, a single-beam, direct-write lithography (SB-DWL) system developed in 2013 by the Dutch company 4Pico B.V. (now Raith Laser Systems B.V.), and exclusively distributed worldwide by Spatial Imaging.

Whilst other systems have come and gone, such as the accomplished but commercially unsuccessful Sparkle system from Ahead Optoelectronics, Inc, a more refined and capable version of the Light Machine system; the Firefly system from Combustión Ingenieros S.A.S., modelled on the KineMax system; and various systems produced in China and India that replicated existing technologies, three light-based digital security hologram mastering platforms have dominated the market over the past thirty years: first, the Lightgate dot-matrix system; second, the KineMax image-matrix system; and third, the PicoMaster SB-DWL system.

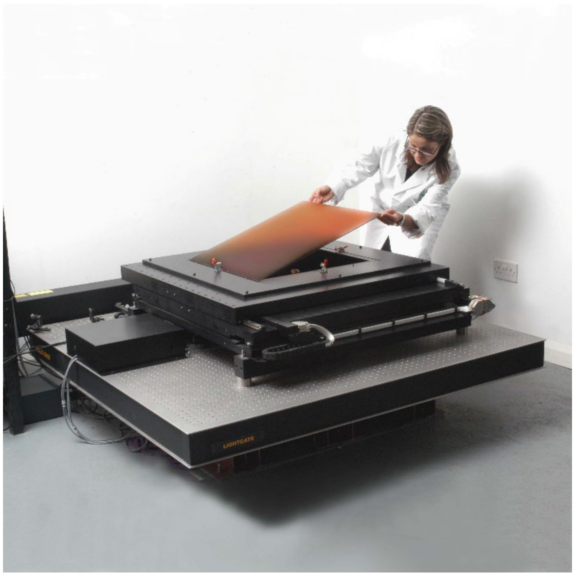
My eureka moment, however, and the Lightgate system that followed, proved pivotal. It set in motion a transformation of the security hologram industry and reshaped its capabilities and competitive landscape.

The Lightgate System 1270, 1997, utilising a Helium Cadmium laser.





Left: The Lightgate B System, 2004, utilising a 405nm Diode laser. Right, Loading a photoresist plate.



Left: The Lightgate P1 large-format system, 2002. Right: A large-format dot-matrix hologram made using the Lightgate P1 held by Spatial Imaging holographer Olivier Pitavy.

The next generation - the 'LightSpeed' Lightgate S and Lightgate P2 systems

In 2004, after seven years of highly successful sales of the Lightgate 1270 (Lightgate B) system, I set myself another challenge. Smaller-format dot-matrix had performed very well commercially, but no digital hologram mastering technology of any kind existed that was fast enough to produce large-format, seamless digital holograms for packaging applications.

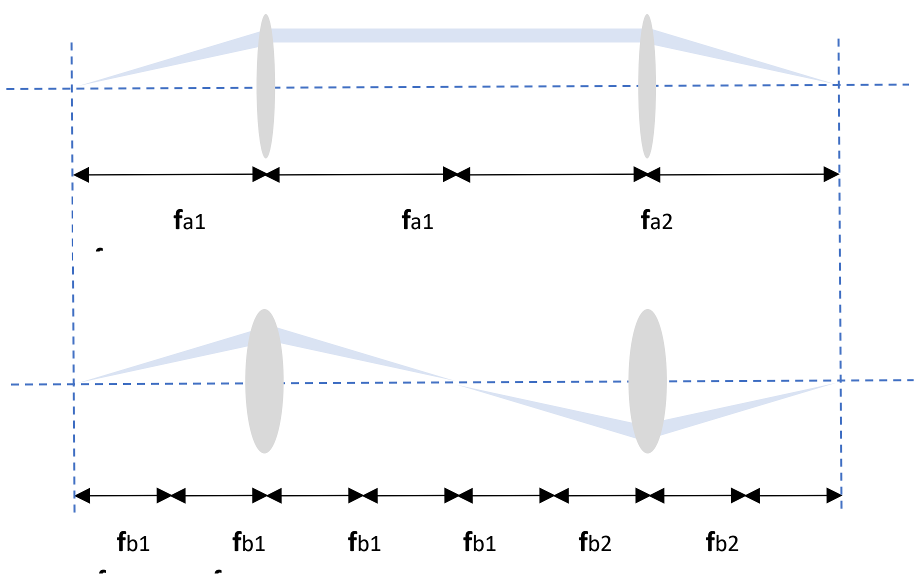
At that time, large area diffractive patterns for packaging, product enhancement, interior design, and architectural use were created by tiling a small hologram edge-to-edge. This approach inevitably introduced visible seams, an unacceptable flaw for packaging manufacturers who wanted uninterrupted, seamless imagery across their products.

The only true solution was to originate a single, large-format hologram, but with existing systems running at only a few hundred pixels per second, producing a master of that scale would have taken weeks - commercially unviable by any measure. I therefore set out to invent a system capable of producing holograms up to, and even exceeding, 1 × 1 metre in just two to three days, transforming what had previously been impossible into a practical, production-ready process.

An idea first took root through a conversation with Jeffrey Wyle of Light Dimensions Inc. in Miami, Kevin Brown's company. Jeffrey had been developing a higher-speed dot-matrix mastering system that utilised rotating dove prisms in two interfering beams, and he flew to London to explore the concept with me. Although ingenious, that optical approach proved unsuitable for the scale and precision I needed. More importantly, my aim was to devise a completely original method, one that avoided replicating existing technologies and opened a genuinely new pathway for large-format digital hologram mastering.

The interferometer concept was compelling, however, and so I began to explore it more deeply. Scanning a beam through an interferometer causes the two emerging beams to move together while remaining superimposed. My idea was to find a way to invert one of those beams so that it became the mirror image of the other, opposite and perfectly symmetrical about the optical axis. Achieving that symmetry would unlock a fundamentally new method of generating dot-matrix holograms at high speed.

The turning point came with a brief but pivotal meeting. I arranged to see Prof. Paul French from the optics department at Imperial College, London and put the above challenge to him. His response was immediate: *"a 4F–8F system."*

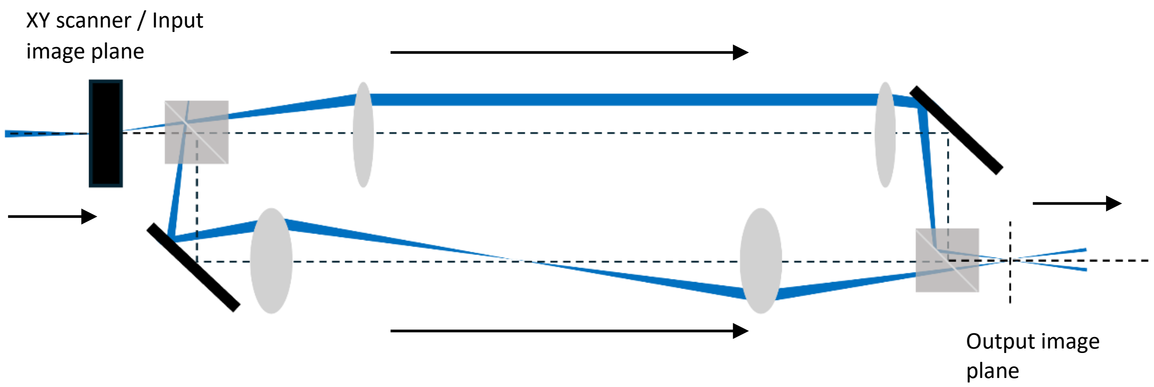


The standard 4F – 8F optical system

A 4F–8F imaging system is essentially an asymmetric arrangement of lenses placed on either side of the interferometer, whereby the input and output images for each arm, in this case a point of light, are equal but opposite to each other.

On the first arm, two lenses of equal focal length are arranged so that the input image lies exactly one focal length in front of the first lens, and the output image is formed exactly one focal length beyond the second lens. The lenses themselves are separated by two focal lengths, giving a total optical path of four focal lengths. This configuration produces a collimated beam between the lenses, parallel to the optical axis, and yields an inverted image at the output. On the opposite arm, two lenses are again used, but with half the focal length of those in the first arm. In this case, the input image lies exactly two focal lengths before the first lens, and the output image is formed exactly two focal lengths after the second lens. The lenses are separated by four focal lengths, giving a total path length of eight focal lengths. This arrangement causes the beam to cross the optical axis between the lenses and produces an upright output image. This creates the symmetry required for the interferometric method to work.

As shown in the diagram below, the first incarnation of my scanning interferometer used a narrow but expanding beam from a point source directed through a Mach-Zehnder interferometer optical system. This single input beam arrives at the far end as two output beams on opposite sides of the optical axis which refocus and recombine at the same point, to create interference.

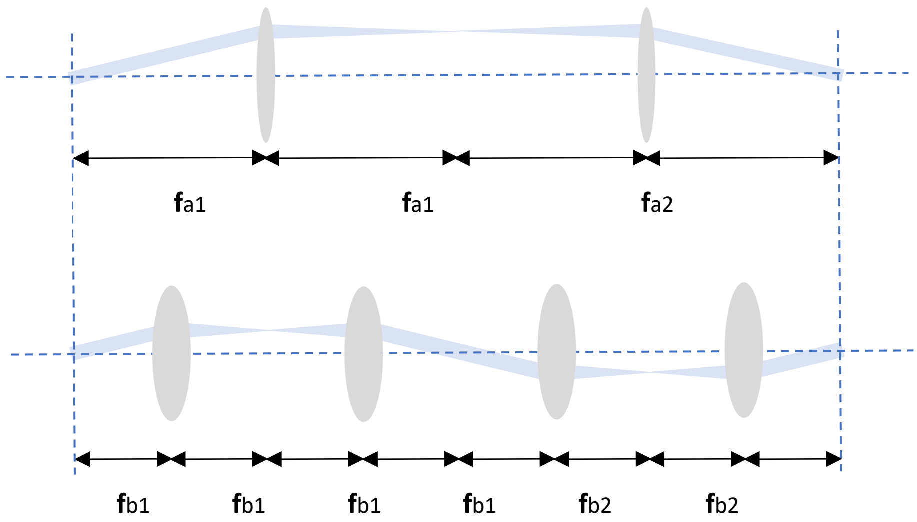


A scanning Mach-Zehnder interferometer based on a standard 4F-8F optical system

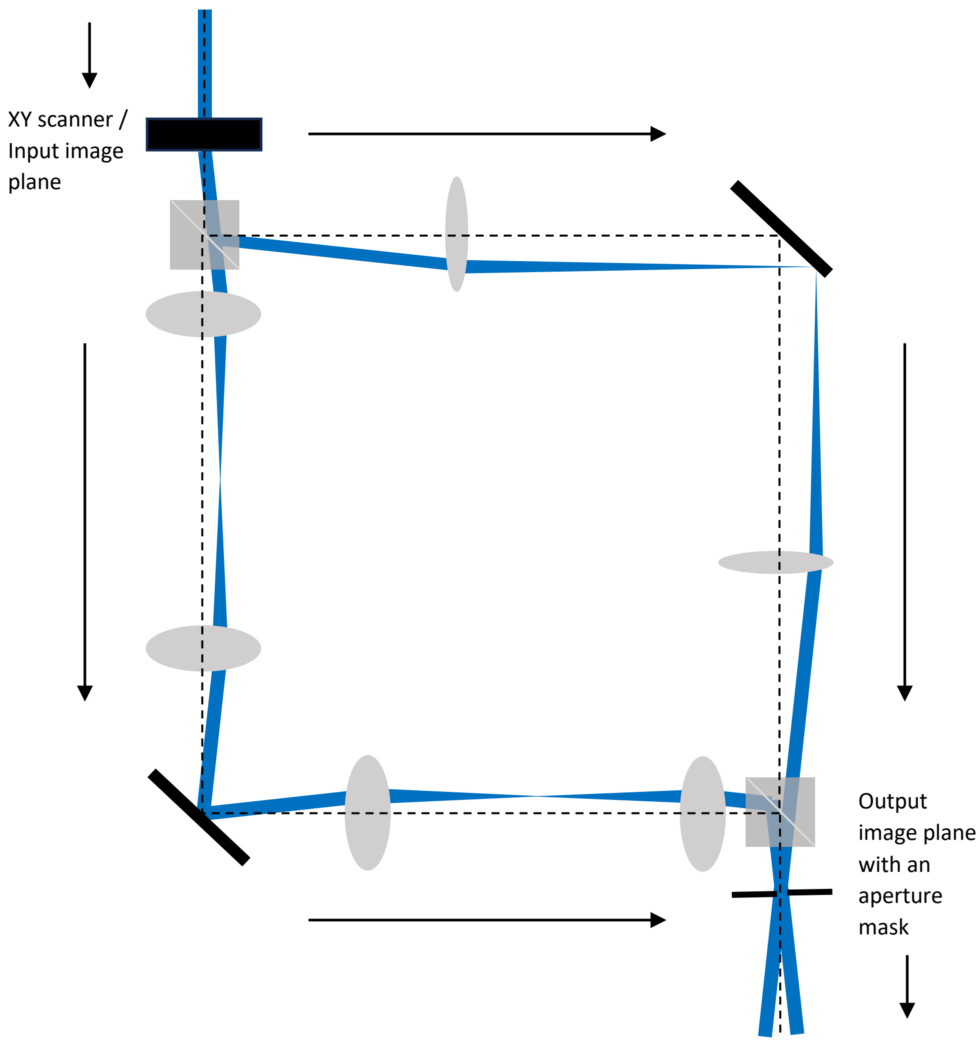
A prototype was built and tested, but it quickly revealed a fundamental limitation. The optical configuration produced two extremely small focal points on the output image plane, and achieving perfect overlap between them, especially when rotating the beams, was extraordinarily difficult. This constraint ultimately rendered the standard 4F-8F configuration unsuitable for a high-speed, scanning interferometer mastering system.

It therefore fell to me to devise the final solution. The approach I developed was to scan a collimated beam through a revised lens arrangement. Instead of beginning with a narrow, diverging point-source beam, the input would now be a uniform circular collimated beam - typically 2 - 4 mm in diameter. This arrangement generated two corresponding collimated output beams at the far end of the system. Crucially, these two beams would once again converge and interfere, but without the impossible alignment demands of the earlier point-focus design. A further advantage was that the relatively large overlap region could be masked to provide a square, or any desired diffractive pixel shape.

The 4F arm of the interferometer remained unchanged, but the 8F arm required a different strategy. Instead, I used four sequential 2F imaging sections, each employing lenses with half the focal length of those in the 4F arm. This configuration delivered the output beam inversion required.

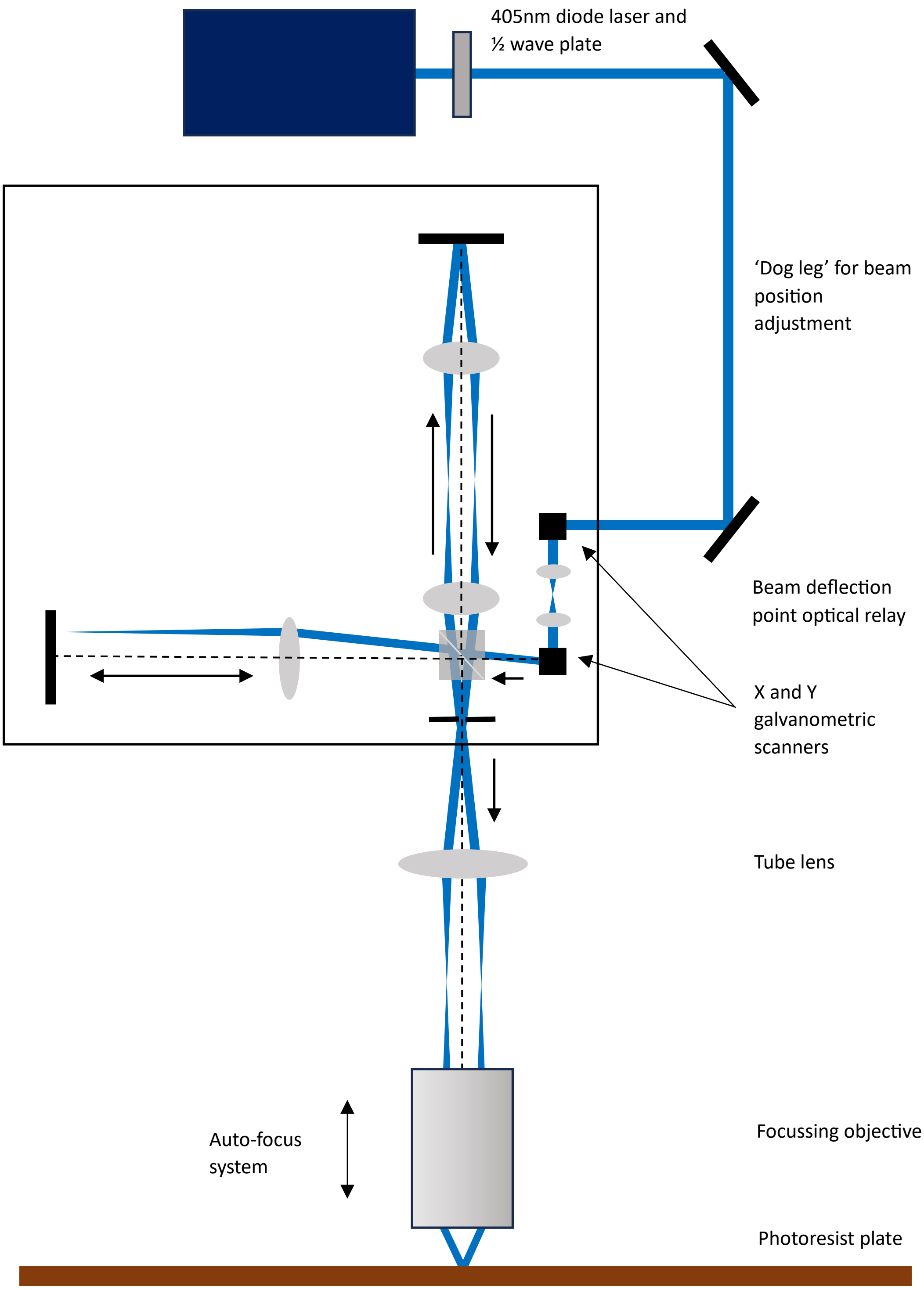


An alternative 4F-8F optical system



A scanning Mach-Zehnder interferometer based on a alternative 4F-8F optical system

Because the previous layout lacked the compactness required to fit neatly underneath the open frame XY table of a Lightgate S system, or within the moving optical head of a Lightgate P system, I subsequently devised a more compact Michelson interferometer-based design. The design shown below became the basis for most of the systems that were ultimately sold.



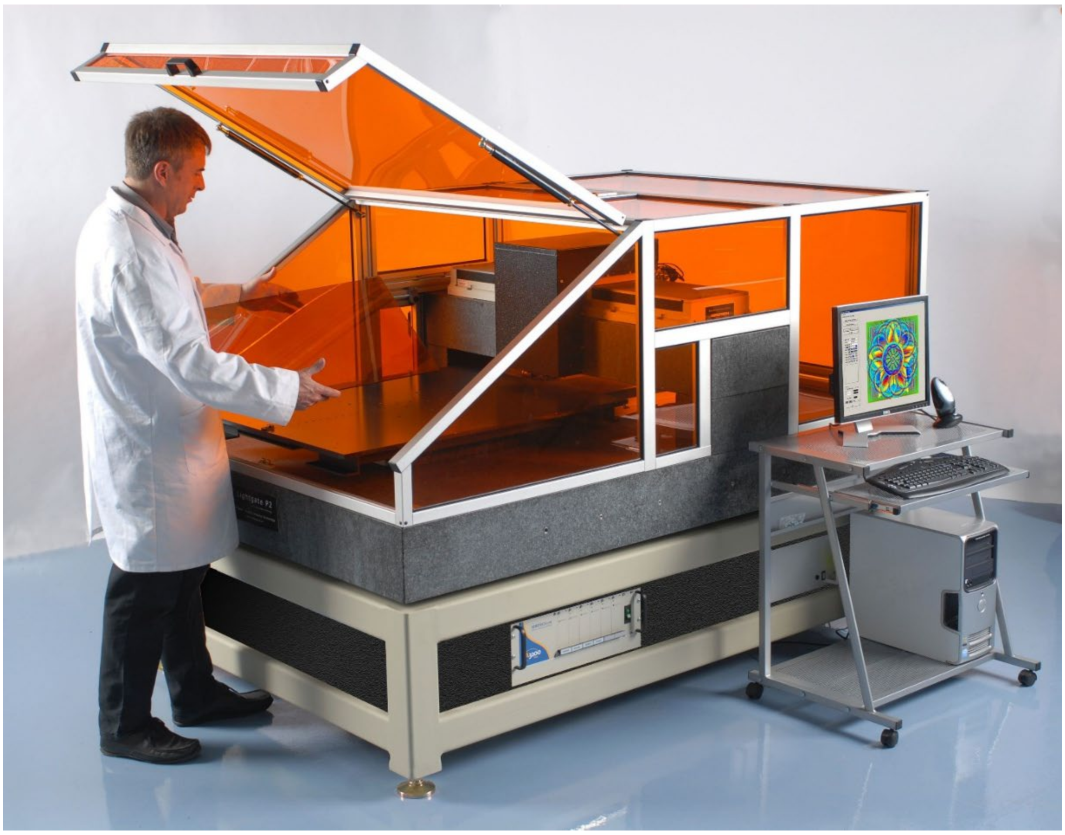
The complete scanning interferometer system used for the ultra-high speed Lightgate S and Lightgate P2 dot-matrix mastering systems. In some configurations, beam-expansion optics were added to increase the input diameter, and a through-the-lens red-laser autofocus system was developed to maintain output image sharpness to within a few microns.

The Lightgate systems that employed the scanning-interferometer technology included the Lightgate S1 and S2, small to medium-format security hologram mastering systems, as well as the large-format Lightgate P2 system for holographic packaging and other large-area holographic applications.

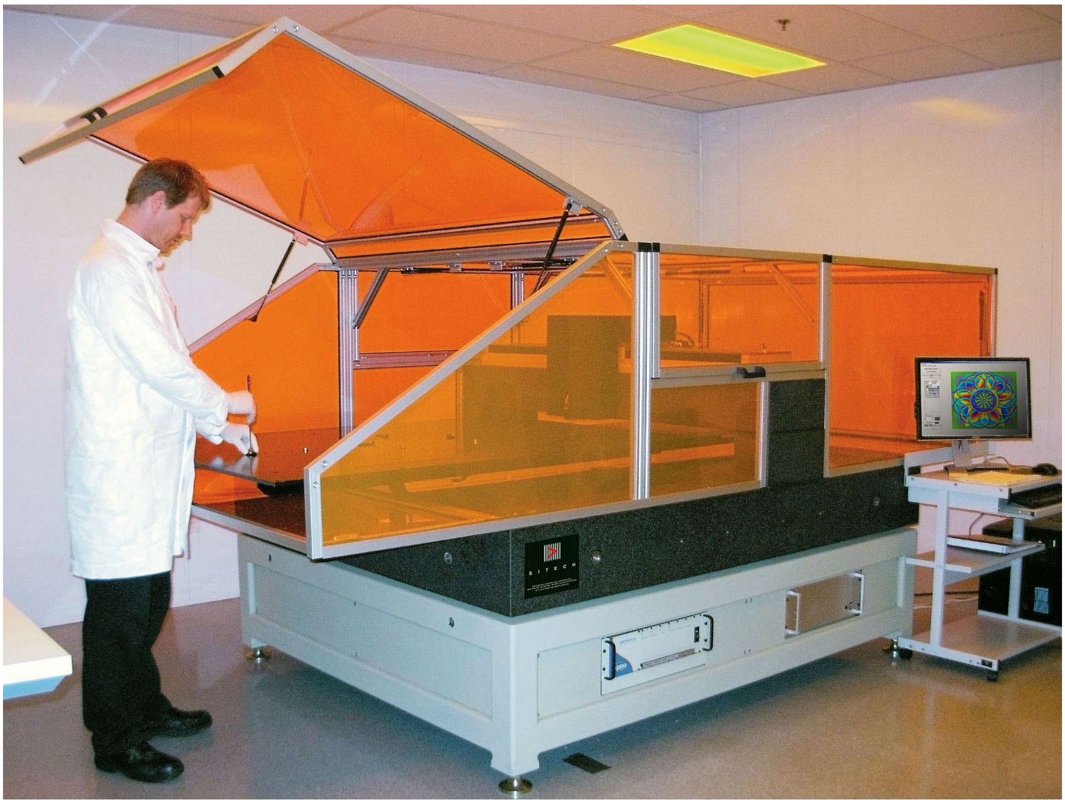
Additional variations of the scanning-interferometer approach were also developed, including a configuration that used Dove prisms in each leg of a Mach–Zehnder interferometer to flip the two beams to opposite sides of the optical axis, and another that used Porro prisms at the end of each leg of a Michelson interferometer to achieve the same effect.

Rob Munday with his Lightgate S2 dot-matrix mastering system.

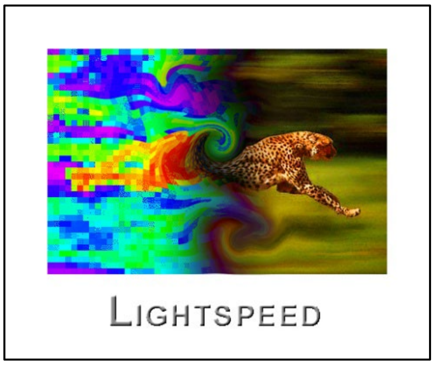
Left: The Lightgate S2 control units, top, the galvanometric scanner and laser controller, and bottom, the Aerotech motion control system. Right: The Lightgate S system in operation.



Rob Munday with his Lightgate P2 system, circa 2008.



Holographer Brian Mentz operates a large-format Lightgate P2 system at the premises of Vacumet Corp, Franklin, Massachusetts, USA.



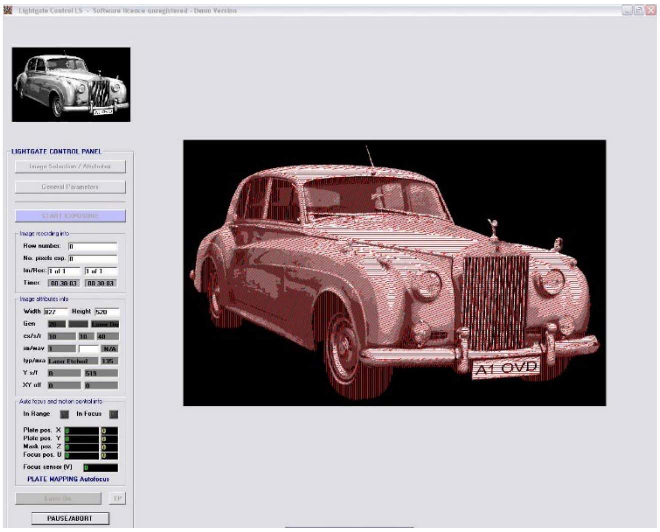
Left: Rob Munday's branded his scanning interferometer technology 'Lightspeed' technology
Right: Spatial Imaging's Lightgate logo.

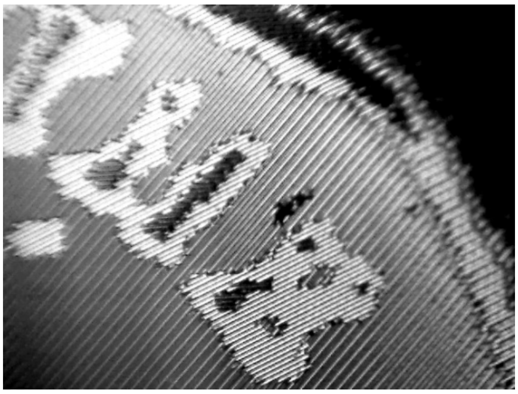
Direct Laser Etching

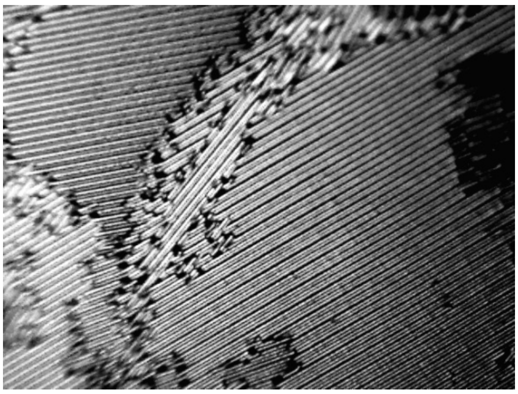
In 2010, I conceived the idea of bypassing the interferometer entirely and directing a single beam of laser light straight through the focusing objective to create a single, tightly focused spot of light. This focused beam was then used to generate a new type of D*irect Laser Etched* optical feature - a low-spatial frequency diffractive image that appeared achromatic or silver - white when viewed.

Lightgate Control first calculated and saved the positional data for arrays of linear vectors for any 8-bit greyscale bitmap image, varying the vector spacing and/or vector orientation according to the grey level. These vectors were then directly written onto the photoresist using the stationary focused laser beam in combination with the fast linear-motor XY stages of the Lightgate system. After development these periodic grating structures were in the order of 2 - 4 microns wide and 1 - 2um deep.

The Lightgate platform was the first light-based hologram mastering system to offer this technique, later followed by the KineMax system. It proved particularly effective for producing silver-metallic diffractive images and patterns. This technique also forms the basis of Spatial Imaging's large-format Lightgate D system.







Left, top: The Lightgate Direct Laser Etch feature selected in Lightgate Control.

Right, top and bottom: Close up photographs of Lightgate Direct Laser Etched images.

Patent Applications

In 2006, I filed an international patent application for this idea under **PCT/GB05/02662**, naming both Dr Paul French and Spatial Imaging's holographer, Olivier Pitavy, in recognition of their help. The corresponding US application, **US 2007/0258119 A1**, was published in November 2007. Although the patent ultimately could not be taken to grant due to lack of funds, the concept represented a genuinely new and significant advance in ultra-high speed digital hologram mastering.

Awards

Spatial Imaging's inventions have won five technology related ***International Hologram Manufacturers Awards of Excellence***:

2000 Category: New Holographic Technique

3Digital – Rob Munday's development of three-dimensional, wide-angle, digital 'dot-matrix' holographic stereograms produced using the Lightgate dot-matrix hologram mastering system.

2005 Category: New Holographic Technique and BEST OF THE YEAR

The Lightgate P2 with Lightspeed technology. The world's first commercially available, largest format and fastest digital hologram design and mastering system enabling the creation of large-format, single-image, seamless digital 'dot-matrix' holograms and diffractive patterns.

2006 Category: New Holographic Technique

The Hydra image capture system - a unique multiple-camera system for the capture of parallax image sequences. The Hydra system was able to instantaneously capture a sequence of images, automatically register those images for smooth 3D / animation and generate any number of intermediate frames using 'parallax rendering'. The image sequence was then be used to make three-dimensional dot-matrix holographic stereograms or lenticular images, particularly portraits. The system was technically conceived and designed by my co-director and business partner, Jeffrey Robb, for a subsidiary company named FaceStation Ltd.

2008 Category: Industrial

Fast Track. The Fast Track system was an optional component of Spatial Imaging's ultra-high-speed digital hologram mastering platform, enabling the extremely rapid recording of digital holograms. It allowed the recording medium to move continuously while maintaining precise 'plate tracking', so that diffractive pixels could be written accurately onto the moving substrate.

Credits

My thanks go to the following individuals who have been instrumental in Spatial Imaging's success from the sale of its very first hologram mastering system in 1994,until today.

Jeffrey Robb, who conscientiously worked alongside me for 15-years from 1994 until 2009, supporting the DI-HO and Lightgate technology business by installing systems, designing and creating promotional and security 'dot-matrix' holograms, and designing and writing educational materials, technical manuals, conference papers, and magazine articles for technical publications, and attending conferences.

Olivier Pitavy, who, as my primary technical right-hand man for 7 years from 2002 to 2009 and beyond, built, tested, installed, and supported Spatial Imaging's range of Lightgate mastering systems, travelling the world with me. When the chips were down, a system component had failed, or the owner of a hologram company in the depths of China misunderstood the capabilities of the system, it was Olivier's patience, confidence, and quiet stoicism that always saved the day.

Dr Paul Apte of Rideo Systems Ltd. in the UK, who has been an integral part of the success of my technology initiatives for more than twenty years. Paul has devised numerous motion-control solutions, contributed major software enhancements, and in recent years has designed, built, and installed new generations of Lightgate systems around the world.

Neil Anderson of C&L Developments Ltd. in the UK has, from the late 1990s to the present day, skilfully designed and crafted, with the utmost patience, every custom component required for my plethora of hologram mastering systems and related technologies. His other claim to fame is that he designed and built the legs for the Star Wars robot R2-D2.

Between 1996 and 2008, the technology business of Spatial Imaging, from designing new systems to writing the software to control them, and from building the machines to installing and supporting them around the world, was sustained and driven by myself with the exceptionally small core team listed above. Since 2008, the operation has been carried forward by me alone, working in continued collaboration with Paul Apte and Neil Anderson.

Despite this exceptionally small operational base, Spatial Imaging has, over the past three decades, delivered more than one hundred digital hologram mastering systems and associated technologies, to companies both large and small throughout the world. Working within what remains a very small and highly specialised global industry, the company has maintained a uniquely long, consistent, and productive presence. Its portfolio of world-leading and best-selling systems includes its DI-HO system, its Lightgate range, and, in more recent years, the paradigm shifting direct-write lithography systems developed by 4Pico B.V., and now produced by Raith Laser Systems B.V., in The Netherlands, for which it is the worldwide exclusive distributor.

Taken together, this represents the largest number of professional digital hologram mastering systems supplied by any company in the world to date, a testament to both the longevity of Spatial Imaging and the technical distinctiveness of its inventions and solutions.

Rob Munday, 2026