10–12 FEBRUARY 2016
Parc 55 Hotel
San Francisco, USA

Discover the latest developments in security features, imaging technologies, smart printing, optically variable devices, micro- and nano-optics and optical examination methods
www.opticaldocumentsecurity.com
Welcome

Over the past 20 years, we have seen the development of some highly sophisticated optical security technologies, most of them introduced at the Optical Document Security Conference. But these new innovations can only be effective if they can be used in practical ways. The challenge is to create features that are even easier to recognise, simple to examine forensically and cheap to produce as well as difficult to copy.

At this year’s ODS, we will focus on some of the ways in which these latest innovations can help both the public and government authorities to authenticate and protect banknotes, passports, ID documents and other types of secure document.

And continuing a tradition established by Rudolf van Renesse in 1996 – when the conference started out as a SPIE conference – this event will provide a forum for scientific and technical discussion between researchers, designers, specifiers, issuers and examiners. Many of the advances in our industry were first announced at this conference – and we hope you will be able to join us in San Francisco in February for a fascinating insight into current and future developments.

Who Should Attend

The conference provides information, insight and guidance on future developments to around 200 delegates including:

- Specifiers and designers of banknotes, ID documents, tax documents and other secured government-issued documents
- Specifiers and designers of commercial or private sector secured documents including those issued by banks and financial institutions, educational institutions, retailers, transportation companies, concert and sports events promoters
- Specifiers and designers of personnel access and identity documents
- Producers and suppliers of security-printed documents
- Producers and suppliers of components for security-printed documents
- Designers and producers of document examination equipment, including smartphones, apps, ATMs, counting and sorting equipment
- Researchers in the security component, biometrics and security printing fields
Banknotes

User Experience and User Interface Functions of Optical Authenticity Features
Hans de Heij, De Nederlandsche Bank NV

Human perception models introduce six User Experience functions and four User Interface functions. This approach brings clarity in the largely unknown domain of human behaviour with banknotes, including the perception of authenticity features. The model is applied on the first banknotes of the Europa-series and includes public feedback on two optical features, a colour changing rolling bar and a portrait hologram.

GoGol: Development of a Security Feature for Electronic Devices
Ernesto González Candela, Banco de México

This project consists on selecting those characteristics already present in banknotes that make each piece unique in a measurable and robust way and that could be quantified using common and accessible devices with image acquisition and processing capabilities. The uniqueness is used to certify the banknotes for providing: an additional highly reliable authentication barrier and a system to track and monitor in real time authentic and counterfeit banknotes.

Banknote Lenticular Security Device Providing Both Image Change and Colour Shift
Brian Holmes, De La Rue

This presentation describes a new security device based on lenticular principles which does not require any registration mechanism between an optical viewing structure comprising 1-D cylindrical lenses manufactured by a cast-cure process and fine micro-images, provided a similar periodicity is maintained. A key property of the device is that it comprises regions generating both Conjugate Image Change and Colour Shift involving complementary colours, thus providing the general public with two distinctive and easily recognised effects for authentication of the host document, such as a banknote.

Print & Printing

Dynamic, Multicoloured Optical Effects: Innovative, Printed Solutions for Intuitive Recognition of Security Features
Christoph Mengel, Giesecke & Devrient

Banknote authentication must be as simple and interesting as possible. In this presentation we will demonstrate a new route to create innovative security features, which facilitate intuitive recognition and authentication. All effects are made by a smart combination of traditional banknote printing methods.

The presentation will conclude with a novel concept to design integrate these features with innovative foil and thread solutions to generate "communicating" features, which enhance the counterfeit resilience and enable intuitive recognition even further.

A Combination of Optically Variable Structures and Coatings – Multiplying Security and Complexity
Manfred Heim, Louisenthal

We present a combination of micromirror elements exhibiting a colour-shifting coating with design elements containing classical aluminium-coated embossing structures such as holograms. In contrast to previous products, this security element can also be fabricated as a transfer foil. The final result is a security foil which combines the well-known holograms found on banknotes with the optical colourful micromirror dynamics changing the colour when tilted.

Complete Print-Read-Decode Prototype for RGB Upconverting Inks
P.S. May, J. Kellar, W. Cross, J. Wright, J. Meruga, A. Baride, J. Petersen, D. Langerman, J. Brackins, J. Rapp

University of South Dakota

A complete system, including ink manufacture, printing of inks as covert markings, followed by reading and decoding of the printed covert marks using a smartphone has been developed. The individual system components will be described followed by demonstration of how the individual components work together to make the complete system. The system in development offers a new method of improving document security, in addition to supply chain management.

Data Collection Unit – A Platform for Printing Process Authentication
Eugen Gillich, Helene Dürksen, Volker Lohweg, Jürg Hofmann, Johannes Schaede, inIT – Institute Industrial IT, Ostwestfalen-Lippe University of Applied Sciences, Lemgo and KBA-NotaSys

Future payment devices will have to handle electronic payments as well as cash in one system. Thus it is necessary to weld such devices and optical document security. This opens a new world in banknote authentication because it will be possible to use built-in optical and processing capabilities which are far away from the standard technologies at date. In this contribution we will research the possibility to focus banknote authentication of the typical standard printing methods like Intaglio, Simultan-Offset, and perhaps others.

Intaglio Quality Measurement
Mark Funk, Eugen Gillich, Thomas Türke

Institute Industrial IT, Ostwestfalen-Lippe University of Applied Sciences, Lemgo and KBA-NotaSys

The proposed approach provides an image processing-based method to control and evaluate the printing quality of the Intaglio process. As Intaglio is used for intrinsic authentication, the approach leads to a combined strategy in quality control and authentication.

The approach is based on the analysis of small patterns on Intaglio test sheets, which represent a variety of typical Intaglio print characteristics used in banknote designs. Our goal is to develop the introduced method to be capable of analysing patterns within the design of security prints, and extension of the approach to analyse diverse currencies with pattern variations in the motifs.
New Approaches to OVDs

Continuous Motion DOVID Security Features
Markus Koch and Frank Seils, SECTAGO

Mask-less lithography is used to create diffractive gratings in the range from <300 nm to >5000 nm. The process combines the addresable structures as conventional dot matrix mastering with flexibility and resolution of modern e-beam technology. This first level security feature appears bright-white upon illumination and reveals continuous motion to the authenticator rather than discrete steps.

Transmissive Nano Pattern Images Using Surface Plasmon Resonance for DOVIDs
Soko Koda, Toppan Printing

Recently, nano-photonics technology is drawing attention in the field of security device. Using sub-wavelength structure realizes the specific physical phenomena by combining the synergy of Optics with Material Science. Therefore we focus on developing the new security features with the combination of electron beam lithography and surface plasmon resonance which is one of the optical effect of nano-photonics technology. Currently 12700 dpi high resolution text image with multi-colour expression has been realized. At the presentation, we will report the technical detail about this research.

Dual Transmission and Reflection Mode: A New Plasmonic Effect for OVDs
Jean Sauvage-Vincent, Hologram Industries

Using the optical losses to create asymmetrical optical effects in reflection viewing with symmetrical effects in transmission viewing enables the creation of a new kind of optical device based on plasmonic activity. Unbalancing the sinusoidal profile through layering materials with different optical properties leads to different optical losses (scattering, diffraction, etc) between the front and the back which result in different coloured reflections between each side of the structure. This duality between reflection and transmission allows us to design a new optical component with an easy to check behaviour.

Subwavelength Gratings for OVDs: From Local Interactions to Using Light Transport
Guillaume Basset, CSEM

In the past 30 years, CSEM SA developed subwavelength gratings as OVDs. As an example, Resonant Waveguide Gratings (RWG) were integrated in security documents under the brand DID™. These RWGs are usually called zero-order Devices because of their zero-order readout. But new developments of RWGs enable readout schemes out of the zero-order using more complex light transport. Alternatively, light transport can be engineered in the thicker dielectric layers of secured documents, using embedded subwavelength gratings.

“RainBow” Control Software via High Throughput EBL, Dot-Matrix Techniques and DLW for Advanced Optical Effects
Sergey Zaitsev, IMT RAS, Chernogolovka

Samples for reflection and transmission modes fabricated by all three lithographies will be demonstrated, noting the highest quality of e-beam lithography samples. Usage of the RainBow software system allows creating DOVIDs with sets of multiple effects and overt/covert features including: True-Colour (RGB) hologram, flat colour rainbow hologram with switching effect, 2D, 2D/3D, 3D-stereogram, kinematic effects, microtext, LetterInLens, Fresnel lenses and hidden holographic image.

Transforming Tunable Optically Variable Materials into Active, Tunable Pigments
André Arsenault, Opalux

Imagine a pigment that combines strong optically variable effects with the ability to respond to diverse and programmable stimuli. This pigment can then be formulated into a screen printing ink for printing on paper, polycarbonate, or other polymers. These printed features can be tuned to multiple colours through use of a Nd-YAG or carbon dioxide laser, or through the use of thermal printing or hot embossing.

The Plasmonic Pixel: Nanophotonic Structures for Security Feature Production with Large Surface Area and Wide Applicability
T. D. James, P. Mulvaney, A. Roberts, L. Maguire, P. Fox, G. W. Dicinoski, Reserve Bank of Australia, School of Physics

The Plasmonic Pixel (PP) is a novel, bright, polarisation-sensitive-colour-switching security feature. The PP utilises optical plasmonic nano-antennas as the fundamental building block of the centimetre-scale full colour security feature. Arrays of CMYK coloured aluminium nano-antennas are arranged using the PP design algorithm to produce the full colour image. Nano-imprint lithographic techniques provide the means to integrate the feature into banknote production.

Nano-Optic OVDs Production Performance in Security Document Substrates
Clint Landrock, Christoph Kocher
Nano Tech Security Corp

Nano-hole arrays can be leveraged to generate many novel optical effects, including high efficiency diffraction and plasmonic colours. In this paper we examine the fidelity of reproduction in low-aspect ratio nanostructures from the origination, subsequent mastering, recombination, to roll to roll lines at production speeds and direct hard embossment into the document substrates. We also review new advancements in utilizing these novel nanostructures to create unique OVD effects.

Personalized Security Features Produced on Nano-Media
Bozenna Kaminska, Simon Frazer University

NanoMedia is a new-generation information carrier with concurrent high-resolution visual display and multispectral storage capabilities. NanoMedia uses a universal pixelated substrate and can produce optically variable colour nano images at a strikingly high resolution that are personalized on demand. The technology can be applied in authenticating personal IDs and also provides a very fast process for new stamp development (for any new image) out of a prefabricated and reusable pixelated master stamp.

In this presentation, we report on a new class of micro patterning techniques that overcomes the manufacturing challenge of NanoMedia and, additionally, allows rapid, large shim fabrication for any OVD.

This programme is provisional and subject to modification.
Combination Features

Colour Movement Effects Based on Zero-order Diffractive Filter
Harald Walter and Sebastian Mader, OVD Kinegram
Zero-order effects have been known for many years as security features for government documents and banknotes. This type of feature possesses a rotation-induced colour shift in direct reflection and is realized by subwavelength gratings coated with dielectric, high refractive index material.

We present zero-order diffractive colour filters with a gradual variation of the azimuth angle. Such filters show continuous movement of the reflected colour upon rotation or upon tilting about its vertical axis.

Novel Security Features by Combining Interferential Thin-film Coatings and Sub-micro Gratings
Kai Sun, Zhongchao Special Security Tech Co., Ltd, a subsidiary of China Banknote Printing and Minting Corp
The interferential thin-film coatings show brilliant colour. Here we find the colour and other properties, such as colour shift, polarization, transmission, etc, can be effectively modified by sub-micron surface structures on which the coatings are made. It is believed that surface plasmon resonance plays a role in the modification. This technology may be readily used for multi-colour colour-shift security products, as well as integrated with various existing security features.

Integration of Customised Colour Shifting Security Features into Complex OVD’s, a New Way of Protecting Goods and Documentation
Paul Dunn and Robert Renton, Opsec
We are in early stage development of a new liquid crystal platform technology that uses unique chemistry to allow precision control of the chiral twist properties and hence the colour within any part of a printed liquid crystal layer. This technology can be optically addressed and allow multi-colour, colour-shifting images with the potential for embedding unique data during production, offering the next level of anti-counterfeit protection.

Advances in Optically Variable Magnetic Printing Technology
Edgar Müller, Mathieu Schmid and Claude-Alain Despland, SICPA
The magnetic orienting of optically variable pigment particles during the printing process yields appealing, dynamic shape – and colour – changing images. The paper addresses, based on experimental measurements and their interpretation, some relationships between the pigment orientation in the obtained images and the characteristics of pigment and ink, the properties of the orienting magnets, and the curing conditions of the printed ink.

Smartphone Authentication

Virtual Identity Document – Sooner, Later or Never
Raymond Wong, Hong Kong Polytechnic University
This paper will explore a possible way in detail how a virtual identity document is available for real-time and on-line verification of identity using electronic or portable devices in a secure and non-repudiable manner. The information flow and areas of concern will be addressed. Rather than a product description, this paper is intended more for comments and further deliberation to stimulate revolutionary and transformative thoughts for the future.

LILIAC: Transmissive Security Feature and its Integration into Banknotes and Identity Documents
Beatriz Cerrolaza Martinez, Alise Devices, S.L.
This feature is a very thin and flexible polymer film (10-20μm) transparent under daylight conditions. When the feature is positioned in front of any screen or display emitting polarized light, latent images invisible until then, appear very clearly defined. The images contained in each side are completely different, and there is no interference between them during the inspection process. In addition, the feature maintains its transparency at all times. Virtually all the displays in everyday devices (such as tablets, smartphones of laptop screens) can be used to authenticate the security feature. Just by flipping it over, different and very clearly identifiable images appear.

Analysis of Traditional Printing Method Characteristics for Authentication of Banknotes with use of Smart Phones
Georgy Kornilov, Goznak
Images made by offset and intaglio were analyzed with algorithms developed to analyze banknote images. Several zones of interest are chosen on the note and up to six analytic algorithms are applied to each zone. Using cameras of smartphones as the source of digital images, such as the requirement of short time analysis that virtually eliminates the use of high-level complex algorithms for its solution, and one-two algorithms are not sufficient in many cases. A plug-in for smart phones was developed that can be used for authenticating banknotes that are presently in circulation.

Blue Light Watermarking
Dr Sylvain Chosson, Orell Füssli Security Printing
The Blue Light security feature consists in personalizing the passport holder’s picture by embedding hidden relevant information using a 5 inks digital printing system (e.g. with an inkjet printing system) comprising the classical process CMYK inks and an additional daylight fluorescent yellow ink, which is hidden under normal illumination. Visible blue lighting or illumination by UV-A light reveals the hidden information. Several smartphone applications exist that assist in revealing the UV-based features.
**Authentication & Examination**

**Plastic Optics for Authentication Tools**
Rosalie Clemens, ASE Optics

Plastic optics have become increasingly popular in a wide range of imaging applications, including cameras, microscopes and other complex display systems. This paper explores the advantages and limitations of using plastic optical elements in authentication tools for high-security documents. Use of such materials in these applications is highly under-utilized, but offers attractive benefits and design options.

**Examination and Authenticity Control of Secure holograms**
Raman Tsialatinauk, Ivan Shumsky, Mikhail Beliatski, Yuri Kariakin, Regula

The paper describes a device for the examination and control of authenticity of the reflection holograms. The operating principle is based on measuring the parameters of diffraction gratings constituting the hologram and to obtain estimates of its authenticity by comparing them with the reference values. Measurement of diffraction gratings parameters is based on the ability of the reflection holograms to decompose the white light into its spectral components. Scanning the hologram at different angles allows sufficient information to be obtained for calculating the internal parameters of the hologram throughout the area.

**Development of Birefringence Measurement as Banknote Authentication Technology**
Robert Stewart, Innovia Films

For some years Innovia Films has been developing authentication techniques based on the concept of inherent security. The current generation of Verus devices use birefringence measurement as important sources of information. The paper describes the process from the development of a scientific model that accurately allows for the prediction of the behaviour of films known, unknown or possibly not existing. The model provides the working devices with their operating parameters.

**Banknote Cash Challenges Met by Advancing Low Cost Image Analysis Tools**
Johannes Schaede, Volker Lohweg, Alexander Knobloch
KBA-NotaSys, inIT-Institute Industrial IT, Wincor Nixdorf

In this paper it is suggested that the advent of low cost image analysis tools will allow merging the necessities of machine readability and public recognition. Because of limited detector technology, most central banks have strict regulations on recycling cash directly at the retail level. This requires image analysis of approx 600 dpi. These resolutions are attainable with detectors and microcomputers which are in a similar cost range as the current gross resolution detectors. Thus the cash cycle which is currently in the hands of commercial bank branches can be transferred to the retail without loss of quality and access at considerably lower logistic costs.

**The Screening of Counterfeit Banknotes for Latent Fingermarks Using Black Powder**
David Kenny, European Central Bank

Experiments designed to simulate the handling of counterfeits during production, counting and passing, suggest that specific fingerprint patterns can be associated with specific actions in the lifecycle of the counterfeit. To that end, the study explores the use of both magnetic black powder and the use of ultra-fine black powder within a purpose designed desk top chamber. Results obtained using this approach, can in most cases be separated from the background line patterns associated with banknote design. This can be carried out using the infrared image capture function on high-quality optical instruments common in questioned document labs.

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**Conference Dinner and Exhibition**

On the evening of Thursday 11 February we will be holding a table top exhibition and buffet dinner. This informal setting is the perfect opportunity for delegates to see, handle and discuss in detail what is happening in their field. This is also a chance to study some additional poster papers that could not be included in the main programme. The opportunity to take a table top is open to both presenters and non presenters and this is a great way to showcase products and demonstrate your latest technologies. To book your exhibit table, email tina@reconnaissance-intl.com

**Poster Papers**

**Detection of Commercial Offset Printing in Counterfeited Banknotes**
Anton Pfeifer, Eugen Gillich, Volker Lohweg, Johannes Schaede
inIT – Institute Industrial IT, Ostwestfalen-Lippe University of Applied Sciences, Lemgo and KBA-NotaSys (Country)

**Photochromic Pearl Pigment**
Wataru Yoshizumi, Shota Kawasaki, Kiyoshi Kitahara
Kyodo Printing Co

**Encryption of Watermark in Personalized Stamps**
Kuan-Yu Chen and Hsi-Chun Wang
Department of Graphic Arts and Communications, National Taiwan Normal University (Country)

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**Author Dinner**

All 2016 authors and committee members are invited to join us for dinner on 10 February. As usual, there will be a charge to cover the meal.

If you would like to attend, please email kate@reconnaissance-intl.com

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**The 2016 Conference Committee**

We would like to thank the following members for their assistance in peer-reviewing this year’s papers.

- Anton Bleikolm, AFB Engineering & Services (Switzerland)
- Paul Dunn, OpSec (UK)
- Christopher Haas, 3M (USA)
- Hans de Heij, De Nederlandsche Bank (Netherlands)
- Kenichi Kimura, Research Institute, National Printing Bureau (Japan)
- Andrey Kuryatnikov, Goznak (Russia)
- Volker Lohweg, Ostwestfalen-Lippe University (Germany)
- Johannes Schaede, KBA-Notasys (Switzerland)
- Elisabeth Schulz, European Central Bank (Europe)
- Robert Stewart, Innovia Security (UK)
- Marc Surrency, Federal Reserve Board (USA)
- Harald Walter, OVD Kinegram (Switzerland)
- Raymond Wong, Hong Kong Polytechnic University (China)
Short Course on Optically Variable Devices

Wednesday 10 February 2015

Tradition is that the popular Short Course provides a comprehensive technical coverage of the features that qualify in providing optical security for documents. The objective of the 2016 Short Course remains similar, but the flavour is different. ODS is about the new, so we are taking on board that philosophy in structuring the Short Course, but it will retain the essentials of the old.

The course will provide both a refresher for those technically oriented but who have been away from some or all of the technologies, and it will provide an introduction to the dark (light) arts (sic) for those less technical or specialised but needing a sound base in optical security sufficient to “challenge” when necessary.

In addition to satisfying these two requirements, the Short Course will also have a greater focus on the latest trends in optical technologies such as micro and nano technologies. There is a need to understand what a plasmon is if we are going to use the word. And it will be used more and more as transmitted light is used in document verification.

We will also consider the potential of these technologies to become a disruptive technology – defined as one that displaces an established technology and shakes up an industry. The list of “next big things” grows ever longer especially as Science and Engineering departments at Universities now partner with Industry in research projects to develop new products. Only a very few will succeed. It is therefore critical that leaders in our industry understand which technologies will matter to them and prepare accordingly.

*The course has two presenters who have experience of OVD’s for banknotes, payment cards, tax stamps, brand and ID documents.*

Dr Mark Deakes will be presenting for the first time at ODS. Mark has many years’ experience working with surface relief holograms having spent 15 years, prior to joining Reconnaissance International, at De La Rue in various roles including Process and Technology Development Manager for De La Rue Holographics and Technical Sales Manager for Solutions.

During his time at De La Rue, Mark was involved in the production and development of over 30 hologram products, including scratch-off holograms and co-lead the development of optically variable magnetic stripe (OVMS). Mark also spent time in holographic production where he was heavily involved in improving aspects of the surface relief production processes including: embossing, coating and demetallisation. He has both a technical (BSc and PhD in Chemistry) and a business education (MBA).

Dr David Tidmarsh has over thirty years corporate and security experience. He joined the Crane group (producers of paper for all US dollars), initially with its subsidiary Technical Graphics Security Products (the manufacturers of security threads for the US and other currencies) as director with responsibility for its overseas activities, then became Marketing Director for Crane AB – the banknote printer and papermaker which Crane bought from the Swedish government.

He previously spent ten years as chief executive of Applied Optical Technologies plc, and before that was a board director of security printers Bemrose Corp plc. Dr Tidmarsh was the first chairman of the International Hologram Manufacturers Association (IHMA) and holds a PhD in Chemistry, as well as a degree in Business Administration.
Useful Information

Registration
To be part of Optical Document Security 2016, go to www.opticaldocumentsecurity.com to book online or download an order form.

Fees
- **Standard**: £895 (€1,253 or $1,432)
- **Late booking**: £995 (€1,393 or $1,592)

*Available until 13 November 2015*

**Pre-Conference Short Course Fees**
- Short Course on Optically Variable Devices: £375 (€525 or $600)

Venue
Fees do not include travel, visas, accommodation or accompanying spouse or social partner fees for the evening reception.

The 2016 event will see a return to Parc 55, a sumptuous Hilton hotel located on Union Square in the heart of downtown San Francisco.

This contemporary, 32 storey hotel has stunning city and bay views, with stylish guest rooms, excellent event facilities and a choice of locations for meeting colleagues over a coffee, drink or dinner.

The hotel also has a 24-hour business centre and a fitness center. The hotel is located within easy walking distance of the Moscone Center, where Photonics West takes place between 13-18 February 2016.

Travel and Accommodation
Delegates are responsible for arranging their own travel and accommodation. Details of special booking rates and how to make your hotel reservation can be found at www.opticaldocumentsecurity.com

Here to Help
If you have any questions about the conference, contact the conference team:

- **Kate Powell**, Conference Manager
- **Nick Tidmarsh**, Conference Executive
- **Tina Hayes**, Conference Administrator

Tel: +44 (0)1932 785 680
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Email: events@reconnaissance-intl.com

Other Information

- **Conference Language**: The conference will be conducted in English.
- **Your Conference Organiser**: The event is organised by Reconnaissance, the leading source of business intelligence for authentication, security printing and holography. Visit www.reconnaissance.net
- **Release**: The organisers accept no liability for personal injury or any loss of or damage to delegates’ personal effects. We reserve the right to cancel, modify or postpone the event without prior notice and to refuse admission to any person (with payments refunded).
- **Terms and Conditions**: Visit www.reconnaissance.net/terms for full terms and conditions

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“ODS is clearly the most significant conference on scientific aspects of security documents and printing”

Joh. Enschedé