

# Integration of 3-D Holographic Latent Imaging for Vital Records

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## ABSTRACT

Over the past 15 years there have been various discussions among Federal, State and County governmental municipalities on how best to either replace or adopt effective alternatives to Intaglio printed security features for identity documents such as Vital Records. Because Intaglio print is primarily restricted to security printers and represents the gold standard for security documents, many government municipalities have adopted Intaglio as the sole source for the printing of their secure documents. Recently in the U.S. several Intaglio security printers have either closed their operations or elected to eliminate their Intaglio print divisions. In 2015 this situation created a supply chain void resulting in the need to research alternative technologies which are comparable to, or better than, Intaglio printed security features. In the case of identity documents, such as Vital Records, one of the most robust security features is printed with Intaglio ink which allows for the creation of transitory latent images. U.S. Vital Records incorporate latent images of a “V” in the upper left cycloid and a “R” in the upper right cycloid. This manuscript provides an alternative method of producing these transitory latent images using semi-transparent Diffractive Optically Variable Image Device, (DOVID) film.

**Keywords:** Intaglio, Vital Records, security printers, identity documents, transitory latent images, cycloid, Diffractive Optically Variable Image Device (DOVID).

## 1. BACKGROUND

In 2015 a major supplier of intaglio vital records announced it was closing its operation. This new information, along with another intaglio printer announcing it would no longer support its intaglio print division, caused major concern to government municipalities which had contract language mandating intaglio print for the printing of their Vital Records. (See letter from State municipality Appendix A)

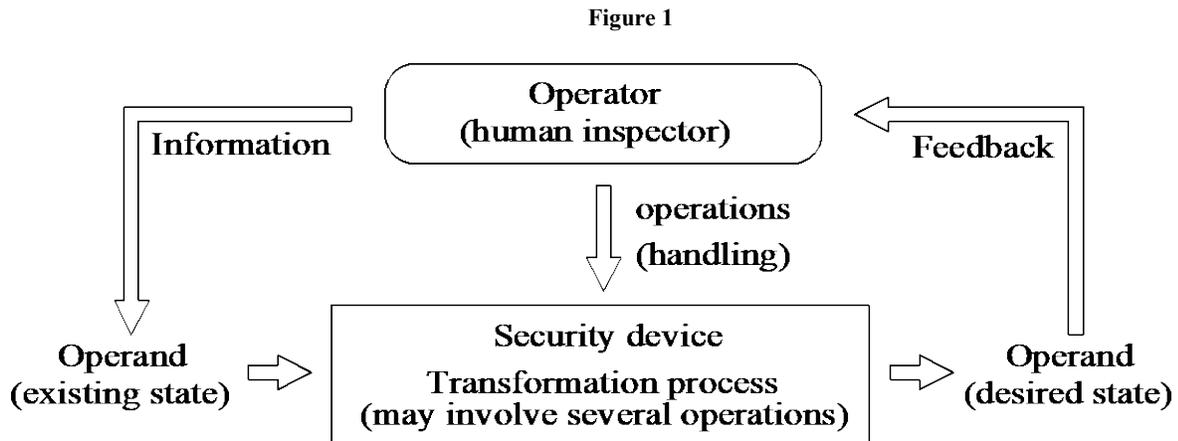
Vital record, “identity”, documents are secure transactional mechanisms which are the basis for the establishment of every person’s identity. Without accurate identity documents the credible establishment of a person’s identity becomes a case for the forensic scientist to discover identity fraud. Identity documents such as vital records are at the heart of a socio-economic system dependent upon the credible recognition of individuals for travel documents, financial transactions, national and state citizenship status, social services, criminal records, etc. Establishing a viable identification system with supporting credentials is vital to our individual and national security.

Unfortunately, due to the lack of standardization of both the appearance and security features between different State issued identity documents individuals have the ability to easily create a false identity for fraudulent purposes. Identity theft has become a growing crime in many countries, providing billions of dollars to criminal and terrorist activity. The ease of counterfeiting, altering or stealing identity documents possess a significant and real threat to national security. Today many terrorists view their ability to obtain travel and identity documents as important as their ability to obtain weapons. Vital records such as birth certificates are breeder documents and are at the heart of establishing an individual’s identity and without the standardization of appearance and security features are the most vulnerable to fraudulent reproduction and alteration.

State and county issued vital records are primary breeder documents which are also used for the establishment and issuance of our common identity documents, passports, driver’s license and social security cards. With the issuance of any of these documents a credible, recognizable identity is established. Unfortunately, without document standardization State and county issued vital records are highly vulnerable to counterfeiting, alterations and being obtained fraudulently. This is the case, also for other reasons, including lax state regulations for issuance, lax state regulations for proper inspection procedures, improper minimum standards of design, an absence of effective security features in the document, issuance of documents over many generations, technologically antiquated systems of issuance and tracking. All of these factors and more contribute to the vulnerability of this most vital of identity documents.<sup>1</sup>

## 2. FIRST LINE RECOGNITION FACTORS OF TRANSITORY LATENT IMAGES

Human inspection of any security feature is based on a cycle of actions: the development and execution of a strategy, and the observation and evaluation of results. These actions are aimed at establishing the state of the object as genuine or fake. First line inspection of security devices involves the use of the human senses only, without the application of tools like magnifiers, ultraviolet sources, retro viewers, bar code readers, etc. Public security features are of this type. The security device can be considered as a black box that must be operated by a human inspector. As shown by figure 1, an operand (matter, energy, information) can be transformed from the existing state into the desired state, with the use of this black box.<sup>2</sup>



Simple model of a black box transformation system

Within this realm of first line security devices this paper addresses the positive benefits utilizing semi-transparent DOVID film to create a transitory latent image security feature and the utilization of the intaglio printing process to create the same. In general terms both intaglio and DOVID latent images can be developed as first line security devices which have two primary security attributes and are categorized as tactility relating to the human sense of feel and visual latent images related to the human sense of sight.

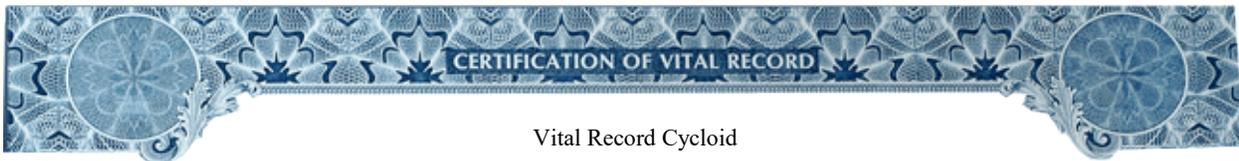
## 2.1 Tactility

With regards to either intaglio or embossed DOVID security which incorporates latent images, both offers tactility which affords the examiner the opportunity of inconspicuously sensing the relief with sensory feel. The intaglio tactility is created under extreme pressure by combining a raised layer of hardened ink along with the paper being slightly embossed / debossed. The DOVID tactility is created by the line grating depth of the latent image area engraved into a steel or brass die. The die is heated and applied under extreme pressure to transfer the semi-transparent DOVID film and the line grated latent image to the paper. The engraved line grating creates embossed relief ridges in the latent image area of the DOVID film which can be felt by scraping with ones fingernail. These embossed or debossed relief deformations result from the enormous pressure by which the engraved image is transferred to either the paper, in the case of Intaglio or the DOVID film. Tactility is a valuable security feature that can allow easy, fast and unobtrusive inspection, which is not associated with psychological inhibitions. However, its value for public inspection is limited, because most current designs neither adequately convey its function nor are the tactility aspect of the document design standardized for tactile inspection.<sup>3</sup>

## 2.2 Transitory Latent Images

Heavily relief embossed or debossed deformations in or on the substrate of a document can create images, which are covert under normal observation, but those same images become visible at oblique light incidence. These relief images are recessed etched or engraved into metal plate dies to produce raised images in or on the substrate under very high pressure. The raised images are made up of line gratings which when composed at right angles and when viewed at oblique light, create transitory images, which are referred to as “Latent Images”. Latent images can be produced utilizing intaglio printing or by metal die stamping to produce embossed / debossed deformations on other substrates such as semi-transparent DOVID film. Presently, one of the security features for intaglio printed vital records is the latent “V” image in the upper left cycloid and the latent “R” image in the upper right cycloid. (Figures 2, 3) These primary security features are complex enough that they cannot be precisely simulated or replicated by digital or traditional lithography-offset printing methods.

Figure 2



Vital Record Cycloid

Figure 3

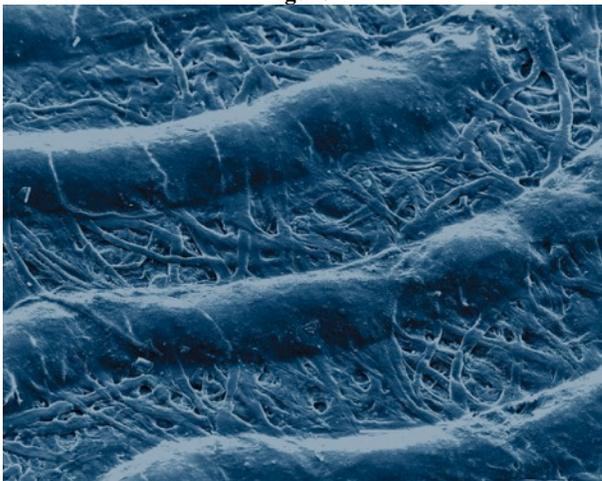


Showing Latent V&R

### 2.3 Intaglio Latent Image

An intaglio created latent image is printed and examined on a one dimension level and requires several important factors to make its function reasonably self-evident. The latent image effect is based on the embossed relief line grating made from the intaglio ink under extreme printing pressure, (Figure 4). The latent image effect can be limited if the printing pressure is not sufficient to allow for enough relief embossment and is also hampered by the gloss of the intaglio ink because the shadow casting intaglio lines will tend to light up in reflection. These effects significantly decrease the contrast between foreground and background, which hampers its orientation of visual examination at most oblique angles to illumination. (Figure 5) Intaglio latent images consist of a foreground line grating and a background line grating that stand at right angles to each other when properly viewed. (Figure 6) The lines are generally printed in a dark color which are hardly perceptible by the naked eye so that, under normal illumination, a more or less uniform field is observed.<sup>4</sup> Viewing the image requires sufficient light which is directed at oblique illumination at right angle to the foreground Intaglio relief lines. When there is sufficient light and embossment relief this viewing scenario casts a shadow that obscures the substrate in between the lines, and as a result the foreground pattern will appear somewhat darker with respect to the surrounding background line pattern. (Figure 7)<sup>4</sup> To reemphasize, the latent image can be difficult to see due to insufficient printing pressure which creates poor embossment relief. (Figure 8)

Figure 4



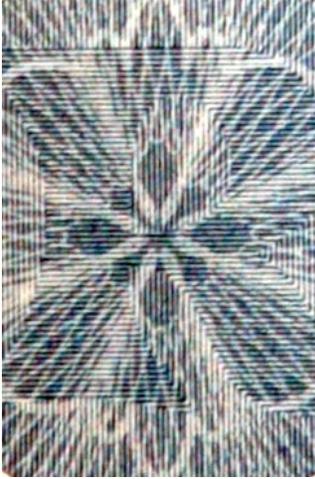
Highly magnified intaglio ink with paper fibers

Figure 5



Hard to visually see latent image due to insufficient intaglio embossment

Figure 6



Enlarged image showing intaglio line grating of latent R

Figure 7



Intaglio latent "R" with sufficient embossment relief

Figure 8



Side by side of two different intaglio documents under same illumination. Top image reflects good embossment relief and bottom shows effect of poor embossment relief.

## 2.4 Critical questions related to identifying Intaglio Latent Images

### 1. *How easily can the examiner determine and understand the function of the Intaglio latent image?*

The first line inspection function of a latent image involves verifying or falsifying the document by looking, under oblique illumination, for the presence of a light image on a dark background or reverse, depending on the orientation of the document. The observed presence of the latent image offers strong evidence of the presence of Intaglio and thus of genuineness. Intaglio latent images are found on many secure documents, such as passports, bank notes, and traveler's checks. However, because the optical effect is only visible under specific oblique illumination and observation, the general public rarely notices the latent image, and its presence is only obvious to those informed with knowledge of its existence. The examiner must know the device is there and understand its function. This is generally not the case because it is not a widely used feature. Unless the examiner is informed as to the existence or inspection process the required knowledge appears neither in the mind nor in the world.<sup>5</sup>

### 2. *How easily can an informed examiner tell what actions are required?*

Observe the document under an oblique angle, so that the light source reflects in it and the surface becomes glossy, and look for the appearance of an otherwise invisible image. This action is not evident at all, and it is difficult to imagine a design to which this disadvantage is not adhered. Subsequently, the examiner must rotate the document in its own plane, about an angle of 90 degrees, and observe a contrast swap between foreground and background. There is no way an untrained examiner can tell about the necessity of this latter action.<sup>5</sup>

### 3. *How easily can an informed examiner execute the actions?*

Even if having prior knowledge about the presence of the device, observing the gloss of the document under an oblique angle is a demanding action for inexperienced examiners. The action is further

hampered if the direction of observation is not along the edges of the image, but, for instance, under 45 degrees with the

edges. Subsequently, observing the contrast swap by rotating the document in its own plane, under near grazing incidence, is time consuming and mentally demanding. Furthermore, this action is so obvious that is strongly associated with the embarrassment factor.<sup>5</sup>

4. *How easily can an informed examiner observe the results?*

If the intaglio latent image is well designed and has sufficient embossing relief its optical effect can be sufficiently obvious. As the effect must be observed under oblique observation, the surface of the document must be sufficiently smooth. Wrinkled documents, which affect with the smoothness of the substrate can hinder the ability of observing the intaglio latent image.<sup>5</sup>

5. *How easily can an informed examiner compare the observed results with the expected results and draw correct conclusions?*

The Intaglio latent image presents a simple background – foreground image effect that easily compares with the expected result.<sup>5</sup>

In summary, as it relates to identity documents, the function of the Intaglio latent image is not always obvious, tends to be laborious, ambiguous, and psychologically inhibited.<sup>5</sup>

## **2.5 Semi-Transparent Embossed 3-D Holograph Latent Image**

Diffractive Optically Variable Image Devices (DOVIDs) are considered multi-level high-end holographic security features, which due to their examination and recognition effectiveness, are increasingly applied on banknotes and other valuable documents. From a security standpoint, there are four reasons for the frequent use of DOVIDs on valuable documents. 1. Color copiers and desk top publishing equipment cannot reproduce the multi-level optical effects of DOVIDs. 2. The production of DOVIDs tends to be complex, requiring advanced equipment and expert know how. This offers enhanced protection against counterfeiting. 3. Competitive priced mass production of DOVIDs is possible. 4. The iridescence of DOVIDs is generally quite obvious and thus readily noticed in first-line inspection. This allows discreet inspection in a glimpse, which tends to be less embarrassing.

In utilizing most semi-transparent DOVIDs, the security printer will hot stamp the film, (Figure 9) to the substrate using heat and high pressure with an engraved steel or brass embossing die. (Figure 10) Since the DOVID film is mostly transparent it can be hot stamped over pre-printed geometric fine-line security patterns such as guilloches or cycloids. Several states have changed from intaglio to DOVID latent images which samples are illustrated in the pictures below to show side by side comparative analysis between the two. In the DOVID latent image examples below we are showing a multi-level device with one printed cycloid background and 6 DOVID optical layers; layer 1 - printed cycloid (Figure 11), layer 2 - lock image (Figure 12), layer 3 - key image (Figure 13), layer 4 - word SAFE image (Figure 14), layer 5 - embossed state name (Figure 15) and layer 6 - latent image R (Figure 16). Outside of these examples any combination of security images can be customized for purposes of identification and optimization of security. Since the optical iridescence effects of combining DOVIDs with latent images is very obvious the inspection process is mostly self-evident and allows for discrete inspection at a glance.

Figure 9



Semi-Transparent DOVID film and brass engraved die

Figure 10



Brass engraved die close up

Figure 11



Printed lithographic & printed intaglio cycloids

Figure 12



Side by side comparison of DOVID cycloid with lock image compared to intaglio cycloid with same illumination

Figure 13



Side by side comparison of DOVID cycloid with key image compared to intaglio cycloid with same illumination

Figure 14



Side by side comparison of DOVID cycloid with word SAFE Image compared to intaglio cycloid with same illumination

Figure 15



Side by side comparison of DOVID cycloid showing embossment compared to intaglio cycloid with same illumination

Figure 16



Side by side comparison of DOVID cycloid showing latent image R compared to intaglio with same illumination

## 2.6 Critical questions related to identifying DOVID latent images

1. *How easily can the examiner determine and understand the function of the DOVID latent image?*

The optical effects of DOVIDs can be simple and obvious. Consequently, DOVIDs potentially allow placing the required knowledge in the world so that their function can be grasped, virtually without foreknowledge.<sup>8</sup>

2. *How easily can an informed examiner tell what actions are required?*

As their optical effects unfold by observing DOVIDs under different angles, the required actions are almost automatically performed by common handling of the documents. Consequently, the required tilt actions can be more or less self-evident.<sup>8</sup>

3. *How easily can an informed examiner execute the actions?*

The effect is simply observed in reflected light under normal handling of the document. The action is not associated with the embarrassment factor. Handling the document while tilting it is a natural act, not an obviously deliberate act.<sup>8</sup>

4. *How easily can an informed examiner observe the results?*

The changes of image and color attract attention and can be easily observed.<sup>8</sup>

5. *How easily can an informed examiner compare the observed results with the expected results and draw correct conclusions?*

Changes of color and image in DOVIDs can be unique and unambiguous to the extent that no misunderstanding will arise with respect to what should be observed.<sup>8</sup>

In summary, the optical effects of semi-transparent DOVIDs hot stamped over printed information or intricate graphics, combined with embossing and latent imaging, allow for easy and unobtrusive inspection. Their multi-level security functions may become obvious by merely tilting the document, or feeling for tactility, which can be done quickly during common handling.

### 3. CONCLUSION

The primary focus of this white paper was to demonstrate that an iridescent and semi-transparent DOVID, combined with a latent message as explained in 2.1 and 2.2, could effectively replace an Intaglio latent message feature and thus eliminate the need to rely exclusively on intaglio security printers for procurement of vital records. In fact, it is this author's opinion that the multi layers of a 3-D Holographic DOVID security feature, produced with an engraved embossed latent image, is superior to the Intaglio latent images and should be an alternative to Intaglio requirements for vital records and other high end security documents. With this said, it is also my opinion that Intaglio print is by itself a significant security feature which enhances one's ability to recognize authenticity and should be valued as such. Because of this, and due to the significant supply chain issues, (See Appendix A), government decision makers should give strong consideration to an "either or" scenario.

In final summary, allowing for the required security specifications to include semi-transparent DOVID latent images which are "as good as or better than" Intaglio, to multiple qualified and certified security printers, solves the supply problem, enhances overall security and allows for more competitive pricing.



APPENDIX A

County Recorders' Association of California

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VAL WOOD

Marshal

KEN BLAKEMORE

July 23, 2015

XXX

Subject: Statewide Bank Note Paper Supply

Dear XX:

There is a critical shortage of bank note paper supplies within the entire State of California. Currently, all 58 county recorders and health departments have a limited supply of bank note paper. At the start of 2015, due to mergers and acquisitions of various bank note companies, there remained only one company (Sekuworks) that met the security requirements of California, specifically, intaglio printing (please see Health and Safety Code 103526.5). However, that company has now closed its doors and recorders and other agencies, including the State Registrar are busy trying to find alternate printers that will meet all the mandatory security requirements of California. A United States company meeting the California statutory requirements for bank note paper no longer exists.

The County Recorders' Association of California is seeking an urgency measure to amend section 103526.5.(b) of the Health and Safety Code to strike 103526.5.(b)(1) and to require the State Registrar to conduct a review of required security features on each certified copy of a birth, death, or marriage record issued pursuant to Section 103525 and to make recommendations to the legislature not later than December 31, 2017. This legislation will sunset on December 31, 2019.

The inventory of chemically sensitized security paper that includes intaglio print to provide certified copies of birth, death, and marriage has been depleted. There are no producers of this paper in the United States. California state and local agencies are in desperate need to replenish their diminishing supply. If the intaglio print requirement was removed, there are paper producers throughout the United States that are available to meet and supply secure bank note paper that public agencies need and the public demands.

Section 103526.5 clearly states security measure requirements for certified copies of birth, death, or marriage records. These requirements have not been reviewed recently and in light of technological changes and proposed federal government regulations, the time for a review of the security measures has come. This proposed urgency legislation will provide for a two (2) year study by the State Registrar and a report to the legislature of suggested modifications to current law not later than December 31, 2017.

It is proposed that this legislation sunset on December 31, 2019 if not superseded by legislative action prior to that date. The two (2) year period between the results of the State Registrar and the sunset date of the legislation would allow time for state and

local agencies to comply with recommended security paper requirements or to seek domestic paper producers to address the requirement for the utilization of chemically sensitized security paper including intaglio print.

We are seeking your urgent help in resolving this crisis.

Respectfully,

Regina Alcomendras
President

## ACKNOWLEDGEMENTS

It must be acknowledged that much of the content language of this paper was taken directly from the writings of one of the foremost security experts in the world on Optical Document Security, the late Rudolf L. van Renesse. With Mr. Renesse's contributions to this field our industry has gained much and through his intellectual knowledge and attention to detail within his writings we can continue to do so.

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