ITW Security Division

The Hologram – Still Going Strong!

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Overview

In recent years, the industry has often heard the statement “the hologram is dead”, yet despite this holography and the use of holograms on ID documents is in fact still going strong – some 65 years since its invention.

Undoubtedly it is fair to say that the use of holograms in secure documents has changed since the late 1980’s and early 1990’s, in order to be relevant to today’s market. Through this evolution and development of new holographic techniques, the hologram is still widely used today and continues to be one of the main security features chosen by Governments and Government Agencies in the fight against counterfeiters and organised crime gangs operating in the multi-million-dollar trade of counterfeit or illicit Passports, Driving Licenses, National ID Cards and other personal ID documents.

This latest White Paper from ITW Security looks at the history of the hologram and its role in today’s ID industry. From analysis of what a hologram is, to understanding its use across a variety of substrates – including ID documents and banknotes – it explores how holography is still meeting Government’s and document issuer’s authentication and security requirements.

What is a Hologram?

A hologram is a photographic record of an image or object produced by illuminating the subject with coherent light (such as from a laser) and then using the light reflected from this object a piece of film is exposed. When interference patterns on the film are illuminated by the coherent light, a three-dimensional image is produced.

The history of holography dates back to 1947, when British born scientist Dennis Gabor (native of Hungary) developed the theory of holography whilst working to improve the resolution of an electron microscope. Gabor coined the term hologram from the Greek words holos, meaning "whole," and gramma, meaning "message"[1]. Further development was prevented during the next decade because light sources available at the time were not truly "coherent" (monochromatic or one-color, from a single point, and of a single wavelength). This barrier was overcome in 1960 by Russian scientists N. Bassov and A. Prokhorov along with American scientist Charles Towns who invented a laser, whose pure, intense light was ideal for making holograms.

In 1962 Emmett Leith and Juris Upatnieks of the University of Michigan realised through their work on side-reading radar that holography could be used as a 3-D visual medium and they produced the first laser transmission hologram of a 3D object. These transmission holograms produced images with clarity and realistic depth but still required laser light to view them. Their work went on to lead to the standardization of the equipment used to make holograms today.

It was in 1968, when Dr. Stephen A. Benton invented white-light transmission holography enabling holograms to be viewed in ordinary white light creating a "rainbow" like image. Benton's invention was particularly important to the world we live in today as it made the mass production of holograms possible using an embossing technique which is essentially the stamping of the hologram interference pattern onto plastic substrate.

The resulting hologram can be duplicated millions of times and it is exactly this type of embossed hologram that we have come to know today and is used in thousands of ID Documents, Banknotes, Tax Stamps and Secure Document applications throughout the world today.

[1] http://www.holography.ru/histeng.htm - Holography Virtual Gallery

Why Use a Hologram?

Since the early 1980s the hologram has grown in popularity as an authentication device, enabling users to validate that the card is real – simply, quickly and effectively. Starting with the Visa dove on credit cards, the application has moved rapidly into software and document protection, branded goods authentication, fiscal stamps and currency.

Today holography dominates the authentication market because no competing print technology works on so many levels of security (overt, covert and forensic), nor combines decorative, eye-catching appeal and kinetic effects. A key competitive advantage is the creation of increasingly impressive optical effects, such as parallax, which appear 3D and change form when viewed from different positions. Other value-added features include the ability to record stereograms of photographic images or computer generated models. The creative options are limitless and difficult to simulate, which is why demand for this dynamic technology is growing so rapidly.

Although there is concern that access to competent simulations or, indeed, complete re-origination of images is possible, the hologram still offers an extremely cost-effective way of defending against even the most professional of attacks. In such situations, the choice of technology and the verification of the hologram at the second level (covert) stage are critical.

Level 1, or overt, features are those that are instantly verified by the naked eye or have some kind of tactile structure. They are visible and discernible to the average person who has no training or instruction. A hologram with its kinetic movement and rainbow colouring along with intaglio ink with its raised structure would be a good example of a level 1 feature.

Level 2, or covert, features would be those that are not immediately discernible to the average person and would only be seen when a trained examiner uses a simple verification tool. Here examples would be a Covert Laser Retrievable element, the use of Invisible UV Ink or Taggants and of course the inclusion of some Hidden Text. In such situations, a laser pointer, UV lamp, taggant reader or magnifying loop would be required for authentication.

Level 3 features are those that we refer to as forensic features. Features that are only discernible by people with extensive training in a complex laboratory environment. Examples here would be the analysis of optical structures that have deliberately been manipulated to create a unique fingerprint or very fine Nanotext.

The Benefits of a Hologram

There is no competing technology in our marketspace that works at multiple levels of security at any one time (overt, covert and forensic). Holography combines powerful security with decorative, eye-catching shelf appeal due to its kinetic effects and highly saturated colours. These features appeal to human perception and are not achievable with any other print technology.

A hologram can display imagery in 3-dimensions or stereographic forms – integrating live objects, people, landscapes or even virtual computer generated models. In its embossed form, there are a vast number of product options in which holography can be used, including Hot Stamping Foil, Labels, Tamper Evident Seals, Laminates and Threads/Fibres. These varied product options can then also be applied on to a wide range of substrates including Paper, Synthetic Paper, Polyethylene (PET), Polycarbonate (PC) and many more.

Holograms in Banknotes

The first banknotes to introduce holograms were issued in 1988 by Austria and Australia. Austria added a patch hologram of Mozart on their 5000 Schilling note and Australia included a computer-generated image of Captain Cook on their $10 commemorative note[2]. These two notes then paved the way for future success starting with Kuwait and Poland also adding patch holograms, Finland adding a Thread in 1992 and Bulgaria adding the first ever holographic stripes on their 2000 Leva note in 1994. By the end of 2007 patch and stripe holograms accounted for more than 80% of all holographic features on banknotes with more than 90 currencies featuring them on one or more circulating denominations. It was further estimated that in 2007 that 42 billion of the 125 billion notes produced featured a hologram[3]. As developments in the market continued and polymer banknotes were introduced, the use of holograms continued.

The first countries to launch polymer notes were Canada and New Zealand and they incorporated patch holograms. The UK quickly followed with their new £5 polymer note with a holographic stripe[4]. In the non-polymer arena, the second-generation Euro banknotes (€20 and €50) included holographic stripes and Israel issued new 50 and 200 Shekel notes with single colour volume holographic stripes. Switzerland also issued a new 50 Franc note with a holographic volume foil stripe and Poland's commemorative 20 Zloty banknote featured a colour shifting holographic feature similar to the ones on the Philippines 500 and 100 Piso notes. By the end of 2015 a total of 280 different denominations globally were using holograms, 132 used a patch hologram, 122 a stripe hologram and 26 a holographic thread[5]

To further demonstrate the importance of holograms in banknotes it is estimated that the average person only ever recognises two security features within banknotes. The first is the watermark which 75% of people recognise and the second is the hologram at 49%[6]. *Hardly a decreasing use of technology or even a technology that is dead!* Even as the world appears to be moving away from physical cash to card and electronic transactions this does not appear to have hindered banknote market growth with production volumes increasing by an average of 3% per year which is clearly good news for hologram producers in this marketplace.

[2] The Evolutionary Use of Holograms on Banknotes – Holography Industry JSC
[3] Global currencies continue to bank on the benefits of holography – Ian Lancaster – The Holography Times
[4] Currency Holograms Undergoing a Renaissance – https://www.reconnaissance.net/news/holograms-in-currency.
[5] Holograms for Currency – Astrid Mitchell, Editor Currency News
[6] Holograms for Currency – Astrid Mitchell, Editor Currency News

Holograms in ID Documents

Let's look to concentrate on holograms used in ID Documents. A hologram first appeared on an ID document back in 1984 on the United Nations Passport, shortly followed by Brunei and Iraq. Holograms in these instances were small metallised versions used to signify an authentic document as opposed to a counterfeit document where the counterfeiter would not have had access to such holograms or technology.

As time progressed, the United Arab Emirates in the 1990's was the first country to use a full face transparent hologram to not only signify a genuine document but also protect the variable data in the document from alteration. This new use of the hologram signified a major shift for ID documents and a technology that would be used in this format for many years to come based on two major drivers.

The first driver was in 1999 when the European Union drafted a set of security standards, that were codified in 2004, mandating the use of an Optically Variable Device (OVD) for authentication and security of the variable information on the datapage. These standards stipulated that "*an optically variable (OVD) or equivalent device, which provides the same level of authentication and security as currently used in the uniform visa format, shall be used on the biographical data page and shall take the form of diffractive structures which vary from different angles incorporated into the hot-sealed or an equivalent laminate (as thin as possible) or applied as an OVD overlay, or stickers on a non-laminated paper inside page (as metallised or partially demetallised OVD with intaglio overprinting) or equivalent devices*"[7].

The second major driver then came in 2002, when the International Civil Aviation Organisation (ICAO), then also specified in their published guidelines that datapages should contain features like optical variable devices to combat potential counterfeit documents. ICAO Doc9303, Part 1 Passports, 6th edition states that "*when the biographical data page of a passport book is protected by a laminate or overlay, an optically variable feature (preferably based on diffractive structure) should be integrated into the page. Such a feature should not affect the legibility of the data…The inclusion of a diffractive optically variable feature is recommended to achieve an enhanced level of*

[7] Holograms: At the forefront of the battel against ID counterfeiting – Ian Lancaster

protection against reproduction"[8]. By 2012, more than 55% of passports use an OVD to protect data, and of this 67% were DOVIDS used to protect tampering, alteration, forgery or counterfeiting[9].

Today the hologram is the main security feature of choice to secure critical variable data on Passports and ID Cards with Keesing Reference Systems estimating that in the period 2010-2016 81% of all secure documents issued contained one or more OVD's and this has continued to increase over the years.

In the period 1990-1999 the figure was just 31% rising to 69% 2000-2009. Regionally, Europe issues the largest number of documents with OVD's at 92% followed by South America at 80% and Asia at 78%[10]. In terms of growth from the period 2000-2009 to 2010-2016 Asia has seen a 23% increase in the use of OVD's followed by South America at 13% and North America at 12%.

Specifically, in the Passport arena the use of OVD's has increased from 60% 1996-2006 through to 89% 2006-2016[11] and with in-excess of 150 million passports issued annually, a growing population and a constant increase in the number of people travelling this makes for growing market for the secure holography industry[12].

[8] Holograms: At the forefront of the battel against ID counterfeiting – Ian Lancaster
[9] Innovation Drives Hologram ID Document Protection – http://www.intersec.co.uk
[10] Keesing ID Academy – The Holography Conference, Warsaw 2016
[11] Keesing ID Academy – The Holography Conference, Warsaw 2016
[12] ABI Government Healthcare ID card Shipments Q2 2017

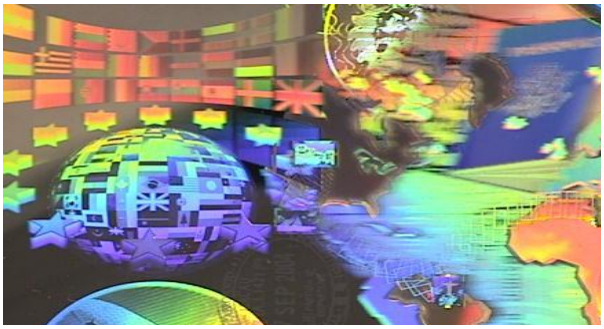
Can Holograms be Copied?

Of course, virtually anything can be copied and the holography industry works hard to constantly get the message across about just how successful holograms can be and the need to include specific security features within them. Competitors of the hologram will argue that the technology is easy to copy but the question is more “how accurately” they can be copied?

The industry will argue that a well-designed hologram integrated into a secure document is extremely difficult to replicate accurately. A counterfeit or copied hologram may be enough to fool a lay person but it is unlikely to fool a trained examiner or inspector. Counterfeiters are likely to copy only the features they can see rather than the features they cannot. In addition, poorly copied holograms are usually very easy to spot and are an instant signal that all may not be as it seems with a document whereas other copied overt features, such as print, may not be so easy to recognise.

The trick for the industry is to not rest on our laurels. We must continually seek to refresh holograms in applications and improve the technology overall. Of course, the holographic industry does not exist in isolation so it is important that as an industry we look to integrate with others. For example, as holography evolves, so too does paper manufacturing. How can we look to integrate the two and extend the life of our individual features or how can we build machine detectable traits into our holograms?

Although we might now be experiencing “feature fatigue” for the more standard hologram options there is still an acknowledged 2.1% CAGR (2016-2021)[13] for the hologram market value and maybe this growth is due to both the existing market preference for holograms and our future abilities to combine technologies.



[13] Smithers Pira – The Future of Personal ID to 2021

Summary

It's clear that holograms remain not only the single most used overt authentication device, but, increasingly the most popular multifunctional devices to include overt, covert and forensic features whilst maintaining their effective, eye-catching appeal.

The hologram appears to certainly be one of the security features of choice for safeguarding the critical personal data in a passport or on an ID card against tampering, alteration, forgery or counterfeiting. Although its use over the years has changed from being the only authentication device used on a banknote or in a secure document to potentially one of a number today, it is by far still the most accepted and admired.

With its use in 81% of ID Documents and 280 different banknote denominations, it is certainly not a dying technology and will continue to remain strong for many years to come.

About Us – ITW Security Division

The ITW Security Division was formed in 2012 through the coming together of the management teams, technologies and resources of Covid®, Fasver® and Imagedata™. Leveraging the strengths of these brands, the ITW Security Division today offers the secure document market a single source supply for high security laminate documents and dye diffusion (D2T2) ribbons.

As an independently operated division of Illinois Tool Works Inc. (ITW), a Fortune 200 company, we have the financial resources necessary to continually invest in new technology, research and development. This global footprint and view has enabled us to supply products to more than half the world's countries from our secure facilities in the UK, France and USA.

At ITW Security Division we understand that the foundation for secure materials begins with highly secure manufacturing facilities. We manufacture products from start to finish in one of our secure facilities enabling us to meet the 'under-one-roof' production requirements demanded by many governments. Our products and technologies driven by our Covid® and Fasver® brands have developed a global reputation for highly advanced security solutions. Overt, covert and forensic security technologies are customised to the specific requirements of each document program to enable the widest combination of personalisation methods and substrates for passport and ID card issuance worldwide. The companies within the security division include:

ITW Covid Security Group Inc was one of the world's first holographic and OVD manufacturers and now has over 25 years' experience. Located in New Jersey USA, the company is ISO14298 & NASPO (North American Security Products Organisation) accredited and manufactures all of its products under one roof, from holographic design and origination through to shim production, embossing, metallising, laminating, die cutting, converting and packing.

ITW Imagedata is a global manufacturer of consumables for the card industry located in the UK, specialising in the design and manufacture of D2T2 (dye sublimation) ribbons that we supply exclusively to OEM card printers.

Fasver® S.A.S.U. is a global leader in the design and production of security products for the protection of personal data on identity documents including Passports & ID Cards. Located in Montpellier, France, the company is ISO & Intergraf accredited and their unique authentication solutions have been protecting documents for over 25 years.