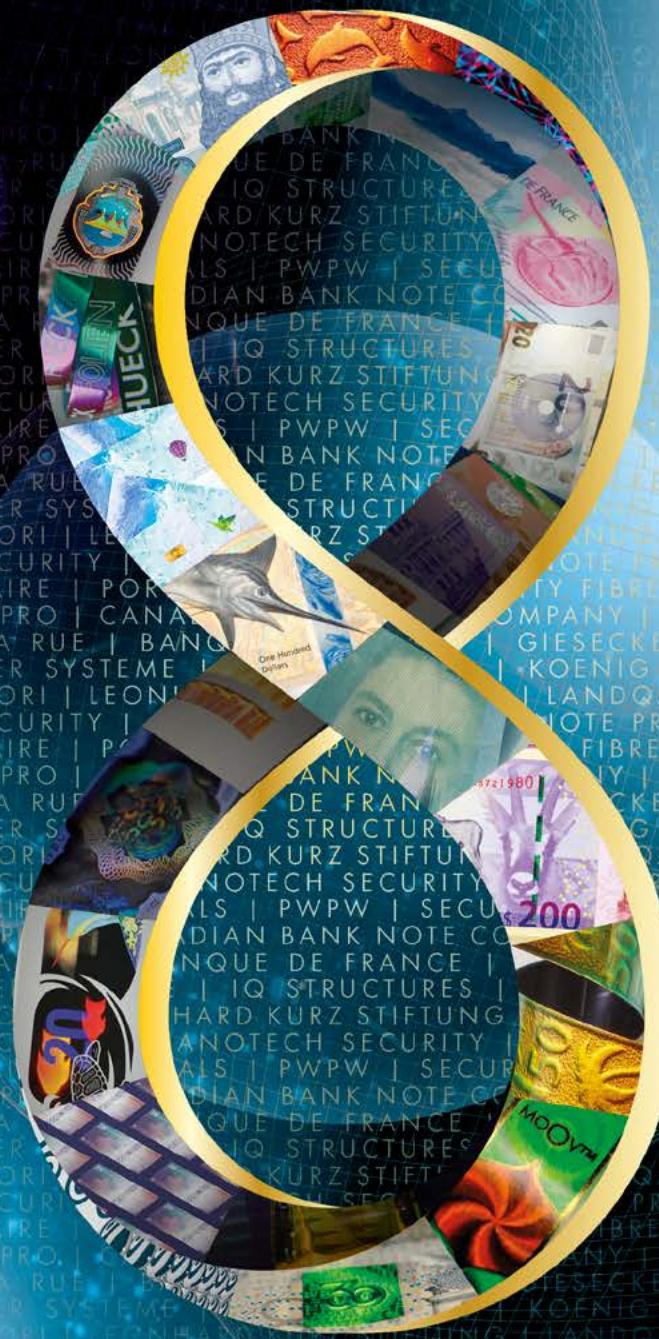


# BANKNOTE TECHNOLOGY REPORT

B T R

ISSUE  
08.22



Created by

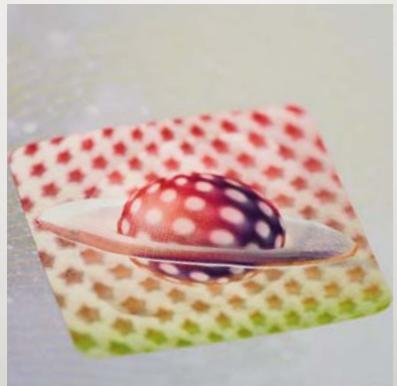
@bin  
**BANKNOTE  
INDUSTRY NEWS**

[www.banknote-industry-news.com](http://www.banknote-industry-news.com)

# KINEGRAM DYNAMIC®

New dynamics for safer banknotes

- Microlens-based security feature
- Depth effect
- Dynamic movements
- Multiple different colors
- Diffractive KINEGRAM® effects
- Secret proprietary process



The Banknote Technology Report is a platform where the latest technological developments and features are centralized on a regular basis.

## IMPRINT

Banknote Industry News GmbH  
Am Sportplatz 1 | 82041 Oberhaching / Munich  
Germany

[info@banknote-industry-news.com](mailto:info@banknote-industry-news.com)  
[www.banknote-industry-news.com](http://www.banknote-industry-news.com)

## DISCLAIMER

The information contained in this Banknote Technology Report is of general information purposes. The information, pictures, drawings, text are provided by the respective companies and we do not take any responsibility or warranties of any kind, expressed or implied, about the completeness, accuracy, design, data, reliability, suitability or availability with respect to the information of the Banknote Technology Report.

## CONTACT US

Philipp Greulich | Managing Director  
[philipp.greulich@banknote-industry-news.com](mailto:philipp.greulich@banknote-industry-news.com)

Donald Scholz | Managing Director  
[donald.scholz@banknote-industry-news.com](mailto:donald.scholz@banknote-industry-news.com)

## › CONTENT

### DESIGN:

|  |    |
|--|----|
| › CRANE CURRENCY   | 10 |
| Modern Banknote Security Software – Meet the 3D Animation Developers<br>Creating Next Generation Banknotes |    |
| › DE LA RUE  | 18 |
| The Truth About Intuitive Security   |    |

### FEATURES:

|  |    |
|--|----|
| › OBERTHUR FIDUCIAIRE  | 28 |
| RELIEF™: 3D solutions for the future                                     |    |
| › LEONHARD KURZ STIFTUNG & CO. KG  | 36 |
| KINEGRAM DYNAMIC® New Dynamics for Safer Banknotes                       |    |
| › HUECK FOLIEN   | 44 |
| Strategic partner for highest security since 35 years                    |    |
| › NANOTECH SECURITY  | 48 |
| Investing in Innovation – Bringing KolourOptik® Technology to Market     |    |
| › PORTALS  | 56 |
| Security can be Agile  |    |
| › SURYS  | 64 |
| How to develop immediately authenticable security threads?               |    |
| › IQ STRUCTURES  | 72 |
| Nanoengineered colourless optical security features for modern banknotes |    |

### POLYMER SUBSTRATE:

|   |    |
|---|----|
| › CCL SECURE                                    | 80 |
| SPARTAN™: The engineering behind a new banknote |    |

### PRINTING & PRODUCTION:

|  |     |
|--|-----|
| › NOTE PRINTING AUSTRALIA  | 90  |
| Mitigating risk in the transition from paper to polymer banknote printing    |     |
| › CANADIAN BANK NOTE COMPANY, LIMITED (CBN)                                  | 100 |
| Challenging Convention: The Bahamas CRISP Evolution \$50 and \$100           |     |
| › GIESECKE+DEVRIENT  | 108 |
| IN GREEN WE TRUST – Shaping the future of a secure and sustainable banknote. |     |

### COTTON & COMPOSITE SUBSTRATES

|   |     |
|---|-----|
| › LANDQART                                  | 120 |
| A Different Perspective                     |     |
| › PWPW                                      | 128 |
| POWER OF THE SUBSTRATE – durable and secure |     |
| › BANQUE DE FRANCE                          | 136 |
| EverFit®: banknotes made durable            |     |

### FIBRES:

|   |     |
|---|-----|
| › SECURITY FIBRES   | 140 |
| 'Under the radar!' Why fibres are still a preferred solution for paper and cotton banknotes |     |

### HIGH SECURITY INK:

|  |     |
|--|-----|
| › SICPA  | 150 |
| SPARK Flow®: Stepping into uncharted territory |     |
| › LUMINESCENCE SUN CHEMICAL SECURITY           | 158 |
| ADVERTORIAL                                    |     |

### EQUIPMENT & SERVICES:

|  |     |
|--|-----|
| › HUNKELER SYSTEME                                     | 162 |
| THREE TYPES OF DESTRUCTION – Fit for Recycling         |     |
| › KOENIG & BAUER BANKNOTE SOLUTIONS                    | 170 |
| Bridging the physical and digital worlds               |     |
| › CASH INFRASTRUCTURE PROJECTS AND SERVICES GMBH       | 178 |
| Technical and legal perspectives on cash recirculation |     |
| › KOMORI   | 180 |
| Breakthrough concepts driven by KAIZEN IMPROVEMENTS    |     |

## › CONTENT



AN INDUSTRY EVENT

Created by the industry,  
for the industry



## BE INSPIRED

by best practice from  
thought leaders from  
within and beyond the  
cash sector



## DISCOVER

the latest experiential  
and innovative technology  
helping enhance cash  
cycle at dedicated  
Technology Workshops



## LEARN

about the latest expert  
and Central Bank  
thought leadership



## CONNECT

with peers and customers  
from around the world

# Spartan™

The answer  
to the  
note/coin  
boundary  
is here.



## Spartan™

**The tougher, ultra-durable, cost-effective banknote.**

Spartan is the first polymer banknote developed specifically for those denominations that sit on the cusp of the note/coin boundary.

It's manufactured by CCL Secure as a complete, finished banknote - ready for issuance - with a unique serial number and both covert and overt security features. Talk to us now to find out more.  
<https://cclsecure.com/spartan>



Scan to watch Spartan in production.



**THE POLYMER  
BANKNOTE  
PEOPLE**

DESIGN

Z  
E  
G  
U  
R



## CRANE CURRENCY

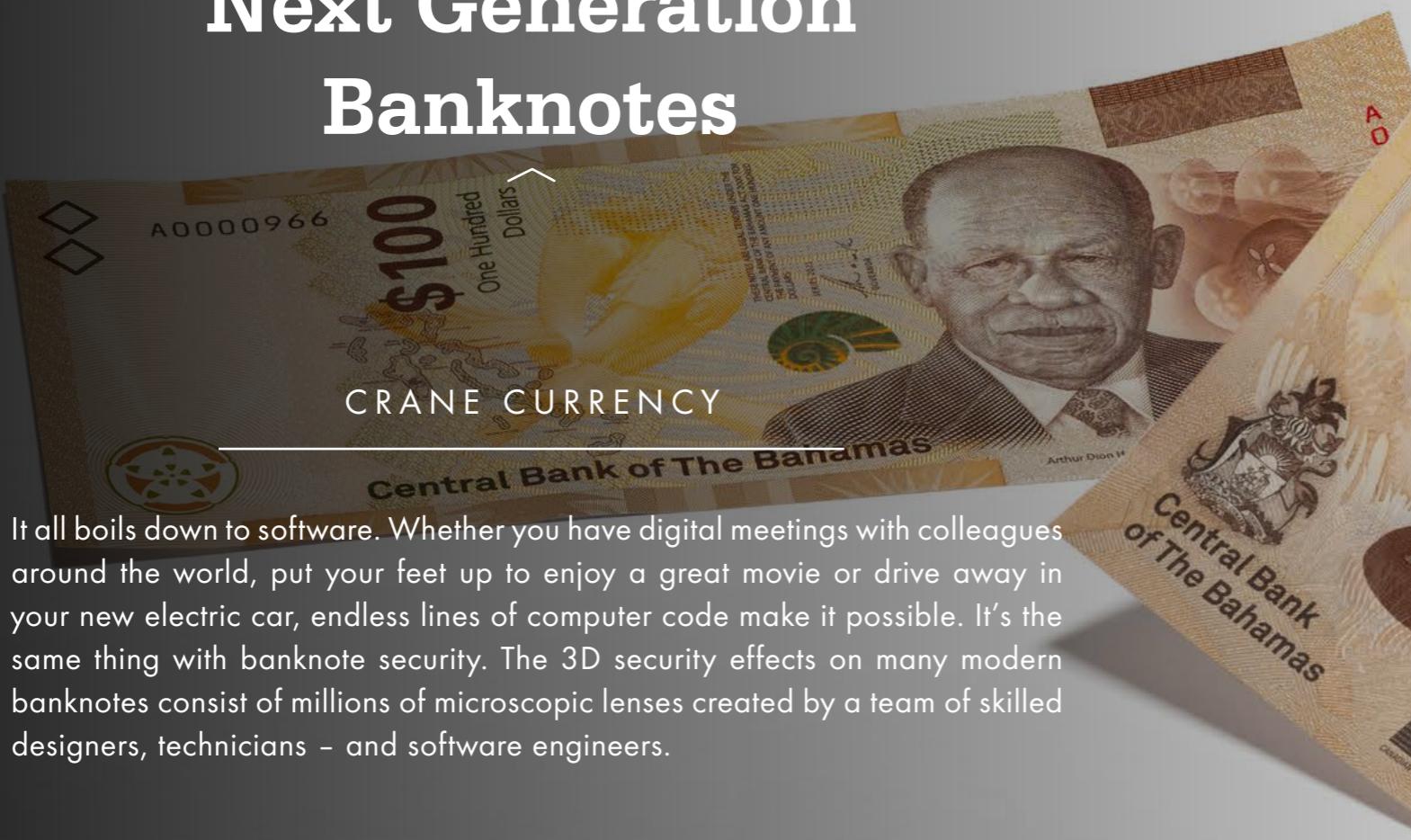
MODERN BANKNOTE  
SECURITY SOFTWARE -

MEET THE 3D ANIMATION  
DEVELOPERS CREATING  
NEXT GENERATION  
BANKNOTES

## Modern Banknote Security Software –

Meet the 3D Animation Developers Creating Next Generation Banknotes

CRANE CURRENCY



It all boils down to software. Whether you have digital meetings with colleagues around the world, put your feet up to enjoy a great movie or drive away in your new electric car, endless lines of computer code make it possible. It's the same thing with banknote security. The 3D security effects on many modern banknotes consist of millions of microscopic lenses created by a team of skilled designers, technicians – and software engineers.



When I started at Crane Currency, it took 20 hours just to visualize a relatively simple design of a new 3D effect. We had a mission to make the software faster and automate human error out of the processes. Today much more complex visualizations can be done in 20 minutes with high-performance computing and more advanced proprietary software. And there's some really amazing new security effects in the works," says Ben Bleiman, Senior Manager of Micro-Optic Design at Crane Currency in Alpharetta, Georgia.

The first micro-optic security feature was introduced by Crane Currency more than ten years ago. It got the name MOTION® to express the visual effects when moving and tilting the banknote. Since then, the micro-optic family has increased with RAPID® HD, MOTION SURFACE®, BREEZE™ and the addition of machine-readability with Detect.

## ADVANCED DESIGN SOFTWARE PLATFORM

Ryan Toole is a senior software engineer and hobbyist game developer. He has roots in Georgia where Crane Currency has gathered a growing team of animators and engineers in its Alpharetta offices. It's a studio-like R&D facility where the team is constantly creating better processes and more advanced design software, resetting the boundaries of what's possible with micro-optics.

Ryan joined the company in 2015 and is one of the driving forces behind the Micro-Optic Design software platform -or MOD, as it is referred to internally -used by micro-optic designers to deliver animations and micro-optic features to the customers of Crane Currency.

"It is a unique software suite that lets our designers create endless variations of complex 3D animations on the thin film of our products. The features are customized for each client and we never reuse designs. By taking the engineering

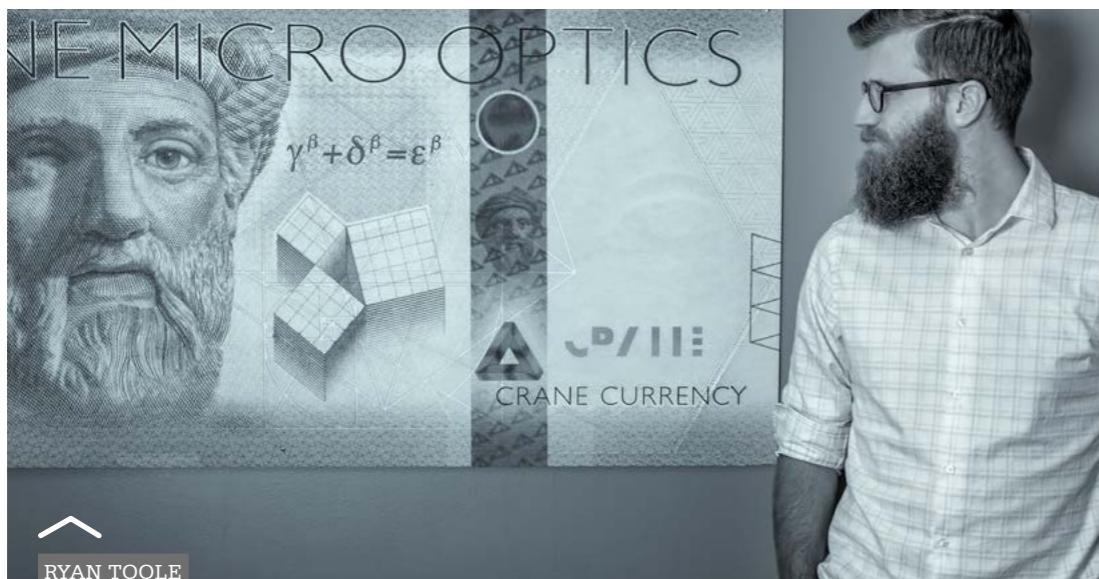
out of the design process, we can hire talented artists to develop our products. I love to see what they do with the tools we develop," says Ryan Toole.

## SIMULATION AND GLOBAL COLLABORATION

When creating a new customized micro-optic security feature, Crane's banknote designers in Tumba, Sweden and Hal Far, Malta transfer the elements of their artwork to Alpharetta where micro-optic designers use the MOD software to incorporate their art into 3D animations. And thanks to the speed and capabilities of the software, Crane can be very responsive in meeting the preferences of central bank customers all over the world.

The MOD software consists of more than a half million lines of code. It is integrated with open-source operating systems like Linux and design software such as Blender.

The software is proprietary – and so is the material and equipment used for producing the micro-optic features at Crane Currency



RYAN TOOLE



BEN BLEIMAN

in its secure facility located in Nashua, New Hampshire where advanced machine-learning features are used to improve the manufacturing processes. But before sending security feature designs to manufacture, the team uses its proprietary software to simulate designs and pre-evaluate the feature's production tolerances without the need to create time-consuming physical samples.

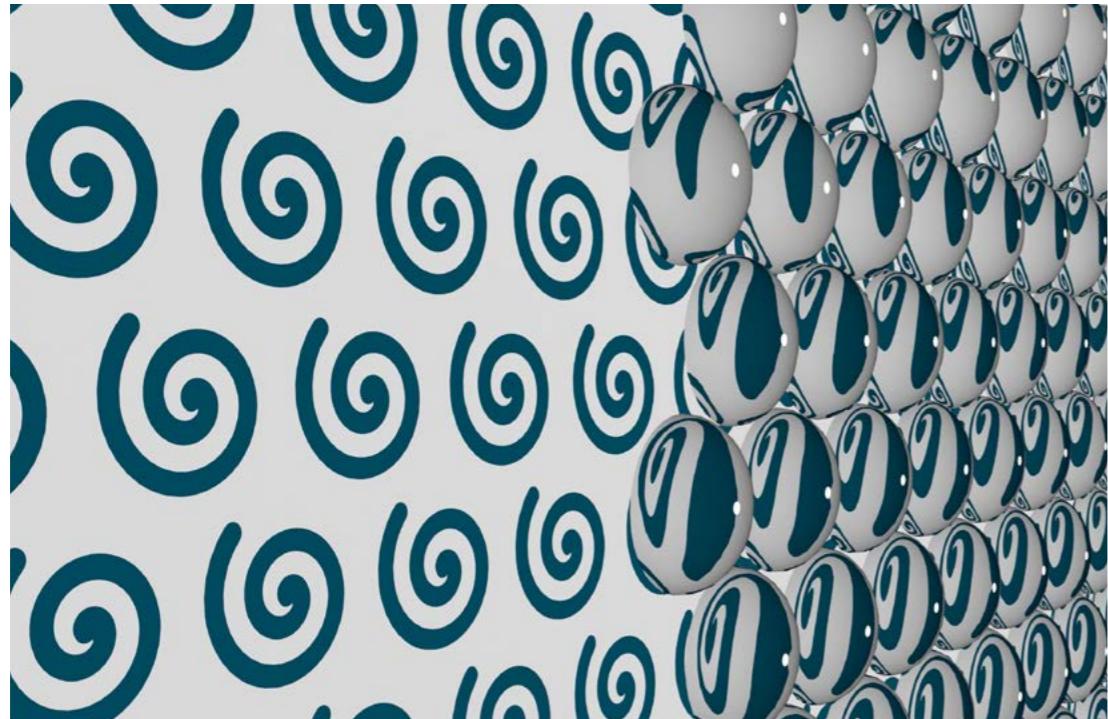
## 3D EFFECTS GENERATE HUGE AMOUNTS OF DATA

The 'Wow! effect' you get from seeing 3D micro-optics for the first time leads to curiosity. How does it work – and how can you make things move on the flat surface of a banknote?

Taking the new 100 dollar banknote issued by the Central Bank of the Bahamas as an example, the numbers behind how it all works are breathtaking. The 12 mm

wide MOTION SURFACE micro-optic stripe includes a water "droplet" and schools of fish swimming deep within the banknote. Each micro-optic stripe consists of more than 3 million optical lenses. The movement we see requires around 160 frames of animation which means that 480 million lenses must be processed through all the compounding effects making up the micro-optic composition. That can be more than 4 trillion lenses worth of computation! And all this can be done and then rendered into a photo realistic animation in under 20 minutes.

"Animation at the microscopic scale creates a copious amount of data, so we have developed techniques, including our own compression algorithm, to handle the volume. And it wouldn't be possible without Crane's high-performance on-premises computing farm in Alpharetta," says Ryan Toole.



"SIMPLICITY REQUIRES A LOT OF WORK"

A new version of the software platform is already on its way. It includes an improved user interface for the designers and refined tools to control the manufacturing process. These translate into more options for central banks. By using elements of gamification on their banknote features, it will give the public more, and easier and faster ways to verify them while creating additional barriers to counterfeiters.

The 3D animations might look simple on the surface, but Ben Bleiman assures us that there is more to the story. To make something simple and intuitive takes a great amount of refinement and iteration, and thanks to the software, Crane's Design Team is able to spend more of their time on all of the details that make the final product so visually appealing and easy to use by the public.

"I am so proud of what we have ahead of us and the work being done by the entire team. While the work of this team takes place behind the scenes, the software they create plays an important role in giving us our competitive edge. The apparent simplicity of our moving and 3D visual effects allow the public to easily verify them in a glance, but that simplicity requires a lot of work," he says with a smile.

CRANE CURRENCY

Mr. Tod Niedeck  
Email: [tod.niedeck@cranecurrency.com](mailto:tod.niedeck@cranecurrency.com)  
Website: [www.cranecurrency.com](http://www.cranecurrency.com)



CLICK OR SCAN



# Currency Research

## Upcoming Events:

**EMEA Cash Cycle Seminar Istanbul, Republic of Turkey May 31 - June 2, 2022**

**Central Bank Payments Conference Athens, Greece June 27 - 29, 2022**

**Asia Cash Cycle Seminar Manila September 5-7, 2022**

**The Silk Road Cash & Payments Conference Almaty, Kazakhstan October 3-5, 2022**

**The Coin Conference Amsterdam, The Netherlands October 17-19, 2022**

**Americas Cash Cycle Seminar San Diego, CA November 14-16, 2022**

**Currency Conference Mexico City, Mexico May 15 - 17, 2023**

**Banknote Conference Fort Worth, TX May 13-16, 2024**

Contact us at [currencyresearch.com](http://currencyresearch.com) to learn more about our commissioned research and consulting projects to promote a deeper understanding of industry issues and to equip industry stakeholders with the most up-to-date information on trends, strategies, solutions, services, and technologies.

Follow us:

LinkedIn | Currency Research

Twitter | @currencyresearch



ARGENTUM™, MASK™ AND THE SECURE WINDOW ON THE LIBYA 5 DINAR

DE LA RUE

## THE TRUTH ABOUT INTUITIVE SECURITY



# The Truth About Intuitive Security

DE LA RUE

## The Continuous Race Against the Counterfeitors

The global threat from counterfeit banknotes is so low that levels are typically measured in parts per million. In 2019 the Bank of England reported £10m in counterfeit banknotes, which is an entire order of magnitude smaller than the £825m of unauthorised financial fraud losses (includes cards, remote banking & cheques) which occurred in the same time frame.

The efforts of the suppliers like De La Rue and central banks keep the banknote counterfeit numbers low. Criminals adopt the latest technologies available to them, which means that central banks and suppliers invest heavily in research and development to ensure that security features and banknote technology stays ahead of the threat. New banknote series and upgrades to the security features are typically introduced every seven to ten years. The future needs of any banknote series must be considered because a series can remain in circulation for many years. Staying ahead of the counterfeiter also means staying ahead of commercial developments, because criminals will adopt the latest equipment and machines that they can buy. Counterfeiting levels, types and trends are monitored and analysed so that the latest insight can be fed back into the security feature and product development cycle.

Good banknote security features are technologically challenging to simulate, often requiring equipment and materials that are hard to source and requiring specific expertise. The more challenging a security feature is to simulate the more expensive it is for the criminals to simulate banknotes. If a banknote or banknote series contains a diverse set of different feature types it generates multiple technology challenges and costs for counterfeiters. Well-designed banknote using the appropriate security feature combination become are economically unattractive for criminals to target.



NEXUS™ ON THE QATAR 500 RIAL

## TECHNOLOGICAL DEVELOPMENTS

The major technology platforms used for banknotes today are colourshift, micro-optics and holographics. All these technology platforms have been around for many decades, with origins that can be traced back nearly a century. This means that decorative, novelty and brand versions of every major banknote technology are available. However these variants are worlds apart from their equivalent highly secure banknote counterparts.



KINETIC STARCHROME® IN THE FIRST EDITION FEATURE SERIES OF HOUSENOTES



IGNITE® THREAD IN THE UZBEKISTAN 50000 S

The date when a technology first appeared on a banknote is a very poor indicator of the protection provided by a security feature based on that technology. In fact – quite the opposite is true, with technologies that started first having had longer for the science underpinning the security features to progress to an advanced level. What is important is the suitability of the security features available today for the needs of a central bank's cash cycle and general strategy, how easy the feature is to authenticate by the public and how hard it is for counterfeiters to simulate that feature.

As the technologies have progressed the product formats have also progressed. Public recognition security features are now available in thread, embedded stripe, applied stripe, applied patch and printed ink formats. New effects, colours, application methods and shapes have appeared over time. Most recently the smooth surface of a polymer substrate has unlocked new holographic effects and integrating features into the polymer window has enabled them to protect both sides of the banknote. Banknote security features have advanced to the point that central banks can now protect their notes with multiple security layers, whilst putting highly customised designs and effects into the security features.

The question is whether the end user notices the step change in technology and design when comparing banknote security features and poorer simulated equivalents?

## CONSIDERATIONS AROUND PERCEPTION STUDIES

Perception studies play an important role in contributing towards our view on what makes a good security feature. They have also led to some misconceptions and represent only one lens that the future banknote needs should be examined through. Over 25 studies in recent years have led to a range of conclusions about what people notice and remember (e.g. in one study the watermark is the most remembered feature, in another it is the hologram). Some of the information initially appears to be contradictory but this is often down to different experimental design set up or the different cultures of those participating in the study.

What perception studies do align on is that most people only glance at a banknote and often struggle to recall what is on that banknote. Generally the first split second of handling the banknote is considered critical. This has led to the misconception that the best solution is one feature that can be instantaneously authenticated. The argument then goes on to suggest that one, simple feature that is easy to authenticate is also needed to help with public education. The reality however is that people consider a banknote holistically. They may not be able to name a particular feature or articulate a design detail when asked. However they are good at spotting when something isn't right. Public education, whilst incredibly valuable at a new series launch, doesn't reach everybody and is overridden over

time as people handle notes and build up an understanding of what to expect. Good design, strong security features and intelligent integration lead to banknotes that are hard to simulate convincingly and whereby people intuitively know when something is wrong. The features on a banknote should look as though they belong.

## TRIGGERS AND AUTHENTICATORS

On the very rare occasion that somebody encounters a counterfeit note the trigger that something is wrong may be a fast-



GEMINI™ UV INK FEATURE ON THE FIJI \$50 COMMEMORATIVE NOTE



moving security feature. However it may also be an image that hasn't been replicated well or the feel of the note not being quite right. Perhaps the stiffness of the banknote doesn't reconcile with how aged the banknote appears to be or the intaglio is missing. Perhaps the note just doesn't look or feel as though it is the right quality. Multiple factors can simultaneously act as a trigger that something is wrong. These triggers then cause a person to examine a note in more detail to see if it aligns with what they are used to handling.

Authenticators are features that can be examined in more detail – for instance holding up a paper banknote to check for a watermark, checking the quality of the print or tilting the note to see if the hologram changes image as expected. Even if the public don't remember the precise details they can check for general quality and

whether security features look as though they belong on the note. They can even look up information about how to authenticate a banknote.

### THINKING ABOUT BANKNOTES HOLISTICALLY

Shifting thinking away from which is the perfect feature towards thinking about the banknote holistically leads to some slightly different considerations. If every effect is a barrier to simulation, then including a diverse selection of technologies is important. Given that generic materials of all major security features exist then it's important to select unique designs that can be customised and integrated into the theme of the note.

Given that perception studies have been set up to achieve a specific objective then



central banks should think about whether the conclusions of any single study applies to the needs of their specific cash cycle. Different cash cycles have different needs and it's important to pick the security features and overall banknote design that best suits the needs of that banknote.

Security feature selection requires multiple factors to be considered – the overall durability of the note, the cultural preferences, budgets, environmental considerations, functionality needed, whether the note needs to interact with machines, future needs or not etc. The historic performance of the current series and the evolution of the type and level of the counterfeiting threat needs considering. The 25 banknotes belonging to the G7 countries use very different security feature combinations on both paper and polymer substrate. They all experience low levels of counterfeiting and highlight that there isn't one perfect banknote specification out there. In fact if every banknote was the same it would make things easier for criminals because they would only have to target one specification.

Perception studies have suggested that the public don't look at the banknotes. But they still notice when something is off and integrating features into exciting banknote designs and making those banknotes engaging is still a worthy goal. Good banknote design builds multiple layers of security whilst still meeting the functional needs of a banknote and creating a simple public education message.

If you'd like more information about the importance of design and how to get the best banknote for your needs please email currency@delarue.com

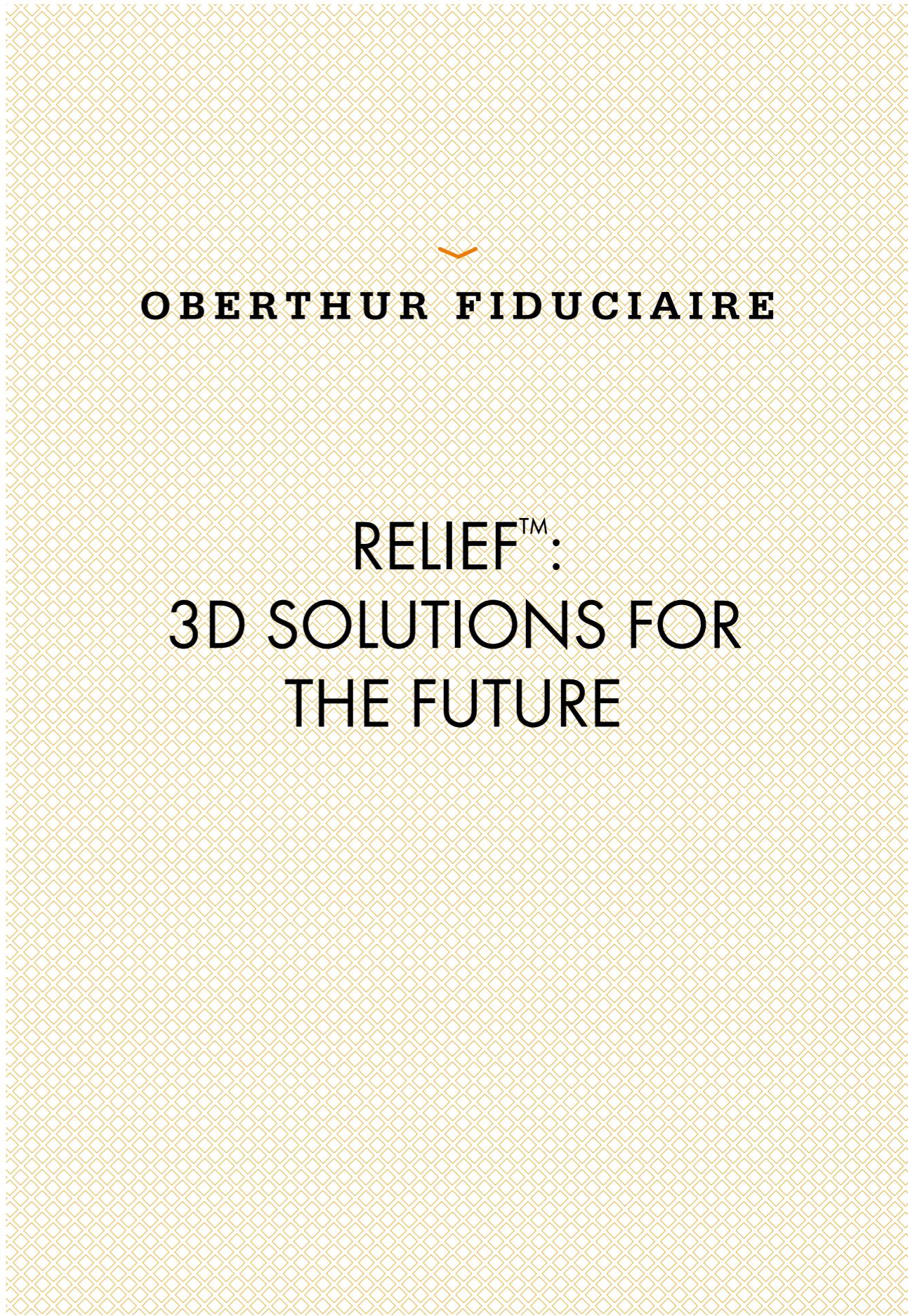
---

#### DE LA RUE PLC

Alan Newman  
Product Director, Currency  
Email: alan.newman@uk.delarue.com  
Website: www.delarue.com

# FEATURES





RELIEF™  
3D SOLUTIONS FOR  
THE FUTURE

# RELIEF™ 3D solutions for the future

OBERTHUR FIDUCIAIRE

Oberthur Fiduciaire is bringing a striking new security feature to the banknote market with its robust new RELIEF™ 3D security thread.

A versatile new product to market, RELIEF™ can be used as a window thread, patch, stripe, or can also be cut for use in foils at Oberthur Fiduciaire's paper mill in the Netherlands.



## MEMORABLE AND EASY TO AUTHENTICATE

As a Level 1 security element, RELIEF™ meets industry expectations, producing banknotes that can be recognised and authenticated at speed.

RELIEF™ works by stimulating the observer's senses to perceive a visual tactility that does not exist – a highly memorable feature, which appears to the user as an intriguing and elegant trompe l'oeil.

RELIEF™ combines its intense and eye-catching visual colour shift effect with a dynamic 3D finish. The result is a robust new banknote security feature that performs well in circulation and has been developed to help people authenticate genuine banknotes with confidence.

## HOW THE UNIQUE EFFECT OF RELIEF™ WAS DISCOVERED

Like the discovery of penicillin or radioactivity, the technology that led to Oberthur Fiduciaire's development of RELIEF™ threads came about by accident – sidestepping the usual time, investment, and methodology required to make any such leaps in design innovation.

In place of the more traditional brainstorming sessions and the application of specific creative thinking, the discovery behind RELIEF™ was made during a laboratory trial.

An engineer working on an R&D project realised that a 3D image of her fingerprint had become visible in the printed liquid crystal samples she had touched when her finger was wet.

This striking visual effect piqued the curiosity of Oberthur Fiduciaire's R&D engineers, who, after a long process of trial-and-error, worked to understand the methodology needed to develop and consistently reproduce the unusual RELIEF™ effect.

## NEW TECHNOLOGY FOR ADDITIONAL SECURITY

When choosing any new security feature for the banknote market, the new component must integrate into existing processes with ease.

RELIEF™ combines a new production process with specific raw materials. The two elements work together to give this product its remarkable and unique 3D colour-changing effect – and provide greater protection against counterfeiting. In addition, when configured for use as a foil, the security of the RELIEF™ feature in

transparent windows can be applied by our use of the production facilities at our own paper mill in the Netherlands.

## HOW RELIEF™ CREATES UNIQUE AND ELEGANT BANKNOTES

Oberthur Fiduciaire technicians produce RELIEF™ security threads by manipulating and layering the localised alignment of liquid crystal inks on plastic carriers. By altering the visual appearance of the inks, they can produce effects with a unique optical intensity.

The distinct vibrant colour shift created by RELIEF™ is available in various colour combinations, each providing a striking visual contrast and eye-catching 3D effect.

Available in Purple-Blue, Orange-Red, Orange-Green, Blue-Green, and Green-Gold, these versatile colour combinations provide greater design freedom than traditional threads. And they give art workers the scope to create elegant banknotes in line with specified watermarks and print designs – all with the added benefit of increased security.

The methodology behind RELIEF™ has allowed us to broaden the angle of visibility of the colour shift effect. It provides additional design freedom, as liquid crystal need not be applied to the entire surface of the thread, patch, stripe – or window foil.

## A TROMPE L'OEIL OF VISUAL TACTILITY

The dynamic effect of RELIEF™, comparable to that of a 3D hologram, means that some previously designed areas may appear to have been shaded. In contrast, other areas look bright – stimulating the observer's senses with a colour shifting play of light and shadow.

While banknotes made with RELIEF™ may appear textured, the technology used is sharper than physical embossing. It allows for even more precise detail, creating a look of visual tactility on a perfectly flat smooth surface.

## ELEGANT AND VERSATILE

Available as a security thread, RELIEF™ widths start at 3mm, and any visual effects can be magnified up to widths of 6mm.

When used as a patch or a stripe, RELIEF™ can be applied with or without a transparent window to fully utilise the large display area.

The combination of RELIEF™ with a transparent window is exceptionally appealing. When held against the light, RELIEF™ appears to be transparent, while when held against a dark background, the 3D colour shift effect appears before the eyes with a striking pop of visual detailing.

## THE BENEFITS OF RELIEF™

### With RELIEF™ you can create:

- 3D designs without a variation in thickness
- Striking colour shifts
- Intriguing texture-like effects
- Secure 3D Cleartext
- Banknotes with magnetic properties

### Available widths:

- 3mm to 6mm

### Colour shift range

- Red – Orange
- Orange – Green
- Blue – Purple
- Green – Blue
- Gold – Green



In this picture, a palm tree and the 50 denomination are designed using RELIEF™ technology. The image appears to be a 3D image that would feel textured to the touch. However, this is an illusion as the palm tree image, and number 50 are printed on a perfectly smooth surface.

If the image is tilted, any light will follow the edges of the palm tree leaves, and bright spots will appear to roll around the curved lines of the "0" pattern.

In this configuration, areas that appear to protrude from the surface of the front side of the note appear to be sunken from the reverse side of the note. This reinforces the illusion of embossing.

#### A ROBUST AND DURABLE SECURITY THREAD

Thanks to the non-embossed, machine-resistant 3D effect of RELIEF™ threads and foils, RELIEF™ products are thinner than existing alternatives and designed to resist the physical pressures of being used in circulation.

RELIEF™ can be printed over, and banknote paper that includes RELIEF™ can be varnished without damaging any visual aspects of the note. A versatile security thread, conventional features like cleartext and magnetism can also be included in the element structure.



#### AN ECO-FRIENDLY SECURITY THREAD

As a fully printed thread, RELIEF™ provides the global banknote market with an option to choose a durable yet eco-friendly security thread. And because no metallisation or demetallization is necessary to include Level 2 and/or Level 3 security characteristics in the thread, manufacturing processes that have a high impact on the environment are not needed.

In terms of sustainability, the environmental impact of RELIEF™ threads is lower than that of notes which contain metallic elements. At the end of their lifecycle, RELIEF™ threads can be recycled easily.

#### A NEXT-GENERATION SECURITY THREAD

The discovery of RELIEF™ represents a dynamic breakthrough in the banknote security features industry. This unique feature combines a remarkable 3D effect with a vivid colour shift effect to produce banknotes that are easily authenticated with confidence. Available for use as a security thread, patch or stripe, RELIEF™ marks a future-forward shift in the fiduciary industry from Oberthur Fiduciaire.

#### OBERTHUR FIDUCIAIRE

Ms. C. Lafont  
Email: c.lafont@fcof.com  
Website: www.oberthur-fiduciaire.com

# Rainbow Fibres™



# Micro-Marques™ & Planchettes



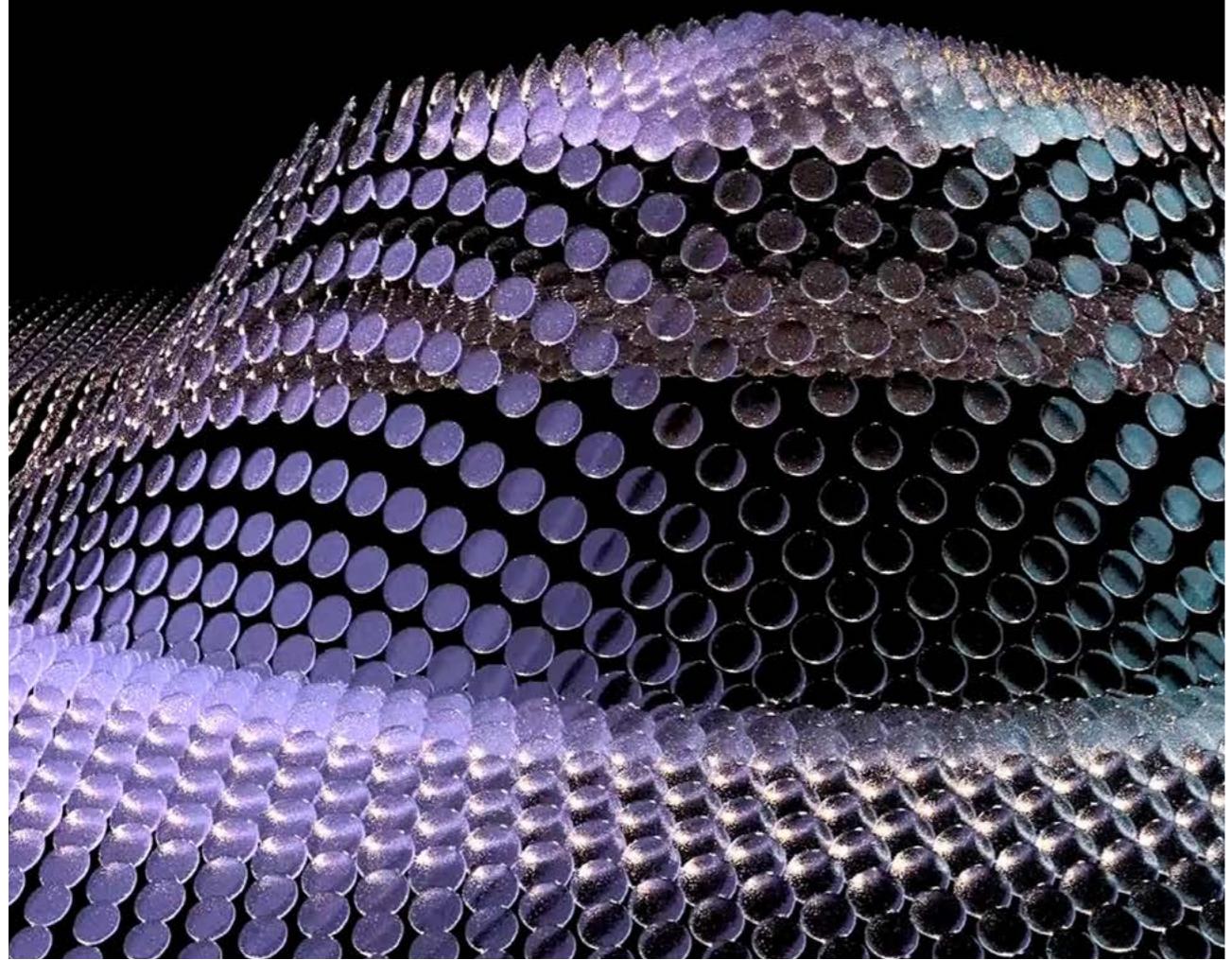
With over forty years of experience producing security components for use in paper, you can rely on the integrity and quality of our products.

[securityfibres.com](http://securityfibres.com)



CLICK OR SCAN

Expert  
Interview on  
KINEGRAM  
DYNAMIC



▼  
**LEONHARD KURZ  
STIFTUNG & CO. KG**

KINEGRAM DYNAMIC®  
NEW DYNAMICS FOR  
SAFER BANKNOTES



# KINEGRAM DYNAMIC® New Dynamics for Safer Banknotes

LEONHARD KURZ STIFTUNG & CO. KG

‘The only constant in life is change’ – the old adage ascribed to Heraclitus is more valid today than ever, as manifold changes are manifesting themselves in all areas of life and before our very eyes. The banknote industry is no exception, and the ever-evolving environment translates to an increasing need for flexibility and dynamics as we strive to anticipate digital transformations and to maintain a lead over counterfeiters.

To answer this need, KURZ has established a globally unique portfolio of security solutions for banknotes. Flexibility is built into this portfolio, as a modular concept allows a myriad of combinations of application formats, technologies, and security effects. KURZ features are compatible with any banknote substrate and any industry-prevalent application machine. With innovative technologies, individual designs for each project and the opportunity to work with multiple colors, customers benefit from over 30 years' worth of experience gathered in notable projects around the globe.

There is no shortage of striking examples for the flexibility that this concept provides – such as the KINEGRAM REVIEW feature applied over a transparent window in the new Costa Rican 20,000 colones banknote, which has been awarded Banknote of the Year for Latin America as well as 'Best New Banknote' at the IACA Excellence in Currency Awards 2022. In a world first, the KINEGRAM REVIEW feature (also used for the new Euro series) exhibits registered images both on the front as well as the reverse side of the foil stripe. On another note, innovative and eye-catching security threads have recently been added to the portfolio of banknote solutions, in particular the notable selection of KURZ THREADS with KINEGRAM COSMIC. With distinct color changes and brilliant movement effects, these can be designed to match the banknote print or a surface-applied security feature, and can incorporate all levels of security.

This spring, the KURZ modular concept has been amplified by a groundbreaking new development: The microlens-based KINEGRAM DYNAMIC security feature. The technology was first unveiled during an online seminar in February 2022 and has met huge interest among central banks and banknote printers.



### BEST OF ALL WORLDS IN ONE SECURITY FEATURE

The disruptive KINEGRAM DYNAMIC technology is the ultimate combination of security and appearance. It creates features that are veritable eye-catchers and extremely effective for authenticating banknotes. A stunning deep-view perception is combined with eye-catching and engaging diffractive effects – the latter are created by our unique KINEGRAM technology.

KINEGRAM DYNAMIC features are highly impressive and intuitive, exhibiting multicolored, dynamic 3D and movement effects. This combination allows a perfect design integration with the banknote print. Spherical microlenses combined with sophisticated and proprietary production processes create an immersive depth and dynamic movement.

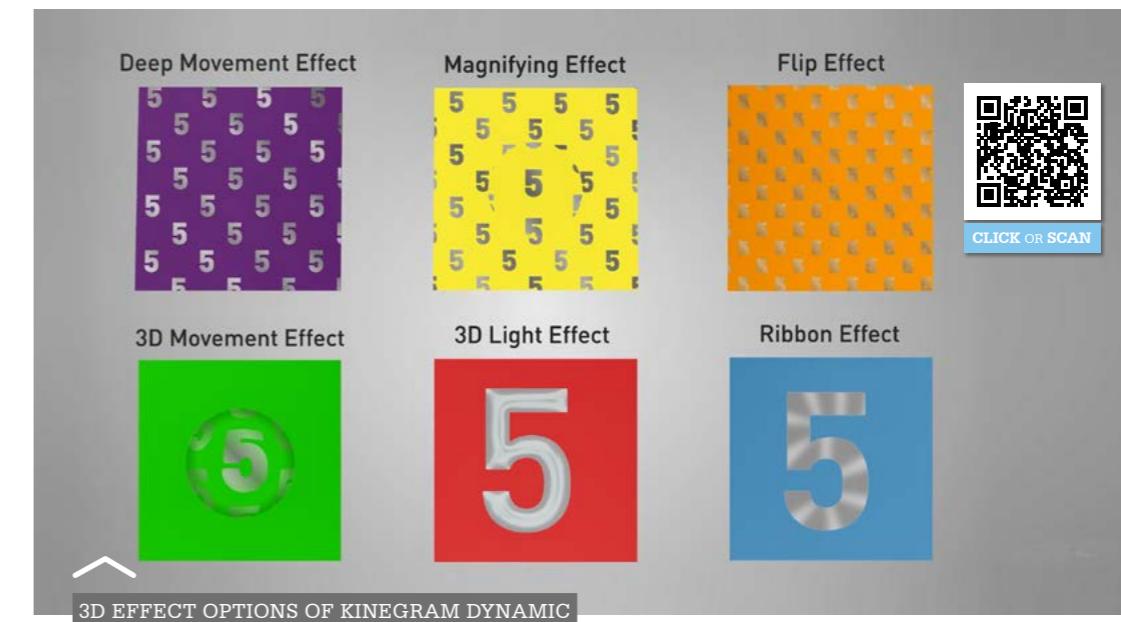
The technology allows for entirely novel, prominent visual effects to be integrated into the feature. They are visible from every perspective and in any light condition. Several effects can be combined with each other in one story-telling and self-



explaining feature. Highly engaging Deep Movement, Magnifying or Flip Effects, 3D Movement or Ribbon Effects are just a few of a wide selection of looks, which bring the entire banknote to life and make the feature outstandingly secure. The option to combine these microlens-based effects with both multiple colors and the unique KINEGRAM technology – which provides the principal security for billions of banknotes around the globe – sets KINEGRAM DYNAMIC apart, not only from other microlens-based elements, but also from the entirety of security features for banknotes.

### CUSTOMIZED COLORS FOR UNIQUE DESIGNS

KINEGRAM DYNAMIC elements can include multiple colors at a time. These colors can be freely chosen according to customer requirements and customized to the banknote design. This makes integrating the feature into the overall banknote design concept even easier and allows responding to individual demands.



## A DYNAMIC PUZZLE

The secret of KINEGRAM DYNAMIC lies in its proprietary and unique production process, that differentiates the feature from other microlens-based solutions in the market.

Firstly, the desired motifs, 3D effects, colors and optionally, additional KINEGRAM effects are transformed into a compelling artwork and an animation that illustrates the visual impression of the final security feature. Once approved, innovative proprietary software digitally processes the design and converts it into an array of individual pieces, comparable to a jigsaw puzzle. These puzzle pieces build the basic layer of the later foil feature, which is then covered by a layer of spherical microlenses which will exhibit the 3D depth and movement effects in the finished feature.

At the end of the production process, the foil is prepared for application onto the banknotes, either in patch or in stripe formats. The end result is an unparalleled optical security feature that makes counterfeiting virtually impossible – especially when used in combination with the unique effects that only the non-holographic KINEGRAM technology can provide. KINEGRAM DYNAMIC is unrivaled among lens-based solutions for banknotes.

## CONCLUSION

KINEGRAM DYNAMIC is a disruptive solution offering the best of all worlds in one single security feature. Endless options for design and effect combinations as well as multiple colors enable perfect design integration with the banknote print and set it apart from other lens-based features.



Offering truly intuitive and instant verification, and with the capacity to include novel 3D effects, individual multiple colors and unique visual effects provided by the non-holographic KINEGRAM technology, this innovation arguably makes the incorporation of other complex features all but redundant. Undoubtedly, KINEGRAM DYNAMIC is unparalleled in its visual appearance and the level of anti-counterfeiting protection it provides.

**KINEGRAM, KINEGRAM REVIEW, KINEGRAM DYNAMIC** are registered trademarks of OVD Kinogram AG, a member of the KURZ Group.

LEONHARD KURZ STIFTUNG & CO. KG

KURZ Banknote Security

Email: [banknote.security@kurz.de](mailto:banknote.security@kurz.de)

Website: [www.kurz-banknotes.com](http://www.kurz-banknotes.com)



Request your samples here >



## ADVERTORIAL: HUECK FOLIEN

### STRATEGIC PARTNER FOR HIGHEST SECURITY SINCE 35 YEARS

#### **High Security at its best**

Since exactly 35 years, HUECK FOLIEN is strategic partner for highest security - we have been lending identity to banknotes through our security threads since 1987. As a recognized technology leader in the field of first-class coatings, we secure tailor-made product advantages for our customers through stable quality and reliable service. Every member of the HUECK FOLIEN team is aware of his or her responsibilities to create originality and continue to guarantee it in years to come, a task that is naturally linked to the highest quality and service standards. As a family-owned enterprise we have implicit trust in the abilities of

our employees, who contribute actively to the ongoing further development of HUECK FOLIEN to the benefit of our customers.

#### **TRILUMIC®: Enhancing holographic stripe with level 2 feature**

The success story of TRILUMIC® started 3 years ago, when we first presented the TRILUMIC® holographic stripe. Meanwhile the product is placed in the market and proven in circulation. The National Bank of Cambodia has decided as first Central Bank to put our TRILUMIC® stripe on the Commemorative Banknote 15.000 Riel in 2019. Although it is a commemorative banknote the volume was quite high, the banknote is officially used by the people and circulating in the country.



The stripe was integrated in the banknote concept and applied on LANDQART's Durasafe substrate. The uniqueness of TRILUMIC® on a holographic stripe is that it is possible to print a full colour halftone image in a very precise detail, much higher than ever seen in a banknote print.

Just recently, the National Bank of Cambodia has launched the second banknote with a 15 mm TRILUMIC® stripe, the 30.000 Riel, which is also now successfully circulating.

#### **TRILUMIC® Threads: A totally new dimension for UV printing on security Thread**

Using the TRILUMIC® technology for banknote threads opens a completely new perspective for the banknote designer. The feature can be applied to all kind of thread types and widths. TRILUMIC® adds a particularly attractive function to all different technologies from printed, over metallized to ColorSwitch™ threads.

What makes the TRILUMIC® feature such a special UV feature? In comparison to today's UV-designs on banknote threads, it was only possible as either one colour full surface, two or three colour printed blocks or as rainbow blocks. With TRILUMIC® it is now possible to create very precise and customized designs in the meaning of text, motifs and colour overlapping. Unique at TRILUMIC® is that the feature enables to create a very bright UV white and negative text in UV.

TRILUMIC® creates completely new designs for banknote threads. Especially if the designer plays with the demetallized area of the thread, a real "WOW" can be generated by switching on the UV light when suddenly a much wider



CAMBODIA NOTE 15.000 AND 30.000 RIEL WITH TRILUMIC® FEATURE



TRILUMIC® ASIA NOTE:  
BRILLIANT AND PRECISE DESIGN

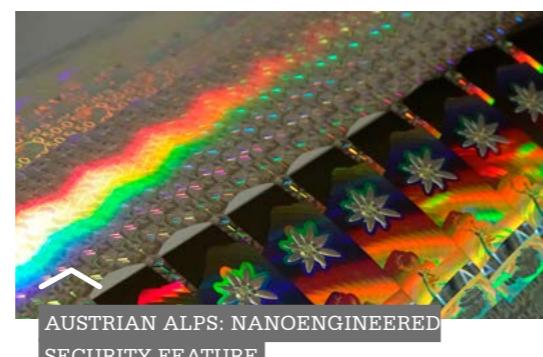


thread in brilliant UV illuminates. Invisible in daylight, extremely brilliant true-color halftone images appear under UV light. The evolution of TRILUMIC® onto security threads has now produced a new feature family.

TRILUMIC® is a trademark resulting from cooperation between HUECK FOLIEN and Banque de France.

### The next level: Austrian Alps in a nanoengineered hologram

Let us give you a slight preview onto the next holographic level. Holographic elements in foils or threads used to be mostly blinky rainbow colors. Through the latest developments in hologram embossing and the trend to much smaller nanostructures, completely new features are now available. Austrian Alps is designed together with our hologram-origination partner IQ structures. On our latest holographic stripe, we show the Austrian Alps as a nanoengineered security feature. It is a combination of finest 3-D-white embossing, bright and colorful elements and the state-of-the-art moving features.



### HUECK FOLIEN GMBH

Mr. Jan Hofmann  
Email: [j.hofmann@hueck-folien.at](mailto:j.hofmann@hueck-folien.at)  
Website: [hueck-folien.com](http://hueck-folien.com)



since 1892

## The Future needs Tradition

Gietz stands for reliability in the security industry

Gietz was a pioneer in the hologram transfer technology and supplied the machine used to apply the very first registered hologram on to the Australian commemorative banknote „Captain James Cook“.



### FSA 1060 Foil Commander NOTA

State-of-the-art machine for application of security foil features

Today, the Gietz FSA 1060 Foil Commander NOTA delivers top quality and demonstrates its versatility in the application of security features on to banknotes, government and secured documents. It is reliable for all types of substrates; hybrid, cotton-based and polymer.

Since the very first days in the history of hologram application until today, Gietz is and remains your reliable partner for applying hologram patch and stripe on to banknotes.

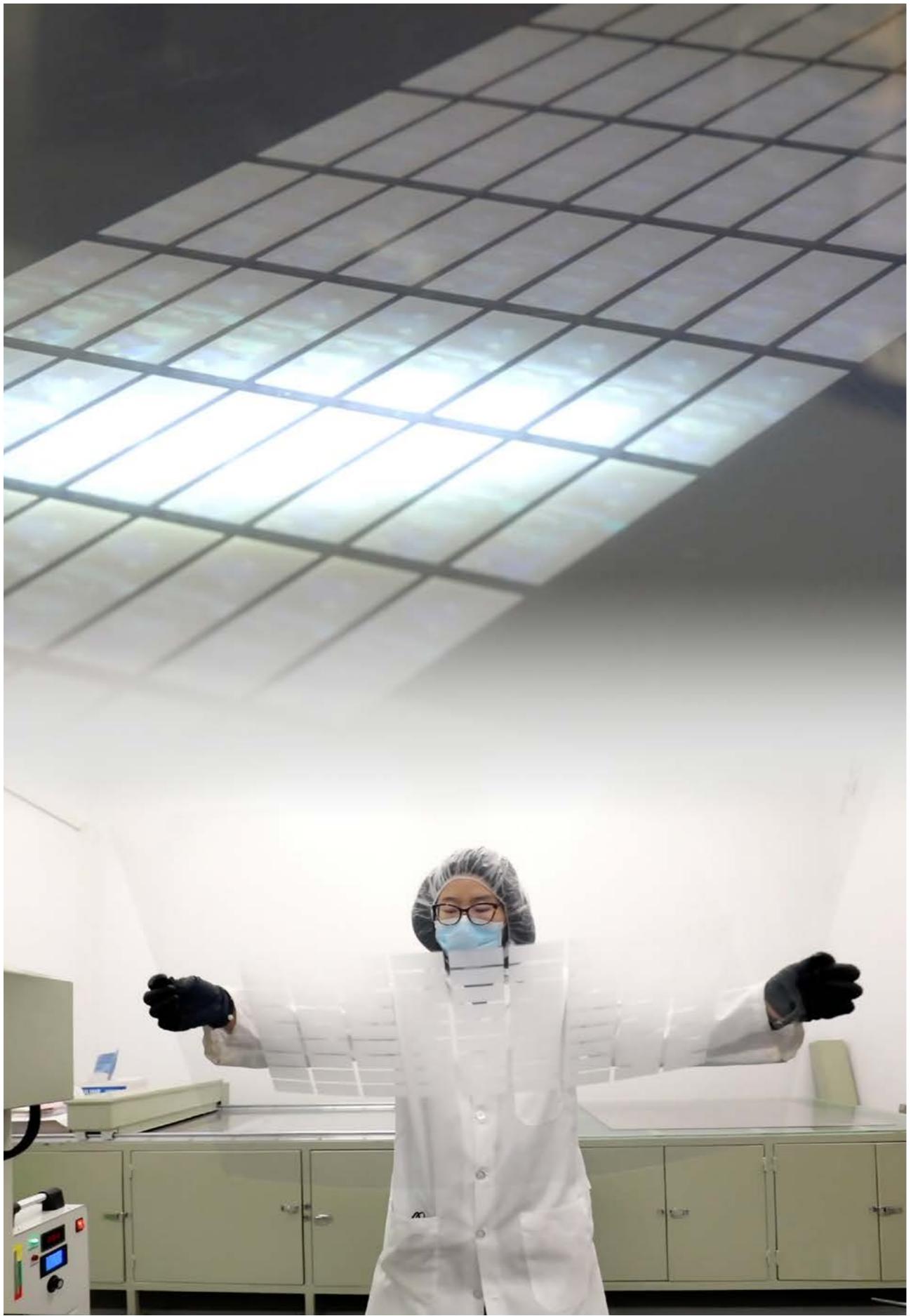


### Gietz AG

Mooswiesstrasse 20 | 9200 Gossau | Switzerland  
+41 71 388 22 22 | [info@gietz.ch](mailto:info@gietz.ch) | [www.gietz.ch](http://www.gietz.ch)

More Information





## NANOTECH SECURITY

INVESTING IN INNOVATION  
-  
BRINGING KOLOUROPTIK®  
TECHNOLOGY TO MARKET

# Investing in Innovation

## —

# Bringing KolourOptik® Technology to Market

## —

### NANOTECH SECURITY

Over the course of the global pandemic, individuals around the world have adapted to change, discovered new passions, and invested time and attention to the development of new skills. Nanotech Security Corp. (Nanotech) has also experienced significant growth and investment over the past two years – most notably, through a change of ownership and a focused attention towards bringing its award-winning KolourOptik® nano-optic display technology to market.

In October 2021, Meta Materials Inc. (META®), a developer of advanced functional materials and nanocomposites, acquired Nanotech. META designs, develops, and manufactures high-performance, functional materials and intelligent surfaces that are scalable, sustainable, and efficient. Along with this acquisition came META's strong commitment to Nanotech's banknote security portfolio as well as significant investment into furthering manufacturing capability to deliver the innovative KolourOptik technology to market, now part of META's product portfolio.

When first introduced, the patented KolourOptik technology platform was intended to demonstrate scientific advancements in and promote opportunities for plasmonic, pixel-based, full-parallax, multi-colour OVDs (optically variable devices). Since then, Nanotech's, and now META's, R&D and production engineering teams have added a new gear; to not only continue technological development of the science, but also to master production-grade recombination and roll-to-roll (R2R) casting with the precision and quality required to maintain nano-scale fidelity.

## KOLOUROPTIK® TECHNOLOGY PRIMER

META's KolourOptik technology combines sub-wavelength nanostructures and microstructures to create modern overt security features with unique and customizable visual effects. The pure plasmonic colour pixels are patterned on ultra-thin microstructures to create the thinnest security stripes and threads that are nearly impossible to replicate.

KolourOptik was developed based on a comprehensive understanding of how human eyes have evolved to see and perceive objects, specifically stereoscopic depth, and movement. By combining movement, three-dimensional depth, and multiple colours, KolourOptik delivers uniquely interactive and intuitive visual effects that are easy to authenticate.

As has been well documented, human visual processing to authenticate a banknote occurs in less than 300 milliseconds. It has been further demonstrated that exposure to 3D depth features for as little as 100 milliseconds is adequate for the brain to confirm authenticity. (J Raymond et al, '3D Micro-Optics Enable Fast Banknote Authentication by Non-Expert Users', Optical Document Security

Conference 2020, S5P2, San Francisco USA). KolourOptik technology leverages this foundation of multi-layered depth to deliver engaging movement across a wide range of recognizable colours and shapes for quick and intuitive recognition.

### FROM PLATFORM TO PRODUCT

To date, bringing KolourOptik technology from research and development through to manufacturing has proven challenging due to the complexity and advanced material science of surface plasmon resonance nanostructures. To this end, META has invested in developing a new nanoimprint lithography (NIL) workflow, as shown below, comprised of 10 key stages, each with proprietary processes and intellectual property, to deliver its KolourOptik Stripe banknote security product in 2022.

While complex, META's NIL workflow is robust and aligned to its three brand pillars:

- Speed of Discovery
- Breakthrough Performance
- Manufacturing at Scale

#### META Nanoimprint Lithography Workflow



CLICK OR SCAN



### SPEED OF DISCOVERY

KolourOptik technology starts with design and simulation via a proprietary graphics engine that renders 3D layer art inputs into hundreds of individual 2D perspective images to create a full parallax display. The optics engine maps 2D perspectives onto the surface of a 3D faceted microstructure. Each group of microstructure surfaces that point to the same spatial direction will display content of one of the 2D perspectives.

The image above illustrates the resulting, precisely micro-engineered surface pattern with interleaved nano-scale structures, which combine hundreds of 2D perspective images into a full 3D colour display. In this example, sets of multi-coloured concentric rings shift in all directions as the user changes the viewing angle by tilting the note.

Through rapid design, simulation, and prototyping, META's proprietary graphics

engine enables its R&D team to accurately model exactly how the KolourOptik effects will behave and appear under a variety of lighting conditions. This helps to ensure the desired depth and movement effects are produced prior to any production in physical form, thereby optimizing use of EBL (e-beam lithography) origination time and resources.

Once a design is approved, both the microstructures and nanostructures are originated to the exact specifications required. META is the only Canadian company that owns and operates a 100kV class EBL system. Operating out of a Class 100 (ISO 5) cleanroom facility, the META R&D team is well equipped to develop continuous advancements in the precise execution of proprietary process steps.

Electroforming is the last origination step in Stage 2 of META's workflow which produces a hard nickel duplication master from an EBL patterned silicon wafer. Proprietary process timing and handoff between development, soft bake, seed layer sputtering, and electroforming have been developed and matured to avoid unwanted effects that deteriorate the final master shim quality. Multiple phases of precise electroforming are required to obtain a nickel shim with appropriate thickness, while preserving the all-important fidelity of the nanostructures.

A team of scientists and technicians oversees separation, trimming, and chemical cleaning of the initial nickel shim. Soft masters are fabricated by a UV casting system and then used as the masters for the auto-recombination production process.

## BREAKTHROUGH PERFORMANCE

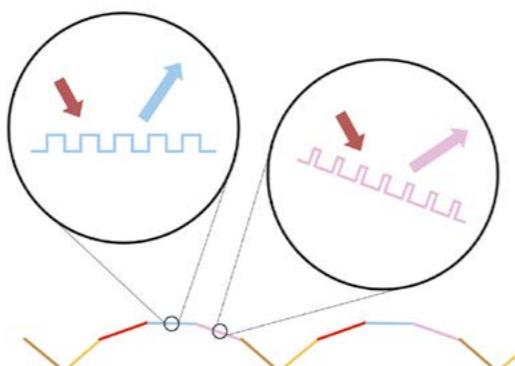
In addition to modeling movement and depth, META's proprietary physics engine is also used to generate a full palette of stable, structural colours. Sub-wavelength nanostructures precisely control how light is reflected at the sub-pixel scale. With pixels of less than 40um, big data processing algorithms intermix physical and graphic data into a proprietary digital format for EBL origination.

As shown below, specific nanostructure patterns and periodicity control the exact wavelength of light reflected to the eye. This enables a wide range of colours that can be used in KolourOptik security feature design to either contrast or complement a banknote design, with always-on performance across a wide viewing angle.

One of the key benefits of KolourOptik technology is the ultra-thin form factor that can be surface applied with existing, industry-leading application machinery, across a variety of banknote substrates. META has developed innovative EBL-based grey scale lithography to produce 40um diameter microstructure domes, each patterned with 4um edge facets. In Stage 2 a second EBL write forms plasmonic pixels onto each 4um facet. The result is an ultra-thin, single-layer, metalized nanostructure with a total height of only 5 $\mu$ m – 10 $\mu$ m, or roughly 1/10 the thickness of competing lenticular technologies.

META is also driving breakthrough performance in environmental sustainability. The development and qualification of its water-based lift-off process for

### Plasmonic Colour Physics Engine



demetalization delivers a sustainable-friendly solution by avoiding the introduction of unwanted materials and harsh chemicals. This lift-off process also produces higher accuracy with cleaner edges than many alternative demetalization options.

## MANUFACTURING AT SCALE

Leveraging the company's decades of experience manufacturing and supplying LumaChrome™, one of the industry's leading colour-shifting optical thin films, META's highly secure manufacturing facility in Thurso, Quebec houses proprietary production equipment that reliably produces nanocomposites in wide-web format, at high-speed and large quantity. Capacity at this manufacturing facility, a company owned building situated on 11 acres of land, is currently in excess of seven million square meters per year. META plans to double capacity to 15 million square meters over the next 1-2 years, with the first phase of expansion already underway.

Over the past few years, considerable time and effort invested have yielded incredible gains towards achieving

commercial manufacturability. Industrial foil production is accomplished through ultra high-resolution replication at the nanometer scale. Within Stage 5 of the NIL workflow, a transparent soft master is repeated many times, maintaining the precise fidelity required to preserve nano-optic colours and visual effects. These advancements in manufacturing have led to the development and announcement of META'S KolourOptik Stripe, illustrated below.

At every opportunity META has strived to simplify the production of its foil and deliver a sustainable solution that relies upon robust high-throughput materials. The company's lens-less, full-parallax colour display is created with 4um high 'flat' optics, reducing the construction to a single-layer of metalized nanostructures, constructed with non-rare earth materials. Similarly, the large palette of structural, plasmonic colours is created without the use of inks or dyes, simplifying the manufacturing process and supply chain variables.

META remains committed to the advancement of banknote industry security through advanced, functional metamaterials, as demonstrated by its KolourOptik Stripe, expected to launch in 2022. Central Banks and industry partners can contact the META Sales Team to request samples or for further information.

## NANOTECH SECURITY, A META MATERIAL INC. COMPANY

Mr. Brian Donnelly  
Email: info@nanosecurity.ca  
Website: www.nanosecurity.ca





PORTALS

SECURITY  
CAN BE  
AGILE



## Security can be Agile

PORTALS

The demands posed on a nation's currency have never been more challenging. It is therefore key that as a supplier we work with you to respond and react – an agile long-term partnership.

If you were to describe our industry with your friends and family, the chances are that flexible, nimble and agile wouldn't be the first words that spring to mind. It's easy to understand why.

**S**electing new security features and designing a new banknote series can take many years – in which time the world has progressed giving counterfeiters the time to advance their own capabilities and gain access to the latest technologies.

In addition, recent global events have put additional pressure on cash issuance which has been compounded by the current global shortage in many raw materials that produce day to day products, including banknotes. When combined with a single source (monopoly) supply from some of the features chosen to secure our banknotes, the result is an extended lead time from currency suppliers.

The need for a different approach is clear.

## PORTALS – A TRUSTED PORT IN UNCERTAIN TIMES

Big enough to trust, but also small enough to care, the team here at Portals are experts with a proven track record of successful delivery and supply. We pride ourselves on our ability to be reliable and responsive, always enabling our customers to get the very most from working with us.

We regularly describe ourselves as #proudlyportals and all of our team drive innovation and change every day with a positive attitude and our PACE values as their guide:

- Performance Driven – We focus on providing the best possible technologies to ensure our customers never have to choose or compromise on what they desire.
- Adaptable – We work together to get things done Now, more than ever with

the head winds of financial instability, global shortages and order delays we are proving to our customers we can flex to their security needs by working with and for them in times of need.

- Customer Focused – The climax of our approach is the close relationships we have with all our stakeholders, which in turn helps us be closer to their needs as they evolve.
- Engaged – We carry ourselves, day-to-day, with a positive attitude and a high standard of integrity in all that we do.

When acquiring the security business of Fedrigoni in November 2021, one of the many cultural synergies we identified was the responsiveness and customer-first behaviour of all of the security business team, we knew they would be a great addition to the Portals family.



With more than 80 years' experience in developing and manufacturing high security components, the site on the outskirts of Milan uses specially developed technology to produce anti-counterfeiting features such as security threads, holographic stripes and patches - which are then used to protect some of the most recognisable banknotes in the world against the continued and ever-growing security threats.

Our product portfolio also supports this need for responsiveness - enabling Central Banks that chose to work with us a choice of technologies, and, where it is needed, the flexibility of a second supply.

### COLOURSHIFT

Our liquid crystal colourshift, Prisma, has been chosen to protect more than 15 billion banknotes issued each year.

Prisma is available in a wide range of colours and is technically and aesthetically comparable to other products supplied by

others. This direct comparability gives Central Banks, State Printworks and commercial suppliers that ability to choose based on standard procurement criteria including quality, price and delivery lead-time, rather than be constrained to one supplier.

Prisma is available with all of functional add-ons that you would expect including basic and advanced (multi-coded) magnetics, fluorescence and demetallised personalisation / text.

Our newest addition to the colourshifting range is Prisma Duo – which combines colourful and striking colour shifting designs layered over latest e-beam originated highly intricate holography to create a stunning effect. We offer seven colour combinations to meet the aesthetic requirements of any banknote design. The level of protection of Prisma Duo can also be increased with demetalisation, magnetics and fluorescence.

**MULTI-CODED MAGNETICS**

Magnetics have been used to provide functional security to banknotes for years, and the latest trend is for multi-coded magnetics that combine different magnetic material layers to give it a unique code. We call our multi-coded magnetic feature Mag<sup>3</sup>™ –because three combinations of the layers are possible:

**MAGNETICS TYPE A**



**MAGNETICS TYPE B**



**MAG<sup>3</sup> RESULTS**



**CHANGE IS GOOD AND NOT HARD TO DO**

Moving suppliers or changing security threads needn't be a complex or time consuming task – we have an expert team on hand to support by providing samples for your technical review, to assist with design concepts and to answer any questions that you or your stakeholders may have.

**STRIPES AND FOILS**

Combining multiple overt effects and covert features into a single stripe or patch is entirely possible with our holographic capabilities. The use of micro images, nano-texts, kinetic effects, switch effects, Covert Laser Readable images and UV fluorescence when combined provides not only a stunning effect, but also one that is impossible to simulate effectively.

**Whilst these features take up more real estate on a banknote, the advantages are clear – the wide format design enables beautiful effects that complement the overall banknote design and can be easily identified and described by the public.**

These advantages are clearly displayed in Vista™ - a striking double sided effect that can be applied over an aperture (secure window). The double-sided nature of Vista means that different effects are revealed in transmitted and reflective lights – something which cannot be easily replicated through common counterfeiting and printing techniques. Vista works exceptionally well when combined with other holographic effects – lively kinetic effects can surround the secure window further enhancing the visual appeal of the feature.



**THE FUTURE**

It has become common place to choose security features, including threads, foils and inks, that are proprietary and exclusive from one supplier – with it being considered that these are, due to their proprietary and IP protection, more secure. When in reality, the counterfeiter pays no attention to this patent protection and can access and utilise similar features from other applications, for example brand packaging to achieve his mischievous goal.

With our existing range of colourshift and holographic products, we have already proven we can challenge this status-quo and our new product developments will be no different.

**PORTALS**

Mr. Steve King  
Product Marketing Manager  
Email:  
[steve.king@portalsinternational.com](mailto:steve.king@portalsinternational.com)  
Website: [www.portalsinternational.com](http://www.portalsinternational.com)

 SURYS

# HOW TO DEVELOP IMMEDIATELY AUTHENTICABLE SECURITY THREADS?

# How to develop immediately authenticable security threads?

SURYS

Security threads have a tremendous success in the banknote industry for decades. Since the first 0,5mm embedded thread, the technology and the functions of security threads have considerably evolved to reach a high level of efficiency against counterfeiting especially by implementing new fundamental attributes, which contribute to the end user's capability of recognition.

Today, security threads are ubiquitous in banknotes and play a major role in their authentication. But they present intrinsic challenges for optical effects due to the size of the component and the available visible surface.

Despite this, threads should encompass the following attributes to be effective:

- High impact cognitive characteristics with high visual attractiveness to attract human attention,
- To be customizable, and bear the security message that help the public to identify the banknote,
- Highly secure technology, to emphasize confidence in the security feature.

SURYS offers two new solutions Moov™ thread and Tristar™ thread that address those challenges by raising the awareness of your brain and enabling an immediate public perception.

## WHAT IS ATTRACTING US IN A SECURITY FEATURE?

The question of people's awareness of a genuine banknote has been investigated extensively in recent decades, particularly with the emergence of new types of substrates and security features. In this context, several researches were conducted to study our behavior during a banknote visual check. Optical security components are visually attractive but some specific factors play a major role to catch the eyes.

When banknotes are viewed and checked in the same context of usage, a certain quantity of Regions Of Interest (ROI) are scanned by the human visual system. Indeed we do not process equally all the available information, we naturally focus on different areas and aspects of the banknote design landscape.

It is possible to study the location of the viewer's ROIs and to figure out the visual factors that drive attractiveness of banknote components such as: motion, position, size, brightness, color, contrast and shape.

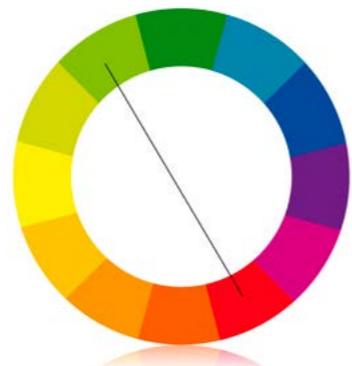
Interestingly, the processing of the retinal image representing the banknote is performed in a selective manner. Indeed, the particular structure of the human retina, the visual cortex as well as the color saliency turns out to be the most important factor to attract attention. These researches have particularly focused on the evaluation of the hues attracting the most the human attention.

## MOOV™: A PREMIUM THREAD TO SECURE YOUR COMPLETE BANKNOTE WITH UNIQUE EYE-CATCHING EFFECTS

### Quick authentication by colors:

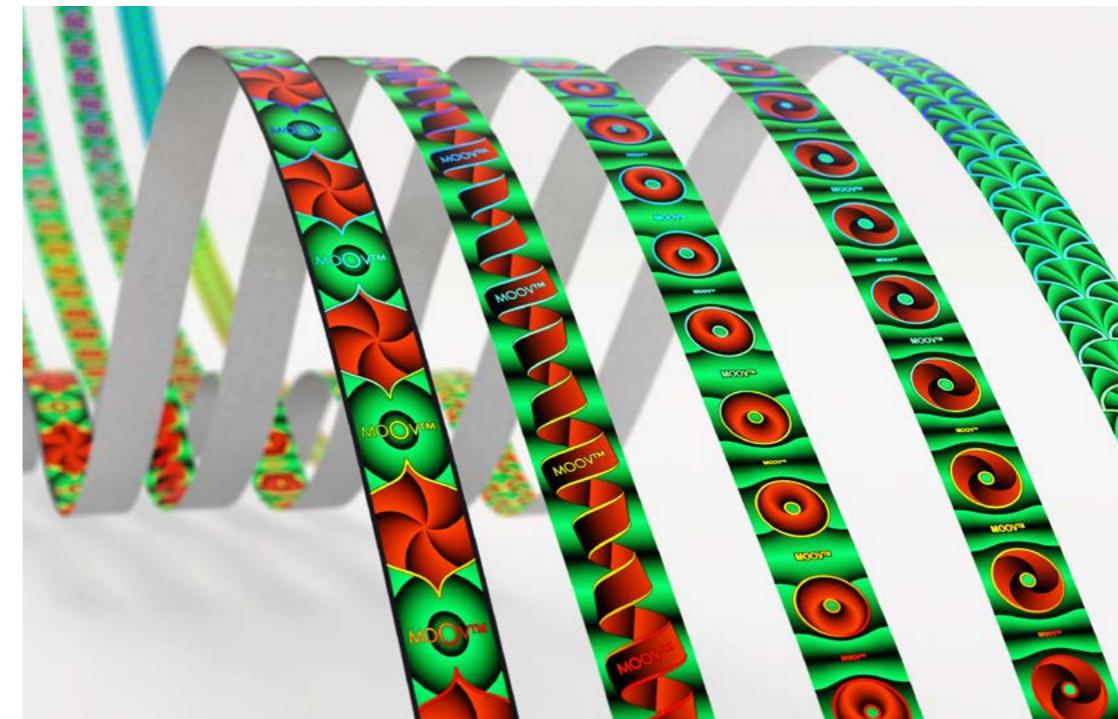
It is a known fact that colors features contribute to confidence, enabling to identify at first sight whether a banknote is real or fake. Neuroscience studies indicated that the colors that had much more hits were red, yellow, green and pink.

Moreover, other studies have highlighted that the color saliency combined to complementary colors allows more contrast. Therefore the unique association of the two complementary contrasted bright colors: green and red, visible at the same time on the Moov™ thread create an immediate attractiveness of the human visual perception.



### Quick authentication by dynamic movements

Movements attract the eye and security features that move in some way are the easiest to catch by the public. This trend has increased in the last decades to enhance the engagement of the public in the banknote authentication.



Therefore, on top of its attractive colors, the Moov™ Thread also exhibits various animated effects in perfect registration with the design that provides dynamism and volume to the full graphical elements. For the first time, animations are coupled with contrasted and attractive colors for the best human perception.

The two vivid colors are associated with dedicated animated images in perfect registration to the high definition design.

Moov™ can associate numerous visual effects and has the unique capability to display effects such as:

- Geometric shapes revealed by a concentric wave effect. This captivating centric movement brings design to life.
- Waving effects within an object thanks to its free lines bringing refinement to the overall design.

- 3D effects, which bring a virtual volume to the design, whatever the angle of vision.

All these possible combination of dynamic movement and color, which are self-explanatory and easy to remember, make the security thread an element of primary importance for the control by the public and attract the awareness.

### Quick authentication by design possibilities

Thanks to its unique optical technology, the Moov™ thread is highly customizable and brings numerous design possibilities to integrate cultural, historical and national symbols or other graphical elements. This makes our security component easily integrated into the banknote design with the best visual attractiveness and people understanding.

**Highly secured**

Moov™ is a patented technology achieved thanks to unique and exclusive optical and industrial processes implementing highly secured nano and microstructures.

The technology brings an additional unique control key through a 90° rotation making the color pair change to another pair of colors. Thus, the thread is highly resistant to counterfeit threat even from the most skilled counterfeiters.

As all modern window threads, Moov™ carries a message in transmission with a clear text and magnetic coding upon Central Banks request.

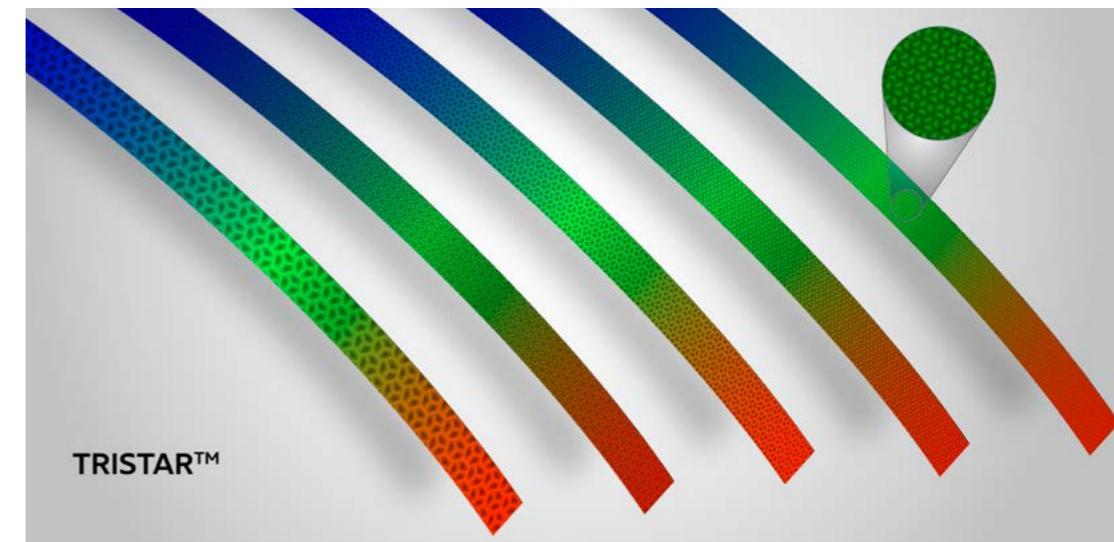
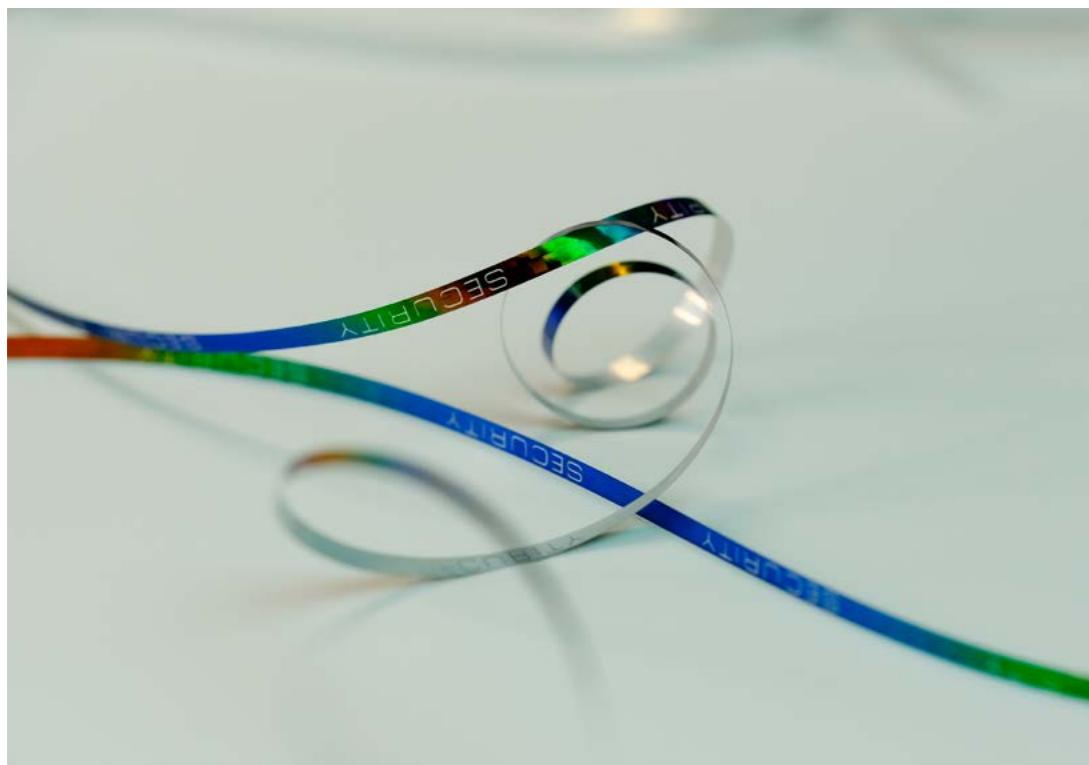
It provides high-level security features intrinsically linked to the paper substrate.

**TRISTAR™: THE BEST THREAD ALTERNATIVE FOR A COLOR-SHIFT THREAD.**

Combining three colors, it provides a unique color-shift security component dedicated to low and medium denominations.

Color-shifting threads have been a trend in the banknote since 2003 with liquid crystal and PVD color-shifting threads with numerous combinations of color couples but only limited to two different colors.

Thanks to its unique technology, SURYS proposes the Tristar™ thread that includes an innovative color shifting effect of three colors. We are using salient colors that are part of the most visible ones to the human eyes: red, green and blue. This color combination is also easy to remember and to communicate to the public, as it is the well-known RGB colors.



Tristar™ is indeed a robust security feature combining optical technologies based on the association of nano and microstructures which create colors without the use of inks or physical vapor deposition.

Additionally, a visual texture is added to the thread to improve the optical effect visibility and to allow a graphical customization. Indeed, Tristar™ can be tailor-made and thus can protect several denominations within the same series.

It also reveals a color transformation when the note is rotated from landscape to portrait view, which is impossible to achieve with threads from other passed technologies.

As an evidence, Tristar™ can also carry a message in transmission, a magnetic coding, upon request of Central Banks.

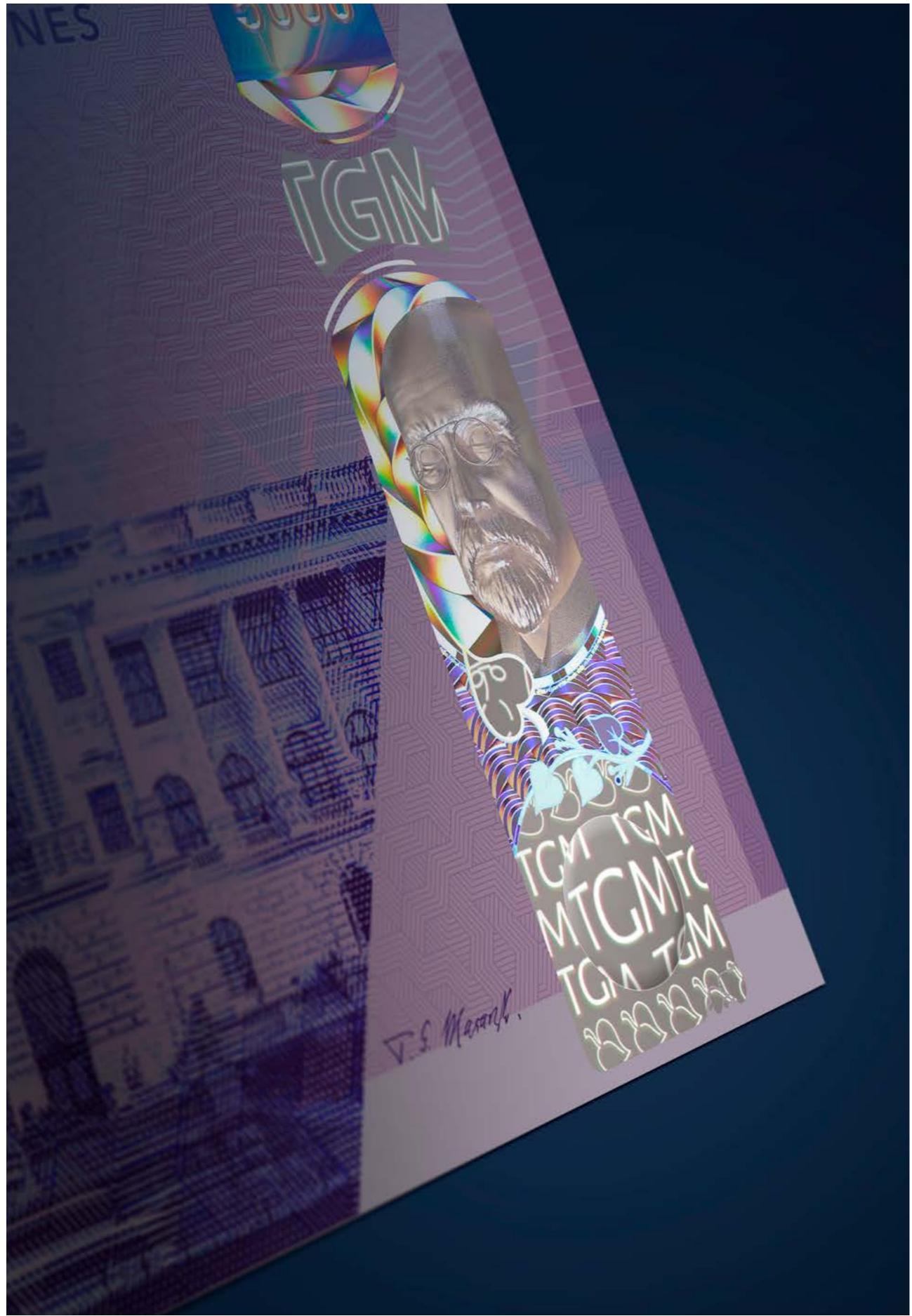
**If you are willing to upgrade or make a decision for new denomination series, Moov™ & Tristar™ threads by SURYS, are your best alternative!**

---

SURYS

Ms. Nathalie Vast  
Email: [n.vast@suryys.com](mailto:n.vast@suryys.com)  
Website: [www.suryys.com](http://www.suryys.com)

Ref: [1] : WHICH COLORS BEST CATCH YOUR EYES: A SUBJECTIVE STUDY OF COLOR SALIENCY Elisa Drelie Gelasca, Danko Tomasic, Touradj Ebrahimi; Ecole Polytechnique Fédérale de Lausanne CH-1015 Lausanne, Switzerland



## IQ STRUCTURES

NANOENGINEERED  
COLOURLESS OPTICAL  
SECURITY FEATURES FOR  
MODERN BANKNOTES

# Nanoengineered colourless optical security features for modern banknotes

## IQ STRUCTURES

A company within the IQS Group, is focused on the development and manufacturing of novel optical security features for protection of banknotes, identity documents and other valuables. It uses the extensive know-how and expertise of nano-and micro-structuring of surface as well as volume elements using electron beam and laser lithography, 3D nanoprinting and nanoimprint lithography. IQS Group's nanoengineered elements, objects and structures, are used in various industries such as pharmaceutical, bio-engineering, automotive, lighting and others.

Tomas Garrigue Masaryk (T.G.M.), the man of bright intellect, firm moral attitudes and unpretentious humanity. The first president of the Czech Republic. Following the dream of free, self-confident and cooperative individuals, he created an environment for the birth of creative society. The Czech Republic was born, a country with a refined sense for innovation. The country where nylons, contact lenses and HIV antivirotics were developed. The country where the use of electron beam lithography for diffractive optics has been pioneered.

The recently developed colourless optically variable features are based on the advanced e-beam lithography, and focuses on a strong and unambiguous visual experience. All so called "Achromic" effects are created using the computer-generated optical modules, defining the diffractive functionality of each nanoscale element forming the final visual appearance of the feature. Despite the overt visual performance, the nanoengineered nature of the features allows the integration of covert as well as forensic elements - the must have components of all optical security features for protection of banknotes.

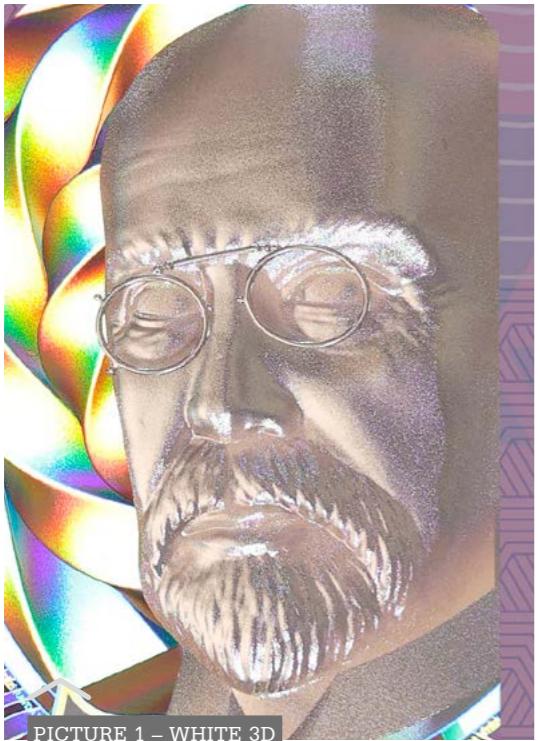
All Achromic effects are suitable for holographic stripes and patches used on paper, hybrid and polymer substrates, as well as holographic window threads integrated in the paper substrates. Based on diffraction optics topology the features may be easily implemented in any foil construction.

### WHITE 3D

The effect appears as a non-chromatic bas-relief with high-resolution details. It doesn't change its appearance when tilted and/or rotated. The bas-relief seems to have a height of approx. 1 mm, but the real depth of the relief forming this effect is around 800 nm. It's the depth which human touch sensors cannot indicate. Due to this fact the feature

„The serious protection is both art as well as science.“

**Petr Franc, CEO**



PICTURE 1 - WHITE 3D

can be authenticated by non-tactile response when touching it. Using the 3D scanning approach or modelling for creation of the effect, any person or object can be reproduced. See picture 1 for the detail.

„Banknotes have always been a fascinating medium. The medium where past and heritage meet the innovations. The technology pioneer telling the old stories of people and nations by the means of latest developments. A contradiction which has been creating an explosive mixture of creativity and knowledge attracting artists as well as scientists and engineers. Hence the theme for an introduction of our novel nanoengineered optical security features for banknotes protection is an inherent part of our past. The first Czech president Tomas Garrigue Masaryk, a man who encoded the ethos of knowledge and humanity in the Czech society.“

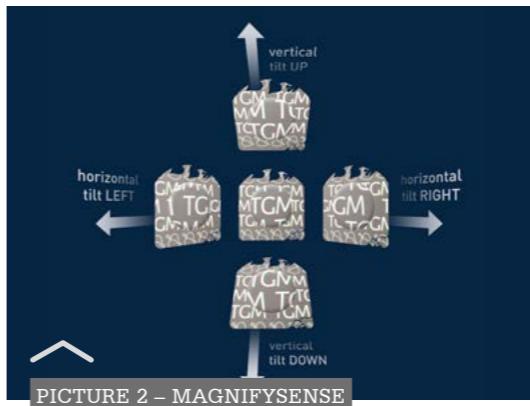
**Robert Dvořák, Managing Director**

### MAGNIFYSENSE

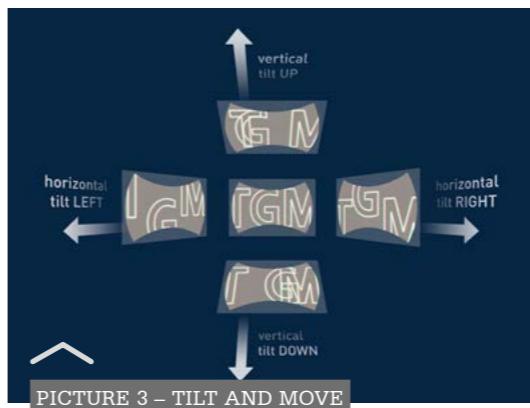
The effect consists of non-chromatic elements (letters, numbers, geometrical objects) hovering below the plane of the feature. When tilting the feature, particular non-chromatic elements are being magnified. The magnification can vary depending on the complexity of the elements. See picture 2 for the explanation.

„Our approach is to create strong visual experience for the user. To catch his eyes using the means of classical diffraction and develop the interaction with the features through their interactive and colourless manner. Our dream is to develop features which are considered by the users to be the games. The games which are played each time there's a payment action.“

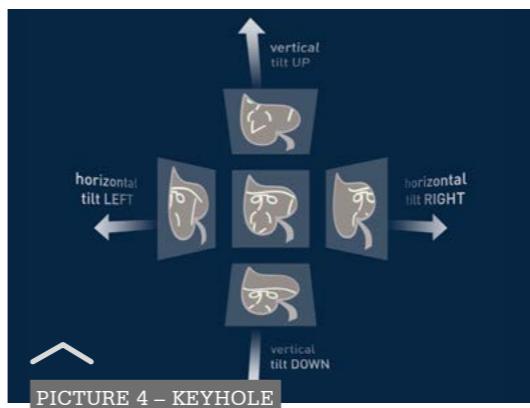
**Jan Dřevíkovský, Senior Designer**



PICTURE 2 - MAGNIFYSENSE



PICTURE 3 - TILT AND MOVE



PICTURE 4 - KEYHOLE

and right and vice versa. See picture 3 for the example. The moves of particular elements can be realized in different depths below the plane of the feature. A morphing, shape changing effect can be integrated.

„The goal of our innovation was to create strong overt effects which will be easily authenticated by the general public. Three major criteria of such effects were defined. The interactivity, the effect must provoke the user for an action, for an active interaction. The simplicity, the feature has to be recognized at the first sight. The visual unambiguity, the effect must be authenticated within few seconds. Following all three above mentioned aspects we have created features which can be described by a phrase „monochromatic action“. They are colourless and interactive.“

**Petr Červenka, Head of mastering**

### KEYHOLE

The effect is created by a non-chromatic element (symbol, geometrical object, letter, number) hidden in or below a display area within the feature. The element is larger than the display area, thus only part of the image is visible. To reveal the whole image the feature must be tilted left/right and up/down. See picture 4 for the example. Due to its nature the effect may be used among the others as an optically variable feature for narrow window threads.

### IQ STRUCTURES

Robert Dvořák, Managing Director  
Email: robert.dvorak@iqstructures.cz  
Website: www.iqstructures.com

### TILT AND MOVE

The effect is formed by non-chromatic elements (symbols, letters, numbers, geometrical objects) hovering below the plane of the feature. When tilting, the elements move in a counter-intuitive manner. When tilted up and down the elements move left

**POLYMER  
SUBSTRATE**





CCL SECURE

# SPARTAN™: THE ENGINEERING BEHIND A NEW BANKNOTE



# SPARTAN™: The engineering behind a new Banknote

CCL SECURE

Behind the launch of CCL Secure's ground breaking new SPARTAN™ banknote – a genuine alternative to coining low denomination banknotes – is a story of innovation and process engineering. To create the new note, CCL Secure undertook a root and branch reassessment of the whole banknote production process.

"To manufacture an effective solution to the well-known challenges associated with the note/coin boundary, it became very clear, very early in the process, that we needed to engineer an entirely new kind of banknote," says CCL Secure's Director of R&D, Marketing and Design, Dr. Tim Berridge. "To address the issues of high transaction velocity, high costs of replacement and pressures to move to coin, we went back to basics and reassessed how banknotes are produced – from raw materials to final product, ready for issuance."

Every SPARTAN banknote is created using Propanote™ Opacity W bank grade polymer film. This has been created solely for use in SPARTAN, based on joint research and development by CCL Secure and their sister company in CCL Industries, Innovia Films. "The combination of our insight into polymer banknotes and Innovia Films unrivalled expertise in bank grade polymer meant that each of us brought in-depth experience to the project," says Dr. Berridge.

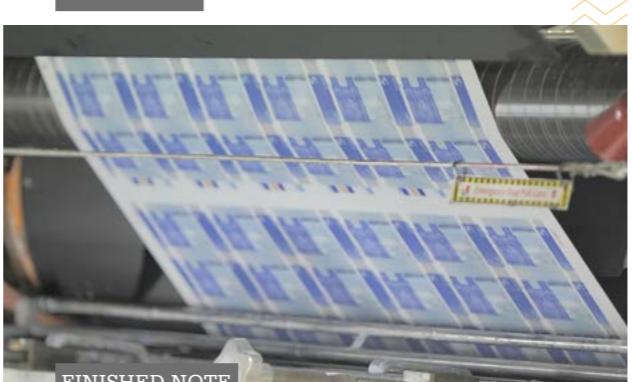
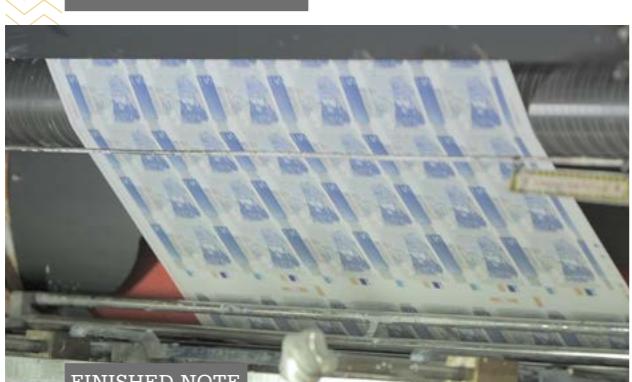


As with any other banknote, a SPARTAN design is built up of many layers that add complexity and security. Dedicated banknote design software enables the use of complex patterns and artwork, including portraits and iconography that are converted into keyline artwork in the same way as an intaglio portrait.

The production process itself has been upgraded and streamlined by CCL Secure so that complete banknotes can be produced in a single pass, rather than multiple passes

- or even multiple processes in different locations -associated with other types of banknotes. "Keeping the cost of production down is one of the key advantages of the SPARTAN banknote approach that we have developed," says Dr. Berridge.

SPARTAN banknotes are printed on an advanced wide web gravure printing press that has been significantly upgraded and is, in effect, a new type of printing process. CCL Secure has used its 30 years of experience and knowledge gained from



producing GUARDIAN polymer substrate to enhance the capabilities of gravure printing, enabling the production of SPARTAN banknotes.

Each SPARTAN banknote starts as a continuous web of Opacity W film onto which layer upon layer of banknote artwork is applied through multiple printing stations on the same production line.

Each layer of the design is laid down in precise registration maintained by class leading registration systems. In addition to the high levels of registration control, each layer is inspected for quality using a high-speed inline quality inspection capability developed specifically for SPARTAN. Every detail of a SPARTAN banknote is inspected and checked to ensure quality. If a defect is identified on a SPARTAN banknote the position and location of that banknote is then tracked so it can be removed.

Special coatings are also applied to give SPARTAN banknotes their unique feel and tactility, including a highly durable over coating to add further protection and enhance their already impressive durability.

Consequently, SPARTAN banknotes have a look and feel that will be familiar to the public - to aid public acceptance - but also have an ultra-durable construction



to enable the note to survive at the note/coin boundary.

In addition, every single SPARTAN banknote is provided with a unique serial number. This serial number is printed as part of the inline process. The style and numbering sequence can be aligned to the current banknotes in the same currency family. Each number is also checked to ensure that the correct number has been applied, that there are no repeat numbers, and that the print quality of the number is acceptable.

Counting, reconciliation of notes, and traceability are all built into the single-pass production process. Security is provided through both covert and security features that are applied during the production process, while Opacity W polymer can be forensically authenticated.

As with banknotes created using GUARDIAN polymer substrate, all SPARTAN banknotes are fully recyclable.

The finished result, says Dr. Berridge, is "the most significant new development in banknote technology for a generation and will transform the way in which central banks and issuing authorities take their note/coin boundary decisions. By providing an ultra-durable, cost-effective alternative to coining - and reducing the cost of the banknote option - we've created a new way in which all the benefits of polymer can be used."

#### CCL SECURE

Mr. Tim Berridge  
Email: [tberridge@cclsecure.com](mailto:tberridge@cclsecure.com)  
Website: [www.cclsecure.com](http://www.cclsecure.com)

October 2022

# THE 2022 BANKNOTE RECYCLING REPORT

Hunkeler Systeme  
&  
Banknote Industry News

**Hunkeler**  
SYSTEME

**bin** BANKNOTE  
INDUSTRY NEWS

**PRINTING &  
PRODUCTION**

**z  
c  
b  
g  
e  
n  
t  
o  
z  
p  
r  
e  
l**



NOTE PRINTING AUSTRALIA

# MITIGATING RISK IN THE TRANSITION FROM PAPER TO POLYMER BANKNOTE PRINTING

# MITIGATING RISK IN THE TRANSITION FROM PAPER TO POLYMER BANKNOTE PRINTING

NOTE PRINTING AUSTRALIA

As polymer substrate continues its steady adoption across currency markets, the number of high security printers printing on polymer substrate is limited. As a key partner in the industrialisation of polymer banknotes, Note Printing Australia (NPA) was the first security printer to make the transition from paper to polymer banknote printing, and since 1991 NPA has printed polymer substrate exclusively. Within the next 10 years (1992-2002), amongst State Printworks (SPWs), the Imprimeria Bancii Nationale a Romaniei (Bucharest), National Banknote Printing Plant (Hanoi) and Fábrica de Billetes del Banco de México (Mexico City, Jalisco) all worked with NPA to understand the key differences between printing on paper and polymer, and all are now highly capable printers of polymer banknotes today. Another early adopter was Nigerian Security Printing and Minting, the first African SPW to start printing on polymer in 2007.

Of course, the polymer technology transfers that took place from the late 1990s to mid 2000s gave NPA the ability to share everything that was known to that point in time about printing on polymer. However, it was still very early days in understanding how to print on the material. At that point in time, ink formulations were being modified to meet the design intent of polymer banknotes and to mitigate basic risks such as curing and drying. Spoilage rates in the range of 20% in those days were considered acceptable as a wide range of common cause and special causes variations were being discovered.

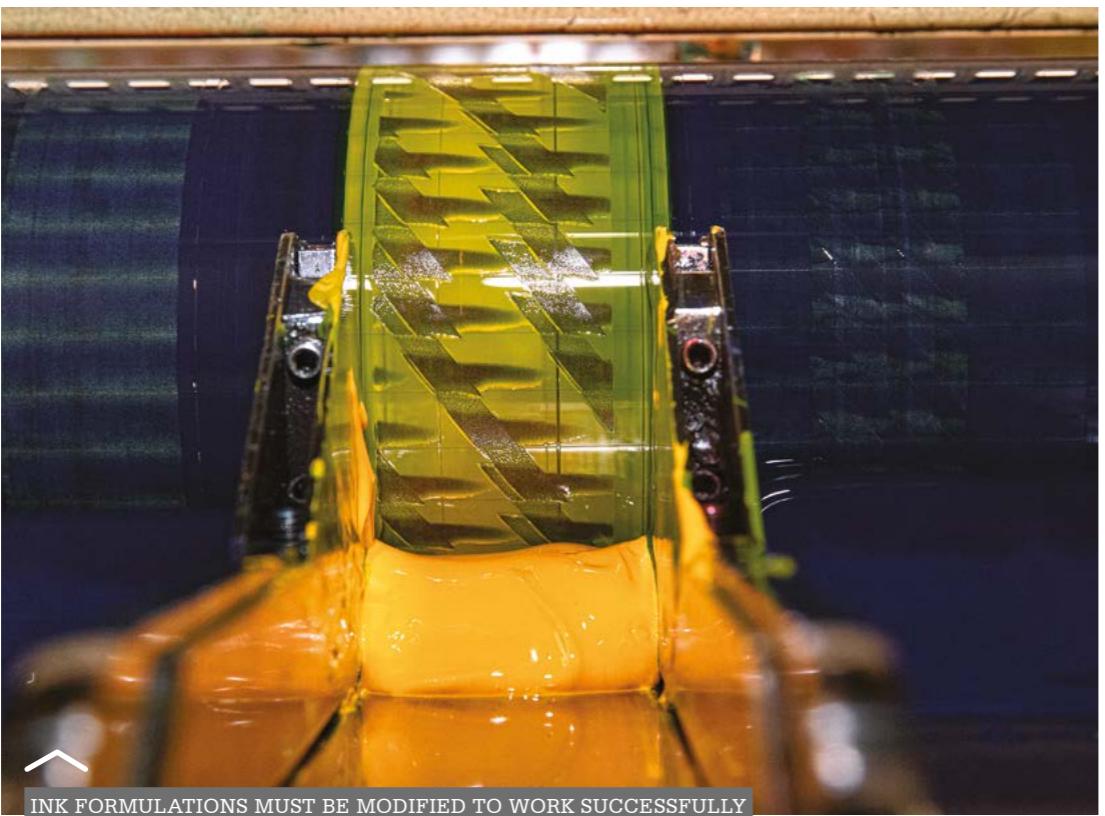
While the originality and immediate benefits of polymer substrate were appreciated by the public back then, the standards and tolerances for printing were much wider. Across the last 30 years, the complexity of polymer printing has grown with the advancement of security features in order to stay ahead of the counterfeiter. This followed with higher standards and tighter tolerances in print production as the expectations from central banks and the note-using public grew.

Based on NPA's observations, we believe that the next decade will see many SPWs make the move to printing on polymer substrate as the preference of central banks for using this banknote substrate grows around the world. The greatest challenge for SPWs today in making the transition is mitigating the risks in an environment where the aesthetic, quality and functional expectations of polymer banknotes are now set to a high benchmark. The margin for error is much smaller, and the potential for spoilage is consequently much higher.

While the equipment used for both substrates is the same and paper printing experience counts for much, the properties of opacified polymer substrate sheets means that numerous adjustments need to be made to the handling of the material, the production process, and the machines

themselves in order to print on polymer substrate in a stable and efficient manner. For the security printer, cotton paper is a far more forgiving substrate than polymer.

The properties of polymer substrate present certain challenges from the outset when it comes to running material on the presses. The largest of these is the generation of static. Increased heat and pressure raises the level of static on the sheet which needs to be managed strategically through each process step. This requires a technical solution to eliminating static before processing, although as part of an overall approach to lowering static, there are other activities that can help to minimise its presence. For example, correct knocking up can lower the inherent level of static in a pile of polymer sheets.



Another common issue across all presses is managing the elasticity of polymer, that is, as the sheet is compressed through cylinders under pressure, it is stretched during the print process and then snaps back once past the compression point. NPA's Pre-Production team track and account for these distortive factors in their platemaking as the sheet works its way through the printing process. By the time the sheet reaches the final process, it is not uncommon for a couple of adjustments to be required to the sheet layout to ensure precise registration.

#### OFFSET

Polymer substrate requires certain factors to be considered in the offset printing process (that is, the process that gives the banknote its background colour.). The clean, smooth polymer surface lends itself to crisp, sharp lines for all print processes, and NPA takes full advantage of these properties, especially when wet-offset printing is used to create extremely high line fidelity. This printing technique is particularly valuable when printing feature effects that require absolutely precise line registration, such as the SUSI Flip™ feature (an offset-printed UV fluorescent ink feature - for more information on the manufacture of SUSI Flip™ please read NPA's article in Banknote Technology Report Issue 7).

Ink formulations specific to printing on water-resistant polymer are used to aid the curing process, which takes a longer period than printing on cotton paper that absorbs the ink on contact. As a hydrophilic chemical, ink elements must be combined in exact ratios with adequate ink strength required to aid both colour and ink laydown during wet-offset.

Depending on the substrate specification, too much water can lead to ink emulsification (watery ink) an example of which is phenomena such as window tinting in which minute amounts of ink pigment build up in the clear window. This effect is too faint to be picked up on a single sheet, and only becomes obvious when looking through the windows of multiple sheets. This defect must be controlled to avoid other functionality issues.

#### FOIL

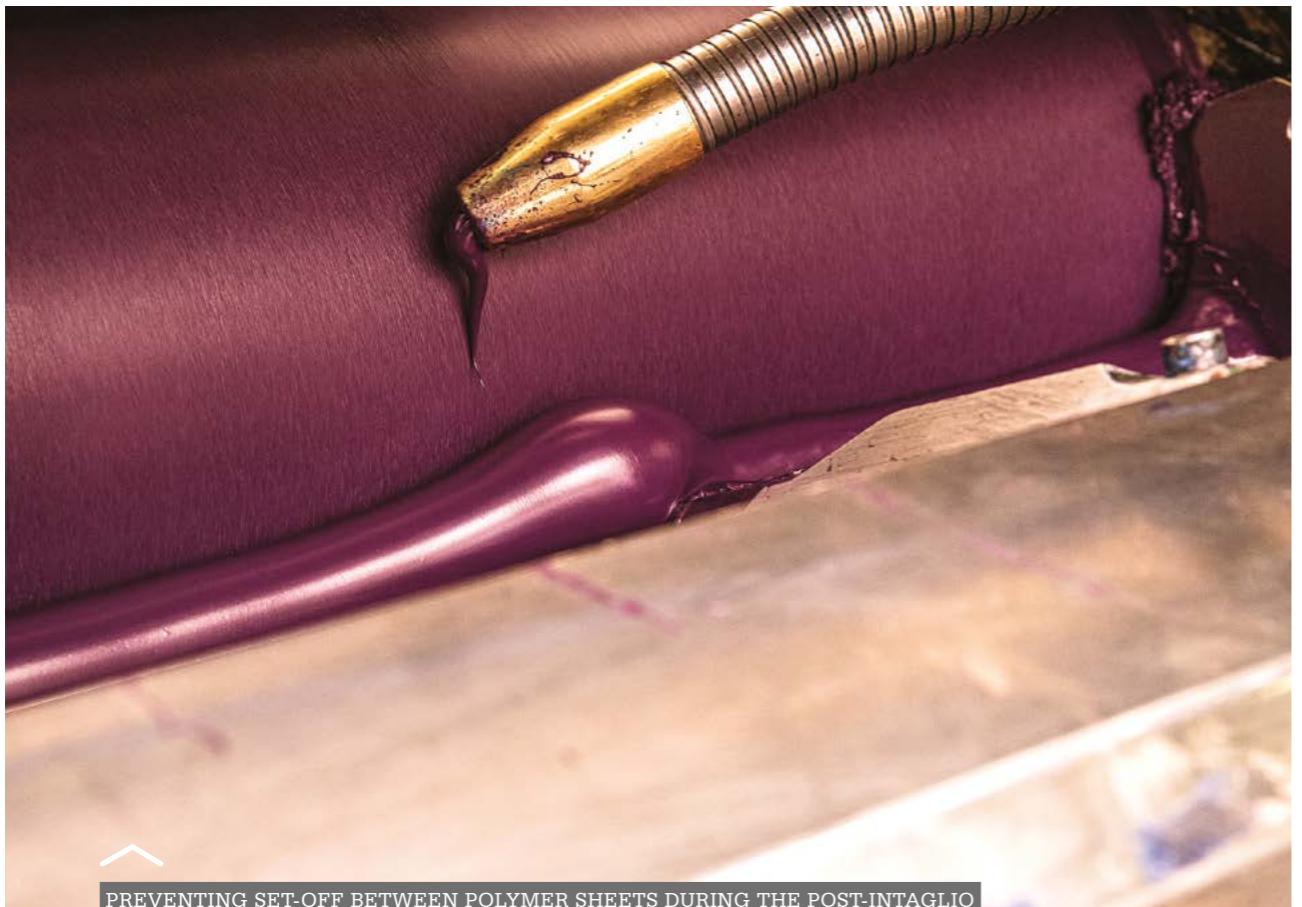
By adding light transparency to reflection, the visual effects produced by a Diffractive Optically Variable Device (DOVD) are optimised when applied to polymer substrate.

To optimise these effects and to preserve the durability of the banknote, foil adhesion is the largest risk to address. The preparation of the polymer surface, the protection of that area from contamination during other print processes, and optimising the combination of foil tension, heat and pressure are key areas in ensuring the best adhesion.

An additional risk for foil in clear windows (as opposed to an opaque background on cotton paper) is the reduced margin of error on polymer with registration and controlling the foil position on the sheet. This is challenging because foil designs are now precisely integrated into clear window designs in order to create a complex window area.

#### INTAGLIO

Intaglio printing on polymer creates extremely precise, clean lines that enhance the tactility of the smooth polymer surface.



**PREVENTING SET-OFF BETWEEN POLYMER SHEETS DURING THE POST-INTAGLIO CURING PROCESS IS A SIGNIFICANT CHALLENGE.**

It is for this reason NPA has always advocated for double-sided intaglio in order to contribute to banknote tactility, which is important for public perception.

While polymer's natural elasticity is most pronounced in the intaglio printing process due to the extremely high pressures involved, the greatest risk is set-off in which a set of printed sheets will stick together via the intaglio ink during the curing process thus contributing to spoilage. NPA has worked on this issue for many years and has run a wide range of experiments to understand all the causes of set-off on polymer banknotes and to minimise its prevalence.

This has included:

- Optimising engraving geometry to encourage air cushions within the stack

- Adjusting impression cylinder heat and pressure to influence ink form on the sheet
- Developing different ink formulations

#### SCREEN

One of the earliest risks NPA needed to address was the risk of blocking. Blocking can occur during the ink or varnish curing process and is amplified by the non-absorbent nature of polymer. The result can be a stack of polymer banknotes that literally form a heavy block. Various design, printing, ink and manufacturing process modifications led to NPA successfully mitigating this risk.

Along with reducing spoilage, an even greater benefit of preventing blocking

for NPA is that it released a bottleneck in the production process. Solving this issue delivered a multiplier effect which in addition to reduced sheet spoilage meant greater production stability, process continuity and product throughput across the entire line.

#### FLEXOGRAPHIC

One of the last processes in the polymer printing process is varnishing. Most polymer banknotes require a varnish layer to enhance the durability of the banknote, which field data has shown to last 3-5 times paper note life. This print layer protects the offset printing and some security features thus the varnish application must be consistent and precise. To this end the specification of the anilox rollers used to apply the varnish has been optimised to ensure the most even possible coverage across the note. Varnish design around the clear windows is also factored in, not just to protect the clarity of the window, but also as a design effect to enhance window complexity and security.

Consistent varnish application without variation is the key requirement, an outcome that was impossible to achieve in the early days when NPA used an offset press to apply varnish which due to the method created varnish that was too glossy or took too long to cure. After the installation of a flexographic press, the NPA team still had to address the presence of phantom imaging, a phenomenon in which a residual image of a design element from one side of the sheet is seen from the other side of the sheet. Mitigating this unfavourable effect was addressed by changing the flexographic plate specification and introducing a plate type that transferred the required amount

of ink in a homogenous coating but did not break down or react to the unusual mechanical and chemical conditions that they are exposed to.

#### EMBOSS

First applied at NPA on the Brunei 1 in 2012 the emboss feature on polymer involves the physical alteration of the polymer substrate to be permanently embossed into a dimple that allows the blind and visually impaired to identify each denomination quickly, and in the normal process of handling a banknote. It is a banknote feature that consistently attracts the most public and media attention and admiration.

For the Brunei note, NPA initially manufactured this feature using a letterpress but then moved to a purpose-built emboss machine as part of Australia's second polymer series which was issued in 2016.

In developing this feature on this new press, NPA worked with different dimple geometries as applied to the polymer substrate. Even polymer substrate materials differ in their response to the same emboss plate, so developing a dimple shape and height that could accommodate this natural variation in polymer material while manufacturing a consistent blind emboss mark that the public could rely on took a lot of time to get right.

Similarly, the emboss blanket composition is critical to the height of the emboss mark. The blanket must be able to accommodate the metal dimple while providing enough resistance to enable consistent and stable feature production.



**ENSURING A POLYMER NOTE IS DESIGNED FOR MANUFACTURE SHOULD ALWAYS CONSIDER THE INTAGLIO AND WINDOW DESIGN IN RELATION TO THE FINISHING PROCESS**

## FINISHING

During the Finishing process, polymer banknote design is important due to the more resilient nature of polymer substrate. The areas of largest focus here are the intaglio and window designs, and in particular the amount of intaglio ink present along the cutting line and size and form of the windows. Scalloping is a phenomenon in which the note edge will take on a wavy appearance due to the resistance of movement under the guillotine blade. This is an example of where design can impact manufacturing productivity. Where scalloping is occurring, unless a solution to reinforce the blade can be developed, the number of sheets being guillotined at one time will need to be reduced.

## CONCLUSION

The number of variables that must be factored into any manufacturing process is always challenging. When it comes to polymer banknote printing, the interrelationship between the above-mentioned risk factors – and many other variables that we don't have room to include in this article – means that despite printing on polymer for more than 30 years, NPA will still have print runs in which a sub-optimal outcome will appear for the first time.

In response to this, and in supporting a culture of continuous improvement, NPA has an outstanding team of Quality Control Technicians and Process Engineers that work with our security printers to effectively manage these special cause variations.



**FINDING THE PERFECT COMBINATION OF DIMPLE GEOMETRY, PRESSURE, AND THE MATERIAL COMPOSITION OF THE BLANKET CREATES PERMANENT BLIND EMBOSSED MARKS THAT HAVE PROVEN TO BE HIGHLY EFFECTIVE IN SERVING THE NEEDS OF THE BLIND AND VISUALLY-IMPAIRED.**

For SPWs contemplating the move to polymer, through previous polymer technology transfers, NPA has seen these printworks become independent and highly capable polymer banknote printers. The journey is a highly rewarding one in many respects, not only for the financial and reputational benefits that polymer delivers to an issuing authority, but for the productivity gains and increased expertise that the introduction of a new capability with requisite new processes and skills delivers to a security printing workforce.

## NOTE PRINTING AUSTRALIA LIMITED

Mr. Steve Casey  
Email: steve.casey@npal.com.au  
Website: www.noteprinting.com

## ADVERTORIAL: CANADIAN BANK NOTE COMPANY, LIMITED (CBN)

### CHALLENGING CONVENTION: THE BAHAMAS CRISP EVOLUTION \$50 AND \$100

At CBN, we routinely rise to new challenges to achieve the exceptional. We couple a rigorous innovation process with a closely collaborative approach with our project partners. So when the Central Bank of The Bahamas requested that new, leading technologies be combined for the first time ever, our natural reaction was to seize the opportunity ...the CBN Way.

In 2012, when the Swiss National Bank announced Durasafe® composite as the substrate for its ninth series of banknotes, it caught the attention of many in the industry. It also drew the attention of other central banks, their curiosity piqued by the combination of security and durability that can be achieved with this novel banknote substrate. Now well-established in circulation, Durasafe® is a remarkably versatile platform for integrating security features. Developed by Landqart AG, the benefits of Durasafe® were not lost on the team at the Central Bank of The Bahamas when they selected it for their top two denominations, the \$50 and \$100, as part of their new CRISP Evolution series.

Determined to use Durasafe®, the Bank was also enthusiastic about the newest micro-optics technologies from Crane Currency. Certainly, a thread integrated into Durasafe® or an optical stripe applied to its surface were established technology combinations. As the saying goes, however, the devil is in the details.

We fell in love with the luxurious feel of the Swiss banknotes. And at the same time, became enchanted with some of the micro-optics technology coming out of Crane. Then we asked, why can't we have both? We were told that this had never been done before. We asked again, why not?"

**Deputy Governor Derek Rolle,  
Central Bank of The Bahamas**

Integrating Crane's RAPID® thread in the \$50 and applying the MOTION® SURFACE optical stripe to the \$100 was not as intuitive as it first seems. Certain combinations of material technologies require development to identify and optimize the right chemistry for adhesion and to adapt the manufacturing process for integration. This is where the commitment of all four parties and the closely collaborative approach amongst project partners, advocated by CBN, were the key factors in the success of these projects.

#### Every banknote a masterpiece

All of this was rooted in the design vision established by the CBN design team. The design brief was extensive: existing concept designs prepared for the Bank needed to be revised to integrate the desired micro-optics technologies from Crane as well as a Durasafe® window, all while retaining mandatory images and features such as the watermark and electrotype.

The adapted designs also needed to maintain a family resemblance with existing CRISP Evolution notes that had already launched or were in production. The design scope also included working closely with our project partners on the component designs related to the substrate, the thread, and the optical stripe.

A key attribute of what our customers refer to as "the CBN Way" means we become closely invested with our partners in the development of product solutions. For the \$50 and \$100, this meant design workshops and factory visits to fully understand the technologies and how they could be used to best effect. Having a lead hand in the design of the components meant a shared ownership and responsibility for a successful outcome in the finished notes. This also provided our Manufacturing team the opportunity to better understand the materials they would be working with in the production environment. The CBN Manufacturing and Design teams work closely together to bring complementary perspectives to the design process, not only addressing potential manufacturing concerns, but to be sure that functional attributes and tolerances are mutually understood and then represented in the Quality Plan for that design.

Banknotes have a deliberate function. They are designed with the cash handler, cash handling equipment, and the circulation environment in mind. This functionality is carefully disguised within a pleasing aesthetic and at CBN, we develop each individual design as its own masterpiece.

Banknotes are widely considered a form of art that represent or reflect the culture and personality of a nation. In this regard, figures of national importance are often included in a banknote design. As striking and memorable as some technologies are, intaglio portraits and vignettes – in addition to contributing the security and tactility associated with this process – imbue a design with a relatable context or subject.



At the sub conscious level, portraits contribute to making a design relatable from the human perspective: faces are what we are inherently trained from birth to recognize.



## ADVERTORIAL: CANADIAN BANK NOTE COMPANY, LIMITED (CBN)

Getting this right was particularly important for the \$100, which now features a portrait of former Governor General and Deputy Prime Minister Arthur Dion Hanna in place of HM Queen Elizabeth II. The prominent portraits on the \$50 and the \$100, the former featuring a likeness of Sir Roland T. Symonette, create a visual focal point that draws one into the design. Similarly, the vignettes on the reverse side – with their vertical orientation – provide a striking contrast that complement the micro-optics features. The colourful intaglio vignettes contribute to the three-dimensional perception of the designs and support the distinctly Bahamian visual identity. And as stunning as the vignettes and portraits are, they are also functional and contribute to the machine-readability of these masterpieces.

### **The CRISP Evolution \$50: setting the bar high**

Launched in October 2019, the new \$50 represents the first circulation note on Durasafe® in the Caribbean and the first ever combination of Durasafe® and RAPID® thread. This pairing relied heavily on Landqart to identify a suitable adhesive to integrate the thread, ensuring durability and integrity in circulation. The Durasafe® process itself also required adaptation to ensure that the insertion of RAPID® did not compromise the micro-optics effects. While RAPID® features a sealed lens array, allowing for the use of both top adhesives and varnish to be applied onto the thread, there was risk of sensitivity to the hot melt polymer extruded onto the primary paper layer in the Durasafe® process. It was conceivable that during integration, the thread could be damaged or adhesion within the final composite structure could be compromised.

In the Durasafe® process, the thread is first adhered to the back of the obverse paper layer before this layer and the reverse paper layer are fused together with liquid polymer. The thread is thus sandwiched (fully encapsulated) between the obverse paper layer and the polymer core. To reveal the thread, a window is die-cut in-line into the reverse paper layer, directly opposite the thread position: this forms a half-window, through which the thread is viewed. Critically, the polymer core material, based on how the Durasafe® process is optimized, maintains a high degree of transparency and optical clarity so that the micro-optics effects of RAPID® are unaffected. The result speaks for itself: the thread is prominently visible within a 36mm tall window – the largest in a circulating banknote – and the micro-optics effects are clear and distinctive. Best of all, given that the thread is fully integrated between the obverse paper layer and the polymer core, it is both highly durable and highly secure.

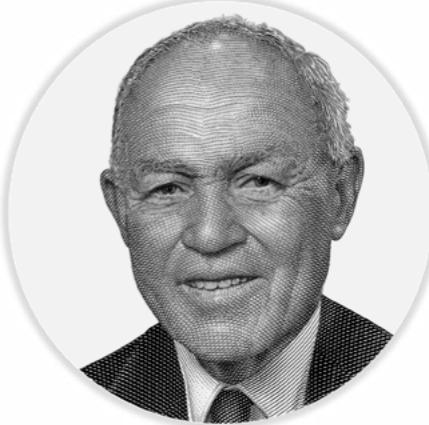
It seemed such a simple task. Make sure the RAPID® thread is securely fixed in the substrate for the life of the note and that its full visual potential is reached. The reality was a bit more complicated. It took many tests in the lab, months of work on the machine, but with the commitment of the company and our partners, we were able to achieve the results that the Bank wanted.

**Hanno Goldbach,  
Head of R&D, Landqart AG**

### **A window as the window**

Of course, the new \$50 is about far more than just the RAPID® thread. A key value proposition of the Durasafe® platform is the ability to integrate full, transparent windows into the substrate. In this regard, CBN's designers took inspiration from one of the key design motifs, Government House in Nassau, to integrate a window (from the Government House building) as the window. The substrate window is created by die-cutting both paper layers in-line on the Durasafe® machine, leaving the polymer core exposed to create a fully transparent window.

Taking a rectangular form that mimics the window shape of the Government House windows, the substrate window is overprinted with lithographic offset and a partial intaglio image of Government House, positioned so that the substrate window appears to be one of the building windows. The effect is eye-catching and very simple for cash handlers to understand – just look through the window!



SIR ROLAND T. SYMONETTE

The new \$50 also benefits from the use of SPARK® Live with what was at the time a new diagonal spike effect from SICPA. Printed in the image of a hummingbird, this feature is instantly recognizable by cash handlers and provides a strong optical effect on the obverse side of the note, with RAPID® appearing on the reverse side.

Taking further advantage of the unique Durasafe® platform, having two distinct paper layers means that the invisible security fibres can be side-specific. Blue-fluorescing fibres were chosen for the obverse side, to provide contrast with other UV features, while green-fluorescing fibres are used on the reverse side. Though subtle, this nonetheless contributes to the multiple layers of security within the note and to its overall sophistication.

Following its launch, the International Association of Currency Affairs selected the new \$50 as a finalist for its Excellence in Currency Technical Award in the category Best New Currency Feature or Product. This honour acknowledged the technical challenges associated with the integration of RAPID® thread in Durasafe® and how the visualization of the thread had been optimized within the

## ADVERTORIAL: CANADIAN BANK NOTE COMPANY, LIMITED (CBN)

note design. Such recognition is also validation that we did indeed raise the bar!

### **The CRISP Evolution \$100: moving the bar even higher**

When it came time to develop the new \$100, the Central Bank of The Bahamas, encouraged by the outcome of the \$50 project, set the bar even higher by requesting Crane's new MOTION® SURFACE optical stripe in combination with Durasafe® substrate. This particular combination also represents a world first and required ingenuity for both design integration and for adapting the application process to suit the material characteristics of MOTION® SURFACE and Durasafe® on the OptiNota-H application machine.

In 2015, CBN had worked closely with KBA-NotaSys and KURZ to establish a registered patch application solution for the Reserve Bank of New Zealand's new Series 7 banknotes. At the time, this represented a bespoke configuration of the OptiNota-H machine to apply patch holograms in tight register with the substrate features. A challenging project, this experience meant that CBN was undaunted by the need to make a further adaptation of the OptiNota-H to apply MOTION® SURFACE. Of course, much as it was with the \$50 project, the production solution was very much in the details.

As it always does, however, the story starts with the design. The new \$100 features an aquatic theme on the reverse of the note and our designers sought to create a tightly integrated solution between the print and MOTION® SURFACE stripe. As the reverse side of the CRISP series notes have a

vertically oriented design, they felt it was important to create effects that would work when the note is held vertically as well as horizontally. The design leverages a suite of optical effects starting with DEEP™, to impart a powerful three-dimensional effect. This is complemented by the TOPO™ lens bubble, microtext, and SHIMMER™, used to animate the fish in the stripe design, including an Animated SHIMMER™ effect that gives the impression of the fish swimming. The latter effect functions when the note is held in a horizontal orientation.

It all comes together rather swimmingly. With lithographic offset being the first step, the background includes a school of fish that merge almost seamlessly with the fish in the MOTION® SURFACE stripe. This is then overprinted using the intaglio process with a dramatic representation of the blue marlin, indigenous to the waters around The Bahamas. The result is an exquisite and eye-catching design that invites cash handlers to play with the note, tilting it along both axes to observe the optical effects.



The new CRISP Evolution \$100 was launched in October 2021 and has captivated the attention of the public and industry observers alike. The new note is also a tribute to the late Arthur Dion Hanna, widely considered a founding father of the modern Bahamas, whose likeness is captured in the portrait gracing the front of the note. This modern design remains true to the cultural posture of Bahamian banknotes while the sophistication of its features – and how they've been integrated – raises the bar very high, indeed.



ARTHUR DION HANNA

This same thinking – creating a well-integrated design solution – extended to the full, transparent substrate window. More than a design feature, the full window contributes to the security of the banknote design and provides cash handlers with a simple yet effective means to authenticate the note. The objective for the design team was to integrate the window organically within the context of the design theme. Like the \$50, the transparent window is positioned near the large intaglio portrait and uses a shape that fits with the design. In this case, the window takes the form of a jellyfish outline that is intaglio overprinted so that the window forms part of a group or smack of jellyfish, thus maintaining the aquatic theme in a way that not only resonates between the two sides of the note but *through* the note, too.

Rounding out the aquatic theme, the SPARK® Live feature takes the form of a nautilus shell. With a stunning open form effect, this durable feature contributes a dynamic, optically variable element to the obverse design that smartly complements the full window feature. Again, like the \$50, SPARK® Live contributes prominently to the security of the obverse side of the note, with the micro-optics feature from Crane prominent on the reverse side.

### **Embracing challenge**

Our customers often refer to "the CBN Way". Meant as a compliment, it refers to our culture and how we work in close partnership with them to approach challenging opportunities, maintaining a strong, disciplined innovation process coupled with our commitment and flexible engagement. It is this culture that encourages us to embrace challenges, to keep moving forward, to develop solutions that provide the measure of security and durability demanded of currency today and, not least, to create outcomes that raise the bar. The new CRISP Evolution \$50 and \$100 have achieved precisely this and more. As Deputy Governor Rolle said of the \$50 project, "We couldn't be happier with the result. More importantly, the public seems to be really fond of the note and we could not have chosen a more dedicated group of professionals to help us bring this vision to reality."

CANADIAN BANK NOTE COMPANY,  
LIMITED (CBN)

Dr. R. Sean Pemberton  
Email: spembert@cbnco.com  
Website: www.cbnco.com

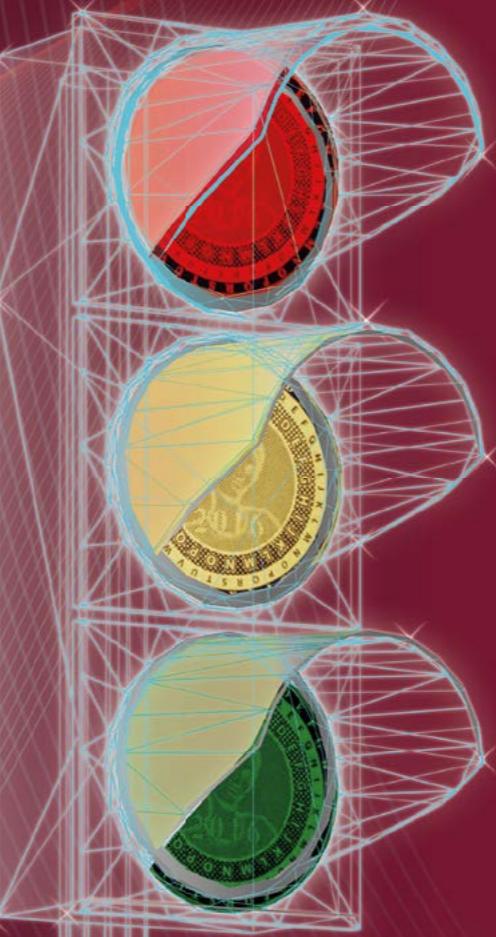
LET'S  
**mouve<sup>INK</sup>**

THREE LUMINESCENT EMISSIONS TRIGGERED BY  
A SINGLE UV-LIGHT AVAILABLE IN A SINGLE INK

The unique, innovative security feature combines well-known fluorescent colour emissions with a long-lasting phosphorescent after-glow effect, previously not available for the high security printing industry.

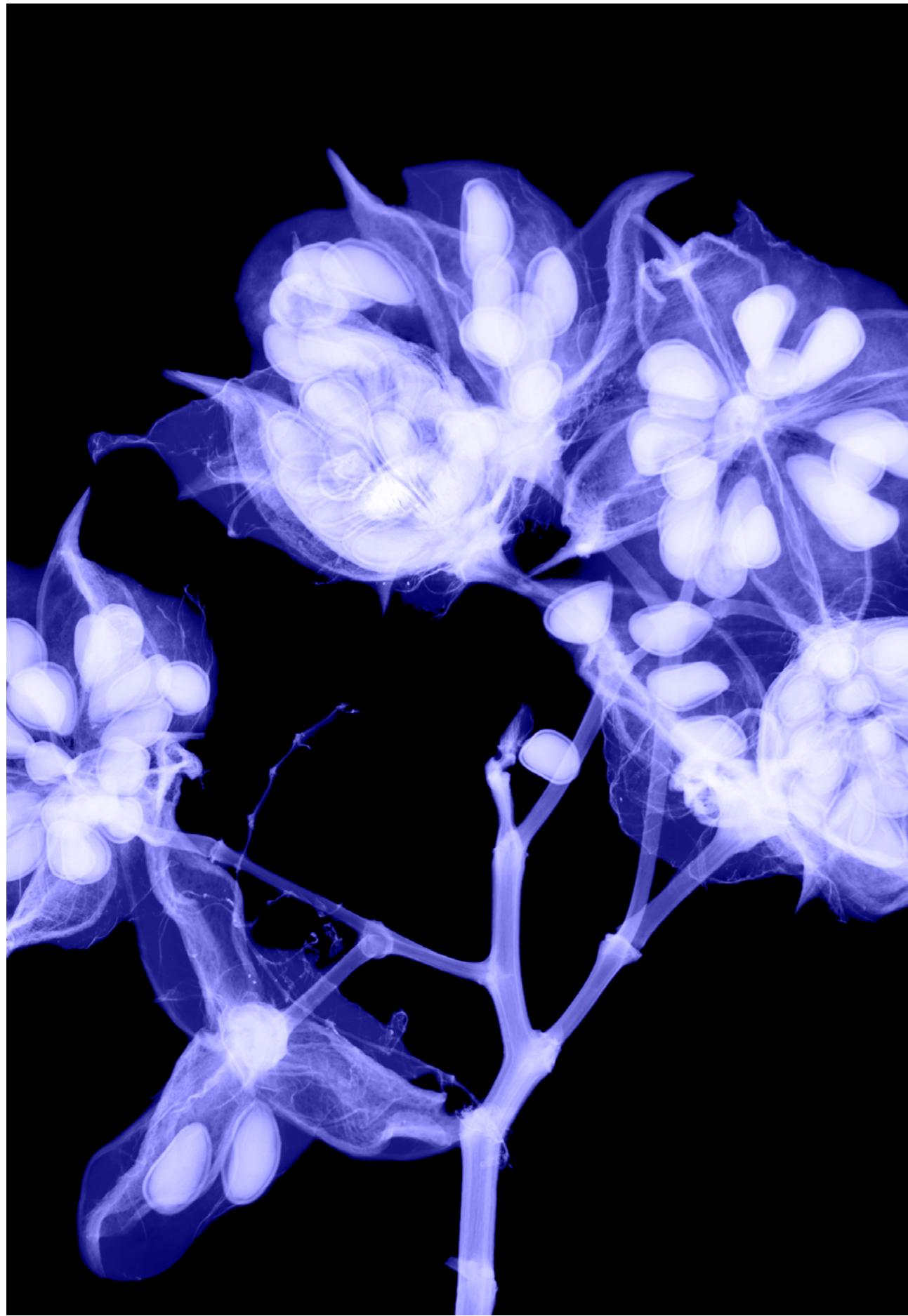


World's First Traffic Light for Banknotes  
and Identity Documents



trust  
dynamic  
colours





GIESECKE + DEVRIENT

IN GREEN WE TRUST

SHAPING THE  
FUTURE OF A SECURE  
AND SUSTAINABLE  
BANKNOTE.



# THE EFFICIENT CASH CYCLE IS BASED ON DURABLE COTTON BANKNOTES.

GIESECKE+DEVRIENT

The demand for more durable and security-scalable banknote solutions is increasing – but without embedded security concepts, this demand will only be met with compromises. Add to this the strains of progressively more complex cash cycles and challenging environmental and circulation conditions, and the triangle of security, sustainability, and longevity appears to be a dilemma. However, there are ways to achieve durability in a sustainable way that is compatible with proven cotton-based security.

Giesecke+Devrient (G+D) and Papierfabrik Louisenthal have been working on reducing the environmental impact of their banknote production and cash-cycle-related activities for many years. With the Green Banknote Initiative (GBI) 2022, G+D now aims to point the way to a future banknote that is as secure as it is sustainable, underlining that the sustainable banknote of the future relies on natural fibers: cotton-based substrates already use a “recycled” short fiber fraction and can therefore be considered a natural recycled product.

And natural-fiber-based banknotes today are very different from what they were just a few decades ago – see LongLife™ and Hybrid ADDvance® substrates, whose durability has increased considerably thanks to modern technologies: market studies show that Hybrid™-based banknotes achieve 2.5 to 3 times the durability of standard cotton banknotes.



## WITHOUT SECURITY DURABILITY IS USELESS.

However, durability alone does not make a valuable, sustainable banknote. An unbalanced interplay between security and sustainability means not only a shorter lifetime in the cash cycle but also a loss of money, confidence, efficiency, and sustainability.

It is about time for a holistic view of the future of the sustainable banknote. Thankfully, enhanced durability and a lower environmental impact through raw materials, production, longevity, and destruction are already built into today's paper banknotes. So to be truly sustainable, banknotes must have several properties in addition to durability. Within its Green Banknote Initiative G+D calls this **Durability+**.

A concept that covers the whole range from product to production to end-of-life, considering the different fields of action across the entire banknote lifecycle. This starts with the best security solutions for banknotes in a combination of embedded, printed, and applied features; and ends with a variety of options for utilizing the fiber-based matrix of cotton banknotes.

## A BENCHMARK FOR THE HOLISTIC GREEN BANKNOTE: HYBRID ADDvance®.

Longevity is one reason that G+D has gone a step further with its unique composite substrate Hybrid™, along with Hybrid ADDvance®, in which all the valuable security features, embedded and applied, are protected under a very thin polyester film. Together, these give level 1 security features a dramatically longer and effective life in your banknote. The lifelike properties are protected in circulation. No other substrate can offer such high feature durability as is achieved by Hybrid ADDvance®.

From Hybrid™ and Hybrid ADDvance® to the watermark – the latter being the most widely known embedded security inherent in the paper and still the most recognized and accepted security feature by most communities. Functionality, security, and public acceptance must complement each other – as in the case of the RollingStar® i+, for example – a dramatic leap towards greater attractiveness that offers banknotes significant benefits: uncompromising security on the one hand and memorable attractiveness on the other.



By working on the micromirrors themselves and further perfecting the precision in their origination, the multi-facet substructure of the RollingStar® i+, with an even more sophisticated way of aligning and shaping the micromirrors and G+D's proven ColourShift thin-film technology, presents

an even greater obstacle for counterfeiters. It additionally provides security by using proven Level 2 magnetic technologies: G+D's machine-readable magnetic code MultiCode™ is reliably integrated and highly accepted amongst all major sensor manufacturers.

## SECURITY IS THE THREAD THAT BINDS US.

G+D constantly analyzes a huge range of counterfeiting scenarios leading to a holistic feature strategy. One that relies among others on the combination of three effects in one security feature: G+D's proven ColourShift thin-film technology for brilliant and distinctive color change; dynamics, through micromirror technology; and last but not least individualization and customization – for country-specific designs – by ClearText and customized dynamic effects.

The importance of combining all these features in one thread? Because in their entirety they can be recognized quickly and without doubt by the user – especially in diffuse light conditions.

This provides security, as scalable and sustainable as resistant.

### ROLLINGSTAR® i+: BANKNOTES IN A NEW LIGHT, WITH UNMATCHED SECURITY FROM WITHIN.





## INVISIBLE. INVINCIBLE. THE M-FEATURE®

With the M-Feature®, G+D has created the highest standard for banknote security and continues to drive it forward. Functionality, anticounterfeiting resilience, efficiency, or robustness: everything that counts at Level 3 is continuously reviewed and improved. An invisible and invincible barrier for counterfeiters, the M-Feature®, the first feature of its kind, is the most advanced and innovative one.

No matter which functionality a central bank prefers, there's an M-Feature® solution for it. Whether embedded into the substrate or printed on the banknote, whoever is producing the banknote, and no matter which high-speed machine is used for sorting the banknotes – the

M-Feature® is the recognized standard for central bank security. Our sensors perform consistent authentication for all banknote conditions.

And: best-in-class processing efficiency has made us the market leader in central bank authentication and the M-Feature® the pacemaker for the sorting shop floor. Processing with the M-Feature® tremendously reduces the number of rejects in a high-speed machine – by up to 80%. Its unique ability to securely authenticate the banknote under all its conditions maximizes the circulating lifetime and thus contributes to the sustainability of the cash cycle.

UNAMBIGUOUS AUTHENTICATION WITH HIGHEST SORTING EFFICIENCY



GALAXY®: THE LATEST, AND EXCLUSIVE TECHNOLOGIES FOR HIGH-END SECURITY

It leads to fascination and security at a glance, also guaranteed and realized by G+D's Galaxy® security threads, wherein dynamic reflections combined with changing colors deliver a stunning experience that's extremely difficult to forge. This results in benefits that are not just animated 3D images allowing for 360° authentication or the huge design freedom enabled by colors and dynamic effects – it is Galaxy's® unique security concept based on the three pillars of secure technology, secure effects, and secure design that maximizes security and ensures a harmonious look and feel.

## PAVING THE WAY FOR GREENER PAYMENTS.

G+D's Green Banknote Initiative is not "just" about sustainability: it's no one-trick pony. It underlines that banknotes and sustainability need a 360-degree approach and proves how cotton-based banknotes will and can be even more sustainable and secure in the future than they are today: not just in their production, but as a sustainability driver for the cash cycle as a whole – and thus pave the way for greener payments

## GIESECKE+DEVRIENT

Mr. Andreas von Loepel  
Email: [andreas.loepel@gi-de.com](mailto:andreas.loepel@gi-de.com)  
Website: [www.gi-de.com](http://www.gi-de.com)

THE CONVERGENCE OF SUSTAINABILITY AND SECURITY, LEADING TO MULTIDIMENSIONAL SOLUTIONS EMBODIED IN ECO-FRIENDLY BANKNOTES



AS WINNERS OF THE IACA AWARD FOR SUSTAINABILITY, G+D AND LOUISENTHAL ARE CONSTANTLY WORKING ON IMPROVING THE SUSTAINABILITY OF BANKNOTES AND LEVERAGING POTENTIAL THROUGH INTENSIVE RESEARCH AND DEVELOPMENT.

# Success Partner of the World's Most Secure Currencies:

There is nothing more precious to a country than its national currency. We are honored that over 70 countries worldwide put their trust in our high-security products to protect their national pride from counterfeiters. Among them the Swiss Franc, known as one of the most secure currencies in the world.



# The Swiss Franc

Security starts  
with quality,  
the best solution  
with independence.

- + 100 % independent partner
- + high security standard for the highest demands
- + wide range of reliable, functional products from time-proven to tailored solutions
- + individual consulting and services

Highest Security

# COTTON & COMPOSITE SUBSTRATES

Wool  
Cotton  
Silk  
Satin  
Hemp  
Flax  
Organic  
Dyed  
Composite  
Substrates

 LANDQARTA DIFFERENT  
PERSPECTIVE



## A Different Perspective

LANDQART AG

Vertically oriented banknotes aren't exactly new, but they are growing in popularity. The change of orientation allows for the design space to be used differently, and for certain subjects to be presented more effectively, than in the more "traditional" landscape orientation. In some circumstances notes make use of both perspectives, giving the obverse and reverse of the note very different feels, but maintaining the necessary harmony of the design as a whole.

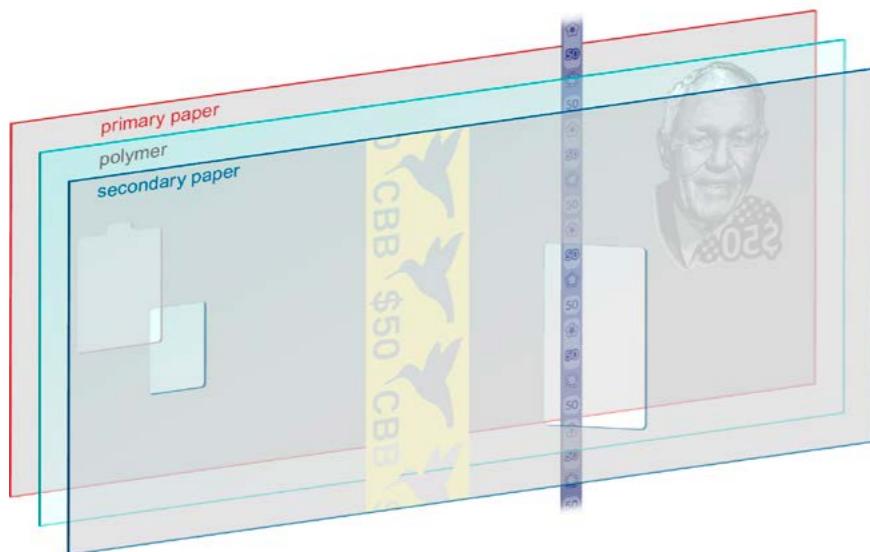
# Central Bank of The Bahamas

Arthur Dion Hanna

**W**hat has perhaps not changed apace with design, is how designers integrate security features. A security thread or foil, for example, still tends to cut across the vertical scene of the note; it is something that remains the same while everything else changes. It can sometimes appear like an abrupt interruption of the design but, done well, the integration can still be beautiful and the overall harmony maintained. The recent CRISP Evolution \$100 banknote issued by the Central Bank of the Bahamas is a perfect example.

Of course, the traditional approach to integrating features may be influenced by traditional manufacturing methods. If vertical notes are a departure from the norm, let us throw caution, and convention, to the wind, and let our imagination run. Security threads and foils are very strong public recognition (so called Level 1) features, so why confine the former to appearing in small sections, or restrict the latter to the width of the note? The Durasafe platform gives designers the freedom to break from tradition. Because threads are fully embedded inside the substrate when we make Durasafe, we have to create apertures to expose the thread. In doing so we allow the designers a relatively free reign to decide on the shape and size of the aperture.

This approach was fully embraced by the Central Bank of the Bahamas when they chose a combination of RAPID thread and Durasafe substrate for their CRISP Evolution \$50 banknote. The designers chose to embrace the freedom allowed by the substrate and presented the thread in a single 36mm long window.



It is the first note in circulation to present such a large, continuous surface area of thread, giving cash handlers a much clearer view of the feature, and making the job of a potential counterfeiter that much harder. All this, without affecting the clarity of the RAPID thread optical effects.

As generous as the amount of thread shown might be, there was a feeling that more could be done: was it possible to show even more thread? Because of the composite nature of Durasafe, mechanical resistance (physical strength) is a lot higher than with regular cotton, so we can make a very large aperture for the thread without compromising the strength of the note. We put this to the test in the Hydro house note that was designed and printed by Crane Currency, a note that incorporates a 72mm long window for the thread! It presents an unparalleled view of the expanding and contracting shapes in the RAPID Breeze thread. Though not a circulation note, the

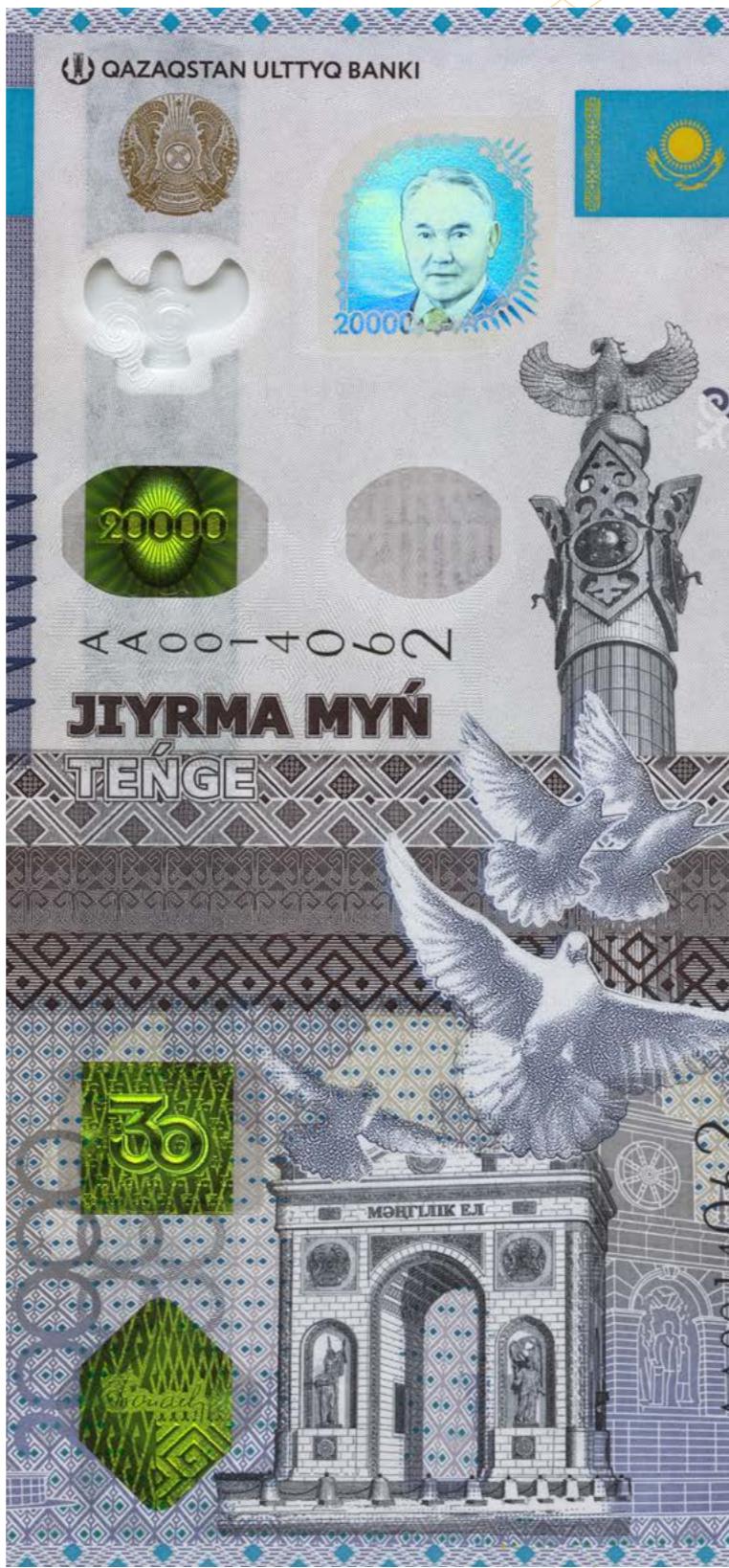
project was a tremendous success in giving the designer, Fredrik Blixen-Finecke, a totally free hand to design the substrate in a way that would suit the print design as best possible. An example of the freedom to design with Durasafe, the only brief he was given was "the subject is water, and it has to have a very big window for the thread".

Embedding something like a thread or foil into the substrate in this way has a practical, as well as an aesthetic, benefit: it is completely protected from becoming detached or damaged during circulation. By selecting the location, shape, and size of the apertures it is possible to further integrate the feature into the design, or selectively showcase parts of it. This is particularly convenient when we talk about registered security foils. One of the characteristics that make foils unique as public recognition features is the way different effects and designs can be brought together.

The way foils are used in banknote designs has evolved over time: from a small, endlessly repeating pattern, to the total registration of images and text that we are so used to seeing today, allowing for larger and bolder images that are simpler for the public to recognise and understand.

With so much range to the features on offer, applying the foil across the width of the note can be rather... confining. By now you can probably guess what's coming next: what happens if we make use of the full height of a vertically oriented note to spread out the individual effects of the foil? And let's take it a step further, using the placement of apertures to draw the user's eye to each effect, and intersperse them with printed elements on the paper above the note, and demetalised elements inside the note. This was exactly the proposition from the designers of the National Bank of Kazakhstan for the new 20000 Tenge banknote. The Bank launched the first regular circulation Durasafe note in 2014 and wanted to make an upgrade to the design to mark the 30th anniversary of Kazakh independence. Always at the forefront of design and innovation, a long-edge embedded 15mm wide foil was seen as the way to achieve this.

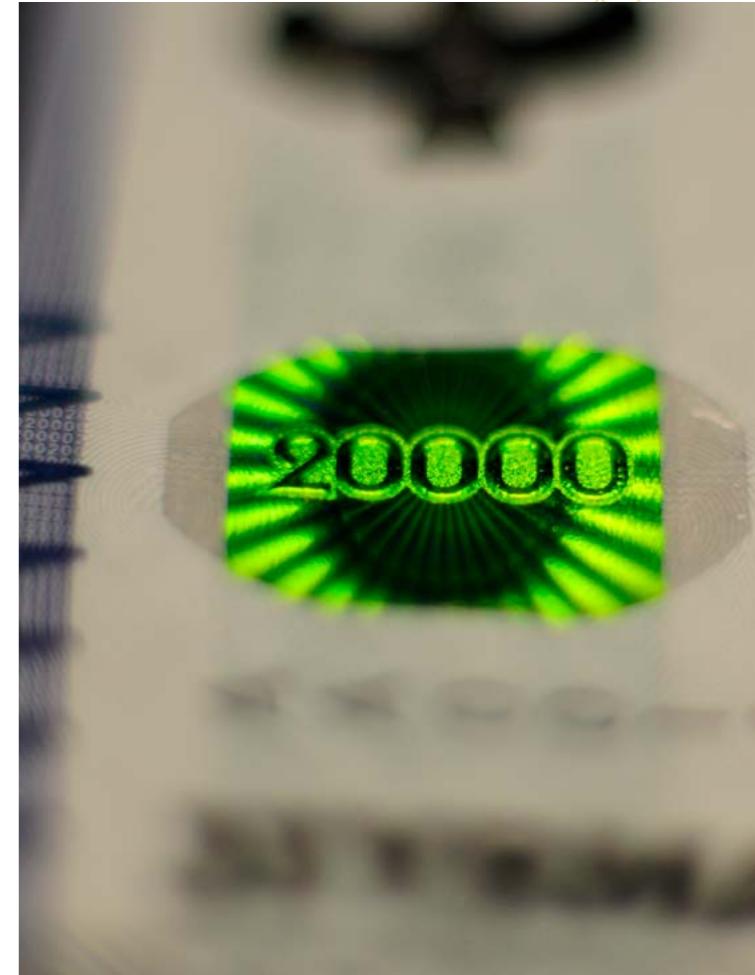
In order to integrate the foil in this way, it is applied at the Landqart mill, in register to the watermark, to one of the two 35gsm reels of paper that make up the paper-polymer composite substrate. This reel is taken to the Durasafe machine, where it is unwound simultaneously with a second reel of paper, which has the apertures cut into it, in register with the foil, to create the windows that show the foil's features. The two paper layers are then fused with molten, extruded polymer, which binds everything



together into a single, composite structure as it sets. This ensures the foil is completely encapsulated between the paper to which it is adhered, and the polymer. This is illustrated in the picture on the right.

For this new issue of the 20000 Tenge banknote, the Bank chose a RollingStar® LEAD foil from Louisenthal, making full use of the different effects that can be built into it. Applying the foil parallel with the long edge of the note, and exposing portions of it as needed, utilises the available design space in a way that effectively creates space for the print design to integrate with it. It allows for generous placement of the features of the note, and makes each of them unique and distinct, and yet still part of the whole. For cash handlers, the eye can wander from vignette to vignette, taking it all in, carefully and calmly: the design is not conducive to a casual glance, all the better to make life harder for potential counterfeiters. And, as a win-win scenario, since the RollingStar® foil sits behind a protective layer of polymer, the colours and effects will not get scratched or worn during circulation, preserving the optical characteristics for the life of the note.

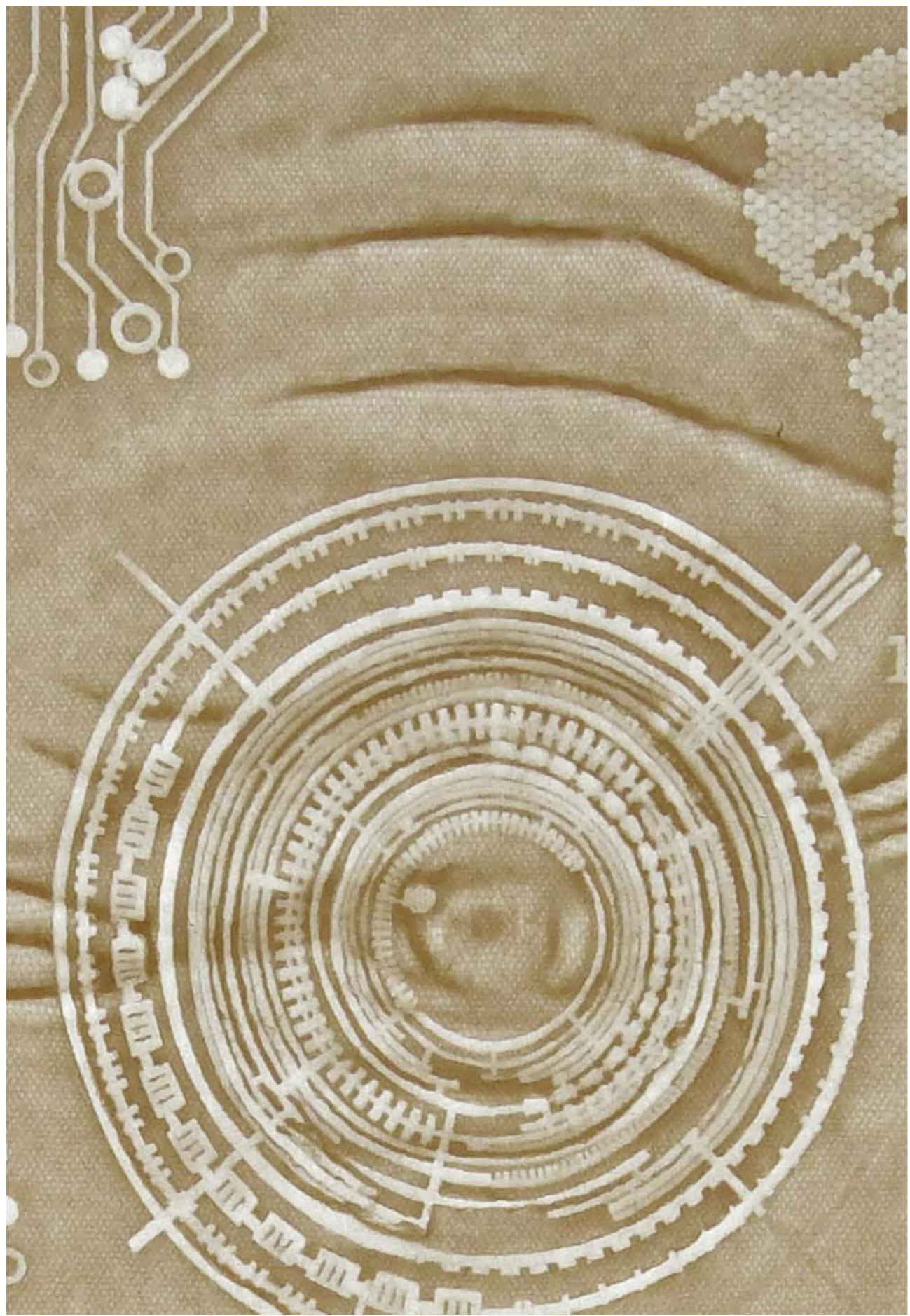
Choosing a different perspective when conceptualising a new banknote design brings us a long way towards getting people to look at, and interact with, their banknotes. An opportunity to develop a connection rather than taking them for granted. Durasafe is a versatile platform that allows features to be integrated in a way that makes them truly stand out and be looked at, making the most of these different perspectives. Banknotes play a crucial role in society and are considered a public good. By providing designers the freedom to exploit a different perspective,



creating designs in a way that also promotes the durability of features within the design, cash handlers are more likely to instinctively take more time to look at their notes. And less likely to take them for granted. So if we've mastered horizontals and verticals, what's next – a diagonal design, anyone?

LANDQART AG

Mr. Richard Perera  
Email: richard.perera@lanqart.com  
Website: www.landqart.com



**POLISH SECURITY  
PRINTING WORKS (PWPW)**

**POWER OF THE SUBSTRATE  
—DURABLE AND SECURE**



# POWER OF THE SUBSTRATE

## – durable and secure

POLISH SECURITY PRINTING WORKS (PWPW)

The durability and the condition of banknotes during circulation has never been a more important topic. Security, the carbon footprint and, most importantly, cleanliness (hygienic considerations for the users) are only a few of the key points considered during discussions between producers and central banks. Depending on environmental conditions, methods of cash usage, and other factors, finding the right solution is no easy task.

A variety of solutions have been developed over the years in response to different circulation issues. Environmental conditions, methods of handling cash by citizens, the level of cash usage, and machine readability considerations require that banknotes remain in good condition during their lifetime. While some companies promote plastic or "half-plastic" substrates as the go-to solution, their environmental impact is still uncertain, especially when associated initial costs are taken into consideration.

On the other hand, banknote paper can be enhanced in order to target given issues without citizens noticing any change.

Solutions can be divided into the following categories:

#### MIXTURE OF FIBRES

Mixing cotton fibres with other natural and non-natural materials in order to increase the mechanical durability of banknotes has been in the industry for a couple of decades. Nowadays, this is losing popularity in favour of anti-soiling coatings or polymer solutions, although those banknotes can be still found on the market. PWPW has its own specialized blend called Fortis® Composite, consisting of natural and synthetic fibres. With multiple productions successfully delivered in Latin America, this paper has proven its value. Depending on environmental conditions, this substrate

may increase double fold (ISO 5626), tearing resistance (ISO 1974) and other mechanical properties by more than 50% in comparison with Fortis® classic banknote cotton paper, while having no impact on the public perception of the banknotes.

#### ANTI-SOILING COATINGS

Specialized coatings have also been popular since their introduction in the early 1990s. Many companies have developed proprietary technologies that increase the lifespan of the banknotes in circulation. The biggest advantage of this is that it can be incorporated into existing production without additional printing passes (varnishing), which would increase production costs significantly.



POLISH BISON PROMOTIONAL NOTE – THE "PELIKAN INK" TEST

Fortis® Pro is a highly advanced coating applied on the paper machine, which makes it a cost-effective solution for every central bank.

According to tests conducted by the UGRA testing laboratory, banknotes that have been given a coating show a significant increase in solid soiling resistance in comparison with reference paper. This solution has been applied in Afghanistan, among other places, which is known for its harsh environment.

#### ANTIMICROBIAL PAPER

Although it has been proven that, under realistic conditions, the COVID-19 virus remains on the surface of banknotes much less than on any other kind of surface (iScience 24, 102908, 20 August 2021),



20 PLN COMMEMORATIVE NOTE WITH KURZ THREAD

the transfer of bacteria and germs is still a concern for many citizens, as this may weaken the human organism and increase susceptibility to viruses.

PWPW has developed a special antimicrobial banknote paper coating Fortis® ABC, accredited by the ISEGA Institute. This solution provides a reduction in the growth of, among others, more than 99.99% of Escherichia coli and Staphylococcus aureus bacteria (AATCC 100). It can be applied during paper making and, similar to Fortis® Pro, does not have an impact on productivity or on the recognition of the banknotes by the public.

#### ENHANCE THE SUBSTRATE

If needed, every substrate can be further enhanced with an additional layer of protection varnishing. This technology, apart from increasing soiling resistance, also protects the print, which provides the ultimate solution for every denomination. PWPW produces cationic-based, banknote-grade varnish of a high quality called Coat4Note®, which, according to internal tests based on ECB's methods, shows better performance than popular varnishes on the market.



20 PLN COMMEMORATIVE NOTE WITH IRIS4NOTE®



#### SECURITY FEATURES

According to research, security threads are still the most secure feature that can be applied to banknotes, and the easiest to recognize. PWPW has always cooperated with thread producers in order to increase the safety of its products. In 2021, as a result of its successful cooperation with KURZ, it was the first company to implement KURZ THREAD, a highly advanced holographic thread with the Kinogram Colors® structure. This has been applied in the newest collector note for the National Bank of Poland, which commemorates Prof Lech Kaczyński, the former President of the Republic of Poland.

In 2019, PWPW produced a collector 19 PLN banknote for NBP to commemorate the 100th anniversary of PWPW, with a state-of-the-art holographic Kinogram stripe, including, for the first time, HDM® technology on a window. This would not have been possible without investment in highly advanced machinery in the paper mill. During the same process, the machine applied an iridescent stripe.

Iridescent stripes are a well-known solution, although, thanks to new eco-friendly technologies, their importance is even greater now. PWPW produces Iris4Note® – security water-based inks that can be applied directly on the paper web. These do not only leave a smaller carbon footprint but also exhibit better optical effects.

All the above-mentioned technologies, applied together with modern watermark technologies, such as DuoWatermark® and Multihexa®, are the optimum solution for all needs.

To sum up, PWPW has the knowledge to provide advice and find the right solution for any given issue. Our experience is growing each year as successful projects are delivered to every corner of the world.

POLISH SECURITY PRINTING WORKS  
(PWPW)

Mr. Piotr Dymala, Chief Security  
Features Specialist and Sales Support

Email: sales@pwpw.pl  
Website: www.pwpw.pl

# CBDC CONFERENCE

The CBDC Conference is the premier event in the Central Bank Digital Currency sphere.

Join central banks, retail banks, policy makers, technology providers and academia in the discussion about CBDC.



Explore. Engage. Excel. [www.cbdc-conference.com](http://www.cbdc-conference.com)

Frankfurt, 29 – 31 August 2022

## ADVERTORIAL: BANQUE DE FRANCE

### EVERFIT®: BANKNOTES MADE DURABLE

#### **Soiling, Ink Abrasion, Colour Fading, Mechanical Resistance – EverFit® Solving Durability Issues.**

EverFit® paves the way to a new generation of banknotes that offers outstanding durability in circulation thanks to a final laminated protective layer.

#### **Durability by Design**

With EverFit®, the Banque de France addresses markets where the conditions of circulation are harsh.

Despite being varnished and/or specifically treated, paper banknotes that return from circulation show heavy signs of soiling after only a short period of time, whereas, during the same time polymer banknotes start to show heavy signs of colour fading.

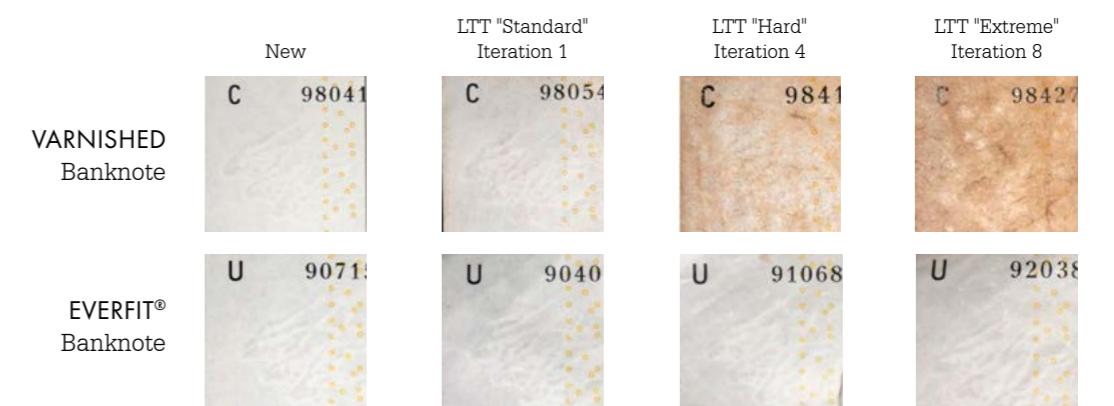
Specifically, on markets which are very familiar with paper banknotes and their strong security features, there is a real need to improve the durability of banknotes without moving away from the paper substrate. EverFit® was born from this observation and it can be applied directly without altering the existing design.

After six years of R&D involving dedicated paper, film and application processes together with the filing of corresponding patents, EverFit®, with several hundred million banknotes circulating throughout the world, is a fully mature technology.

EverFit® consists of a fully printed and secure paper banknote that is laminated

with a polymer film on both sides as a finishing step. This solution both prevents ink abrasion and offers an external soil repellent surface.

Far less brittle than a varnish, the unprinted polymer film used for EverFit® offers an outstanding protection against soiling. Print and security features are durably protected from the environment of circulation, and ink abrasion is prevented.



EverFit® provides outstanding resistance to soiling as proved by independent lab testing through the LTT "Extreme" Test. It is acknowledged that banknotes that withstand 4 iterations of the LTT test are deemed suitable for harsh conditions of circulation. EverFit® withstands 8 iterations, what better proof of its very high resistance in circulation.

#### **Durability in Circulation**

One of the main objectives of EverFit® is to increase banknotes' resistance to soiling and improve their overall lifespan. Thus, according to circulation test results, we can estimate that the lifetime of EverFit® banknotes exceeds that of varnished banknotes by a factor 4.

As the printed elements are beneath the unprinted laminating film, they are totally protected from abrasion and the substrate is fully protected from soiling.

In addition, EverFit® banknotes display improved mechanical properties thanks to their composite structure: they benefit from both the folding resistance of the polymer laminating film and the tear resistance of the paper substrate.

Specifically developed for central banks with the aim of achieving ultimate banknote protection, EverFit® is the solution for harsh conditions of circulation.

With a strong history of over 200 years in the banknote industry, the Banque de France has an internationally recognized expertise in the design and manufacturing of banknotes. With an integrated banknote manufacturing facility, including its own Paper Mill and Printing Works, which ensures an optimal concentration of the value chain, the Banque de France is ready with EverFit® to help you successfully address your banknote circulation challenges.

BANQUE DE FRANCE  
BANKNOTE MANUFACTURING

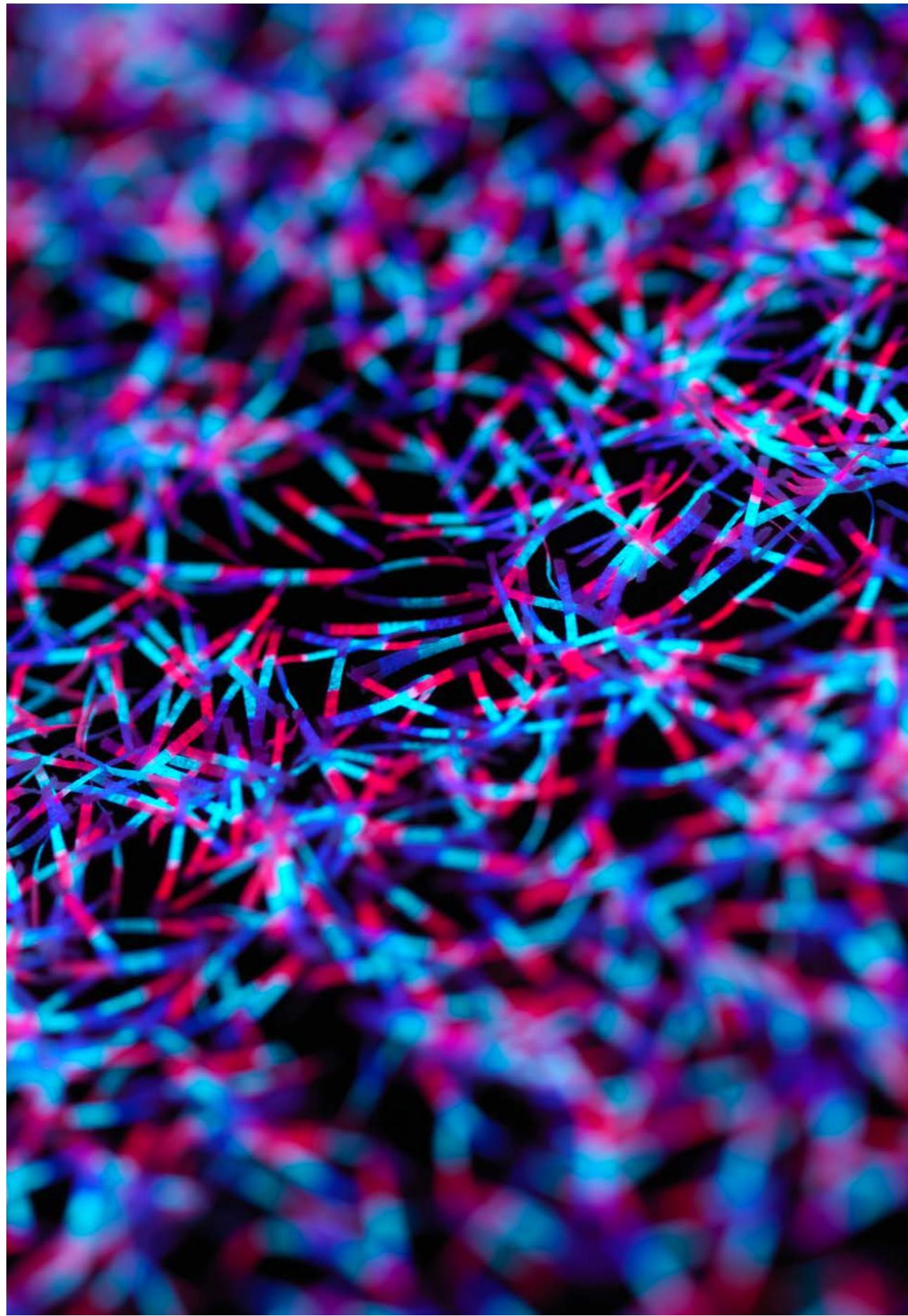
Email: [Everfit@banque-france.fr](mailto:Everfit@banque-france.fr)  
Website: [www.banque-france.fr](http://www.banque-france.fr)



CLICK OR SCAN

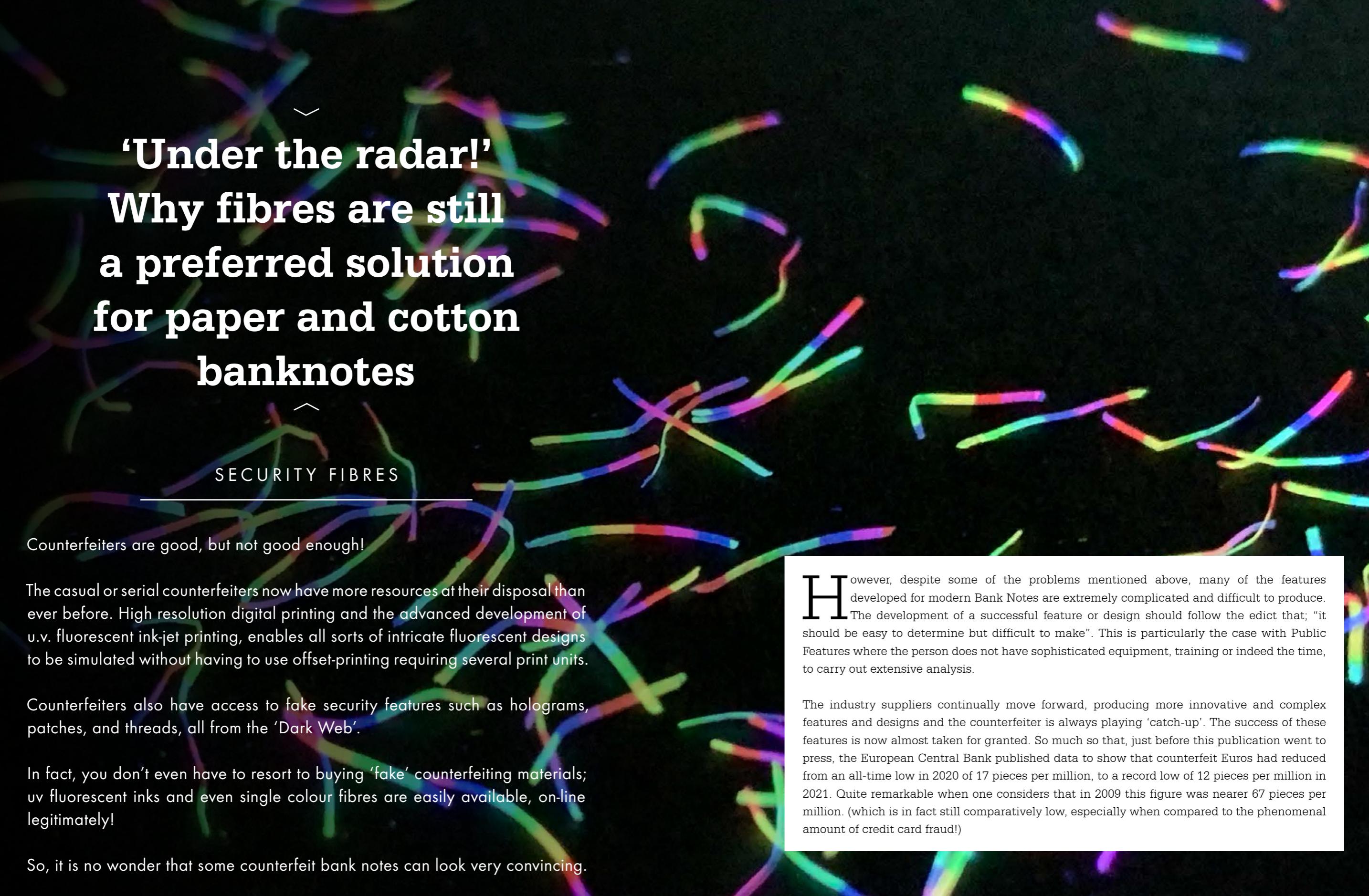
**FIBRES**

**lurene**



## SECURITY FIBRES

**'UNDER THE RADAR!'  
WHY FIBRES ARE STILL A  
PREFERRED SOLUTION  
FOR PAPER AND COTTON  
BANKNOTES**



# ‘Under the radar!’ Why fibres are still a preferred solution for paper and cotton banknotes

SECURITY FIBRES

Counterfeitors are good, but not good enough!

The casual or serial counterfeitors now have more resources at their disposal than ever before. High resolution digital printing and the advanced development of u.v. fluorescent ink-jet printing, enables all sorts of intricate fluorescent designs to be simulated without having to use offset-printing requiring several print units.

Counterfeitors also have access to fake security features such as holograms, patches, and threads, all from the ‘Dark Web’.

In fact, you don’t even have to resort to buying ‘fake’ counterfeiting materials; uv fluorescent inks and even single colour fibres are easily available, on-line legitimately!

So, it is no wonder that some counterfeit bank notes can look very convincing.

**H**owever, despite some of the problems mentioned above, many of the features developed for modern Bank Notes are extremely complicated and difficult to produce. The development of a successful feature or design should follow the edict that; “it should be easy to determine but difficult to make”. This is particularly the case with Public Features where the person does not have sophisticated equipment, training or indeed the time, to carry out extensive analysis.

The industry suppliers continually move forward, producing more innovative and complex features and designs and the counterfeiter is always playing ‘catch-up’. The success of these features is now almost taken for granted. So much so that, just before this publication went to press, the European Central Bank published data to show that counterfeit Euros had reduced from an all-time low in 2020 of 17 pieces per million, to a record low of 12 pieces per million in 2021. Quite remarkable when one considers that in 2009 this figure was nearer 67 pieces per million. (which is in fact still comparatively low, especially when compared to the phenomenal amount of credit card fraud!)

This statistic also compares very favourably to the data released by the Bank of England which stated that in 2021, counterfeits of their notes was also very low at .0022% or 22 pieces per million.

These statistics show that Bank Note technology has improved dramatically over the years and the investment in new features that are difficult to counterfeit, continues to 'pay-off'. Saving money for the banks and members of the public (you are not reimbursed if you inadvertently receive a counterfeit note!)

However, it is also very interesting to note that the two sets of statistics offer an illuminating comparison of the counterfeit resilience of the Bank of England polymer substrate notes (22 counterfeit pieces per million) compared to the European Central Bank notes made from cotton (12 counterfeit pieces per million). There is a saying amongst statisticians that, "if you torture the data long enough, it will confess to anything" so we shouldn't jump to conclusions,

But it is worth mentioning that the move from cotton to polymer substrate is often justified because of its presumed "state-of -the-art, counterfeit resilience" Yet the current Europa series issued by the ECB seems to suggest that it is better or at least as good as polymer and has several upgraded security features that can only be applied in a cotton substrate!

The argument is not polymer v cotton; each has its place in the 'product mix'. Instead, the comparison is used to illustrate that the paper manufacturing process has unique qualities that allow other security features to be used which are not available to the polymer producer.

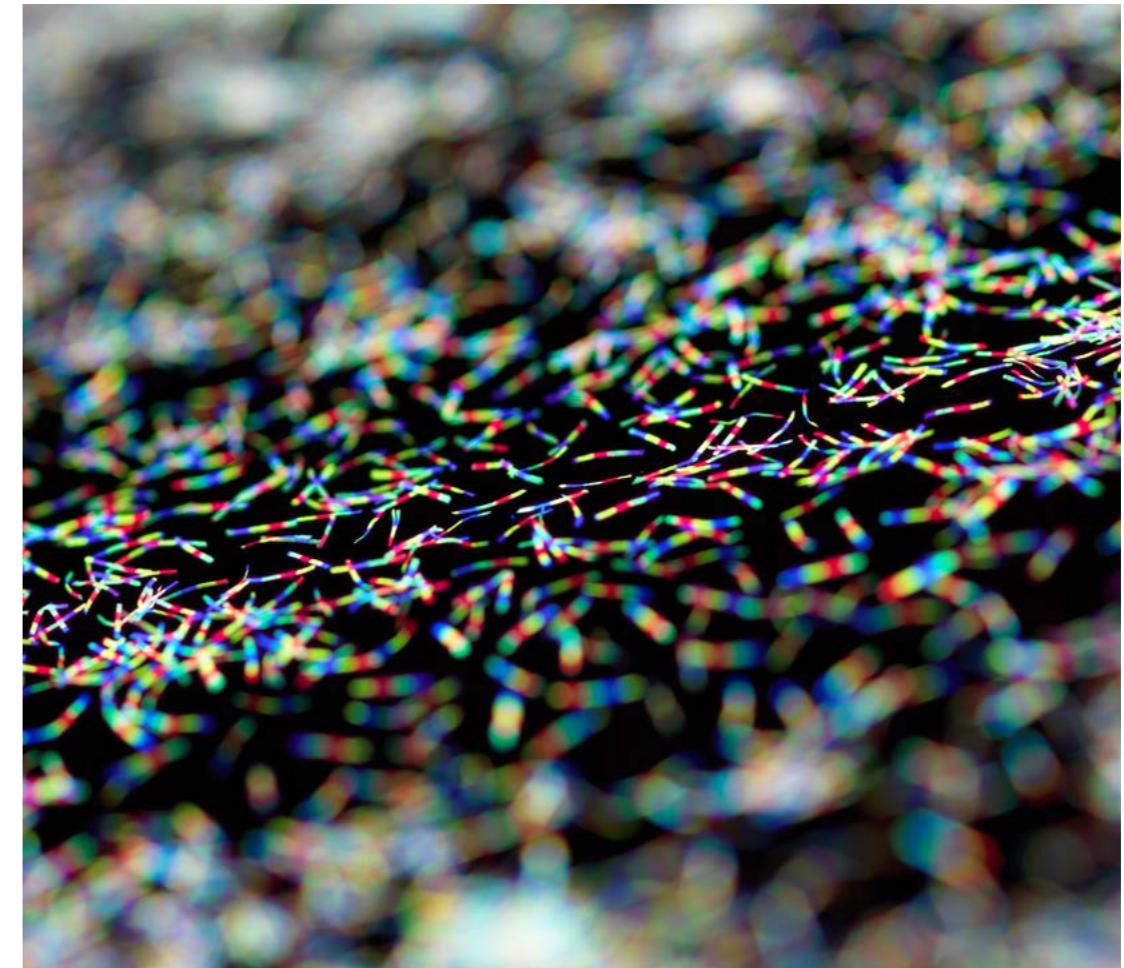
One of the most popular and economic of these are multi-colour security fibres, these fibres do not require any special equipment to put them into the paper and are probably the least expensive of all the other security features in a bank note.

One of the most high-profile endorsements of this type of fibre is in the example of the Europa or ESII bank note mentioned above, where one of the new security upgrades was the use of multi-colour fibres, replacing the single colour fibres that were used in the first series of bank notes issued in 2002.

Single-coloured synthetic fibres were and still are, a popular feature used for many decades. The paper-making process is ideal for adding this type of security inclusion which can easily be mixed into the cotton or paper-pulp during manufacture. This results in the security features becoming embedded in the fibres of the paper so that they become an integral part of the sheet. This has a major advantage over other security features that can be counterfeited by being printed or stuck onto a document. Printing and laminating machines are relatively easy to come-by whereas a paper making machine is not at the disposal of most counterfeiters or forgers.

This makes for an inherently secure and insurmountable barrier to the criminally minded.

In the days before colour copying and scanning became ubiquitous, these inexpensive single-colour fibres were added to the paper to create two or three additional colours that any counterfeiter would have to reproduce as well as those colours used in the print. This was an additional aggravation and cost to the counterfeiter, and it was also easy to see if a fibre had been simulated by printing.



Rapid advances in desk-top printing and digital reproduction techniques made simple, coloured fibres less effective and so they were enhanced with the addition of ultra-violet, fluorescent pigments, and dyes. These could not be reproduced by the scanners and desk-top printers of the day. However, with the advent of ink-jet printing using fluorescent inks, as well as the availability of commercially affordable multi-colour printing presses, the addition of a blue or yellow fluorescent fibre in a security document was no longer enough to stop a determined counterfeiter; especially if the counterfeiter was a state-sponsored entity with ample resources!

Security Fibres recognised that there was an opportunity to improve on the standard security fibres and invented the multi-colour, Rainbow or 'Candy Stripe' fibre. These fibres became a huge success, rapidly replacing conventional fibres to provide a unique and highly effective addition to document and bank-note security. They are now used in billions and billions of bank notes throughout the world, replacing the traditional single colour security fibres that had been used for over a hundred years.

Multi-Colour fibres should be used in place of single colour fibres which are too easily available to a determined counterfeiter.

**RAINBOW FIBRES:**

"The original and best". This is what one of our customers told us! Four colour Rainbow fibres were one of the first fibres we developed, the eye-catching colours of the fibre; red, yellow, blue, and green are attractive and easy-to-identify. This inexpensive up-grade adds a high level of security that will frustrate most counterfeiters

**MULTI-LAYER SECURITY**

Due to the versatility of our Multi-Colour and Rainbow fibres, more layers of security such as taggants, IR up-converters, short wave u.v. fluorescence and so on, can be added to the same fibre. These can be added to the fibre retrospectively or they can be employed as a 'latent' feature, already within the fibre but only 'activated' in an emergency. There is no need to re-educate the public and no need to change anything else about the banknote.

No other security fibre offers the same level of sophistication and versatility, and several options can be chosen to create a truly unique fibre. Including our Country Fibres

which are designed to reflect the colours of a national flag. The colours always appearing in the same sequence and position on the fibre length.

**SPECTRUM FIBRES™**

This fibre combines the whole range of spectral colours along its length. Almost impossible to counterfeit whilst at the same time providing an attractive and unique, eye-catching feature that everyone can recognise and remember. More colours, more attractive and more secure. More headaches for the counterfeiter!

**MYRIAD FIBRES™**

The security fibre that is unique; every-last one! This fibre was originally conceived for tax stamps which because of their very small size, meant that maybe only two or three fibres would appear on each stamp. This led to the idea that if each fibre looked slightly different, it would be easy for the viewer to compare them and if any fibres looked the same, the stamp might be suspect. This resulted in the design of 'pseudo-random' patterning of fluorescent colours arranged



in various shapes and sizes along the length of the fibre. Myriad fibres have an attractive and novel appearance, and with every-fibre slightly different but easily discernible, these unique fibres are a 'nightmare' for the counterfeiter.

**VERIFIBRE™**

The world's first 'smart fibre'!

This latest addition to our family of fibres bridges the gap between public and covert verification. This unique fibre contains a special 'taggant' that can be detected using a smart phone. No special adaptations or accessories are needed for the phone, just download the app. and your smartphone becomes a sophisticated verification tool, ready to inspect and authenticate the validity of the banknote. Verifibre is easy to use and can be designed as a visible fibre for easy detection or can be 'hidden' in a Rainbow or Multi-colour fibre so that existing fibres in a banknote can be easily upgraded.

This fibre is a real 'game-changer' allowing anyone with a smart phone to 'interact' with the banknote, engaging public involvement and increasing user confidence. We can also 'code' the fibres so that they are unique to individual countries. We can provide an app. that is matched to detect these codes. The ultimate fibre combining high security and ease of verification.

**EASY UPGRADE.**

Until now, changing or adding security features to banknotes already in circulation has been prohibitively expensive or impractical. Now you can make a rapid and highly effective upgrade to your existing banknote without changing the design and

without incurring additional costs. Using High Security, Multi-Colour fibres is the easiest and most effective way to improve the security of your banknote whilst at the same time adding an aesthetic and easily recognisable semi-public feature. They can replace existing single colour fibres or can be used alongside single colour fibres to 'future-proof' security and counterfeiting robustness of your banknote series for years to come.

We titled this piece 'under the radar' because security fibres are often overlooked by the counterfeiter or forger. With our programme of continued development and improvements resulting in a wide range of different products, this unobtrusive line of defence is now seen as an even more valuable tool in the fight against fakes.

**SECURITY FIBRES**

Mr. Gary Spinks  
Email: [gary@securityfibres.co.uk](mailto:gary@securityfibres.co.uk)  
Website: [www.securityfibres.com](http://www.securityfibres.com)

**HIGH  
SECURITY  
INK**

**E  
E  
T  
R  
O  
O  
U  
L  
U  
Z  
E  
C**

 SICPA

# SPARK FLOW®: STEPPING INTO UNCHARTED TERRITORY



# SPARK Flow®: Stepping into uncharted territory

SICPA

Technology and security, as we all know, are constantly evolving. SPARK® has, from the beginning, been at the forefront of this evolution and introduces today the latest advancements in banknote optical technology – SPARK Flow®. Embark on this journey where intuitive security meets design sophistication and industrial robustness.

**S**ince launching its first steps into the market in 2006, the SPARK® technology comprising of SPARK Origin® and SPARK Live® has left its mark as one of the most successful and widely used anti-counterfeiting features, protecting banknotes in more than 100 countries across the world. Since then, SPARK® has established itself as a leading optical feature and proven overt security that can be effectively integrated on both lower and higher denominations of a full banknote series.

Today, the SPARK® family leads us into uncharted territory with its new third generation: SPARK Flow®, that takes optical development to another level with its three technological innovations: PRIME, DIMENSION and CONFLUENCE.

It is important to stress two main attributes of this evolution throughout the years – which are innovation and continuity. At first sight, it might seem contradictory to try to fit both of them in the same sentence, but in fact, they have inspired such results from the very beginning, and we see these attributes come to life through these three technological innovations.

#### SPARK FLOW® PRIME

This is the core innovation of SPARK Flow®, producing heightened brilliance, colour saturation, contrast and sharpness. The PRIME attribute is unparalleled visibility obtained through an innovative pigment-orientation process – a biaxial pre-alignment magnetic module.

The result is an eye-catching, dynamic optical feature with a sharper glow and more vibrant colours, applicable to all families of SPARK Flow® effects.



SPARK Flow® PRIME

#### SPARK FLOW® DIMENSION

The second innovation of SPARK Flow® creates dynamic optical features with an augmented 3D visual impact. It adds the dimension of volume to a broad variety of shapes, forms and patterns, paving the way to a new family of stunning effects.

This disruptive visual experience is achieved by a new biaxial simultaneous-alignment magnetic module together with the latest customisable magnetic assemblies. The new family of effects creates an intriguing perception of relief and depth on a flat surface, tempting the user to touch and verify.

DIMENSION capitalises on the benefits of PRIME to achieve unprecedented visual performance both in brightness and 3D visual effects.

#### SPARK FLOW® CONFLUENCE

The third innovation of SPARK Flow® opens up new possibilities for combined effects. Created in one single pass through two magnetisation modules and selective, sequential curing, the CONFLUENCE process generates dynamic optical features with combined effects in contrast, fusion or sequence.

The double magnetisation modules combine the optimised rendering of PRIME and the augmented volume of DIMENSION in one memorable SPARK Flow® experience. With CONFLUENCE, the three technological innovations converge into a creative stream of possibilities for unprecedented visibility, design excellence and cutting-edge security.

#### CELEBRATING THE FIRST SPARK FLOW® BANKNOTE

In December 2021, the National Bank of the Republic of Kazakhstan issued a commemorative 20,000 tenge banknote, the first note containing a SPARK Flow® feature, only a short time after its official launch.

Kazakhstan is one of the pioneering countries adopting SPARK Origin® in 2008 (on the 5,000 tenge commemorative note).

#### SPARK FLOW® AS A TREND-SETTING OPTICAL FEATURE

"The first thing that may come to mind when thinking of SPARK®, is "just" the bright, dynamic and immediately recognisable security feature that is present today on many banknotes around the world... However, hidden beneath the shiny surface

is a unique technology platform that has supported its remarkable evolution, while maintaining continuity and coherence in the approach with each new generation." Says SICPA's Technologies Laboratory Manager.

From the beginning, SPARK® has given designers and printers the ability to contribute significantly to the creation and integration process of security features, enabling them to play a leading role in the associated process of value creation. Such opportunity continues with SPARK Flow®, a trend-setting optical feature carrying numerous benefits such as:



SPARK Flow® DIMENSION

- Strong colour-shifts and bright dynamic effects allowing users to instantly experience a visually intuitive authentication that remains clearly visible even on frequently circulated banknotes
- Complex and sophisticated technology reinforcing the protection of banknotes against counterfeiting threats
- Versatile and easy to integrate

Stakeholders rely on a solution that has grown more and more performant with time, in terms of attractiveness, robustness and diversity; that maintains and increases the value of their investments, not only in terms of equipment and infrastructure, but also in their specific know-how and integration.

The printing modules for SPARK Flow® were co-developed by SICPA and Koenig & Bauer Banknote Solutions.

As SICPA continues to explore the many facets of this ingenious technology, new potential unfolds with exciting opportunities for central banks and security printers to continuously innovate banknote protection and authentication. The collaborative efforts of each stakeholder will enable this journey of pushing boundaries and further exploring the limitless creative potential of SPARK Flow®.

SICPA

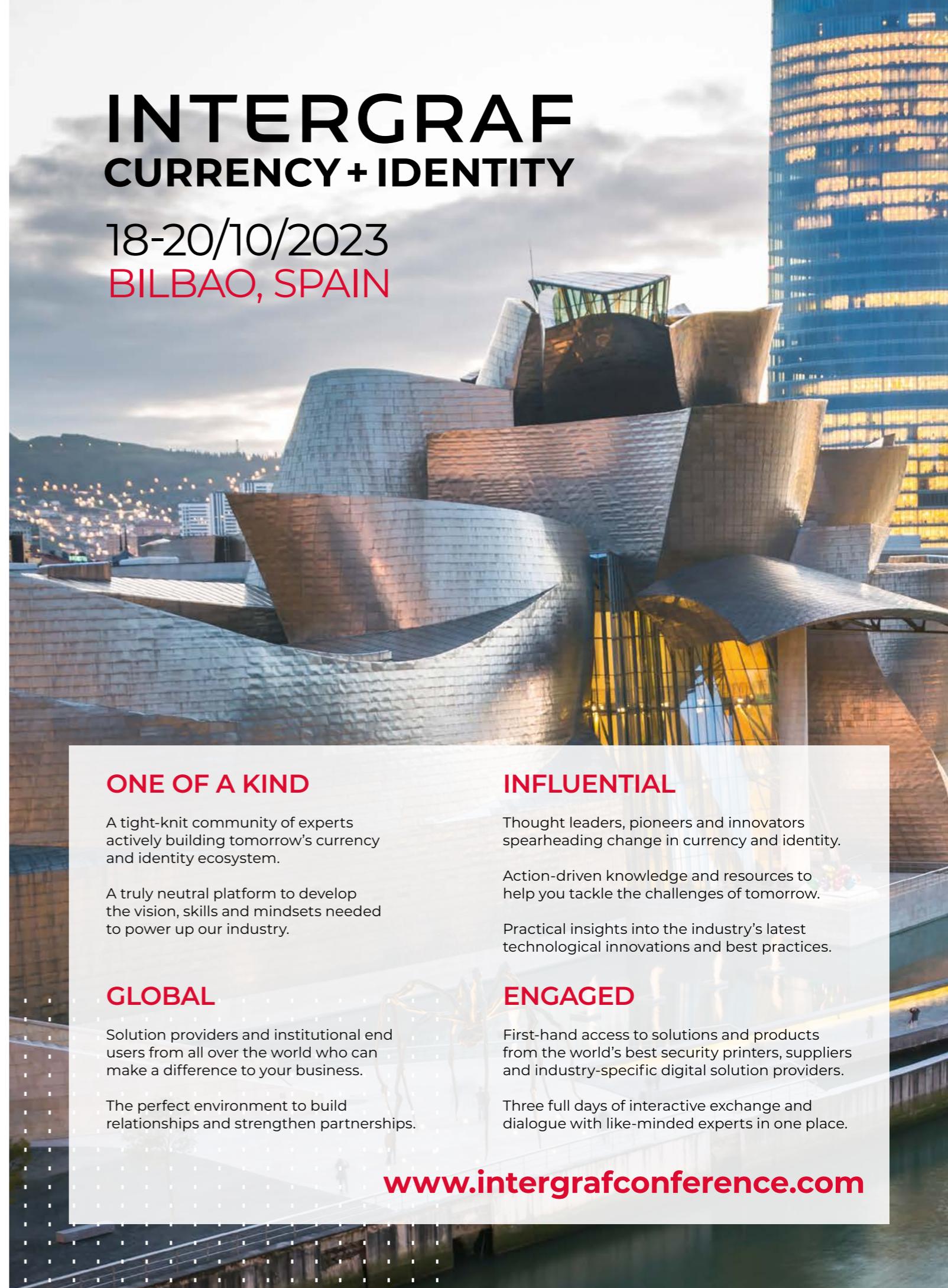
Email: [security.inks@sicpa.com](mailto:security.inks@sicpa.com)

Website: [www.sicpa.com](http://www.sicpa.com)



# INTERGRAF CURRENCY + IDENTITY

18-20/10/2023  
BILBAO, SPAIN



## ONE OF A KIND

A tight-knit community of experts actively building tomorrow's currency and identity ecosystem.

A truly neutral platform to develop the vision, skills and mindsets needed to power up our industry.

## GLOBAL

Solution providers and institutional end users from all over the world who can make a difference to your business.

The perfect environment to build relationships and strengthen partnerships.

## INFLUENTIAL

Thought leaders, pioneers and innovators spearheading change in currency and identity.

Action-driven knowledge and resources to help you tackle the challenges of tomorrow.

Practical insights into the industry's latest technological innovations and best practices.

## ENGAGED

First-hand access to solutions and products from the world's best security printers, suppliers and industry-specific digital solution providers.

Three full days of interactive exchange and dialogue with like-minded experts in one place.

[www.intergrafconference.com](http://www.intergrafconference.com)

## ADVERTORIAL: LUMINESCENCE SUN CHEMICAL SECURITY

Luminescence Sun Chemical Security is the global security business unit of Sun Chemical, combining the great innovative strength of a focused, agile group with the strong corporate culture and power of our multinational parent. Through our parent we have access to over 20'000 specialists in inks, pigments and coatings based all over the globe. With more than 17 highly specialised Research and Development centres from which we can draw resources and knowledge, we are continuously on the search for the latest technologies to help you stay ahead of counterfeiters or other threats to your secure documents.

### WHAT DEFINES US

Providing excellence is our core belief in everything we do and has resulted in the fact that you can find our innovative high security inks, pigments and components in security documents like banknotes, passports or tax stamps in over 130 countries.

We believe in the continuous training and development of our staff and pride ourselves in the high number of long-term colleagues. They give us the base knowledge and experience to bring up a new generation of experts and contribute to the longevity of our organisation.

### WHY YOU WANT US AS YOUR PARTNER

Apart from a healthy and long-term business relation we value the personal contact with you, our team of specialists is continuously travelling around the globe to support our customers whenever needed. You will find our reactivity and delivery times exceptional and unparalleled in your industry.

We understand that it can be daunting to change supplier or to introduce new security technologies or features but you can rest assured that we will be there all the way through the process, as your preferred partner and friend. Your success is of the utmost importance to us.

### "A GROWING GLOBAL FOOTPRINT"

Luminescence Sun Chemical Security has production facilities in three different countries; United Kingdom, France and Brasil. Our headquarter is in Harlow, UK, just an hour North of London here we have a dedicated production facility for our paste (offset, intaglio, letterpress) ink and opened a new production facility for our liquid (flexo, gravure, screen and anti-soil coating) in 2020. In Harlow is also where we have based our key R&D facilities. In France we have another production site in the town of Thourouette, about one hour away from Paris. Our third production location is in Sao Paolo in Brasil, from here we also offer technical support for the whole of Latin America.

All our production facilities are accredited with the well-known ISO standards and equipped with state-of-the-art equipment. Our well-trained staff all have long-time experience in the security printing industry.

As new customers come online we are looking to further expand our global footprint, always looking for the best way to serve our customers.

**LUMINESCENCE SUN CHEMICAL SECURITY**

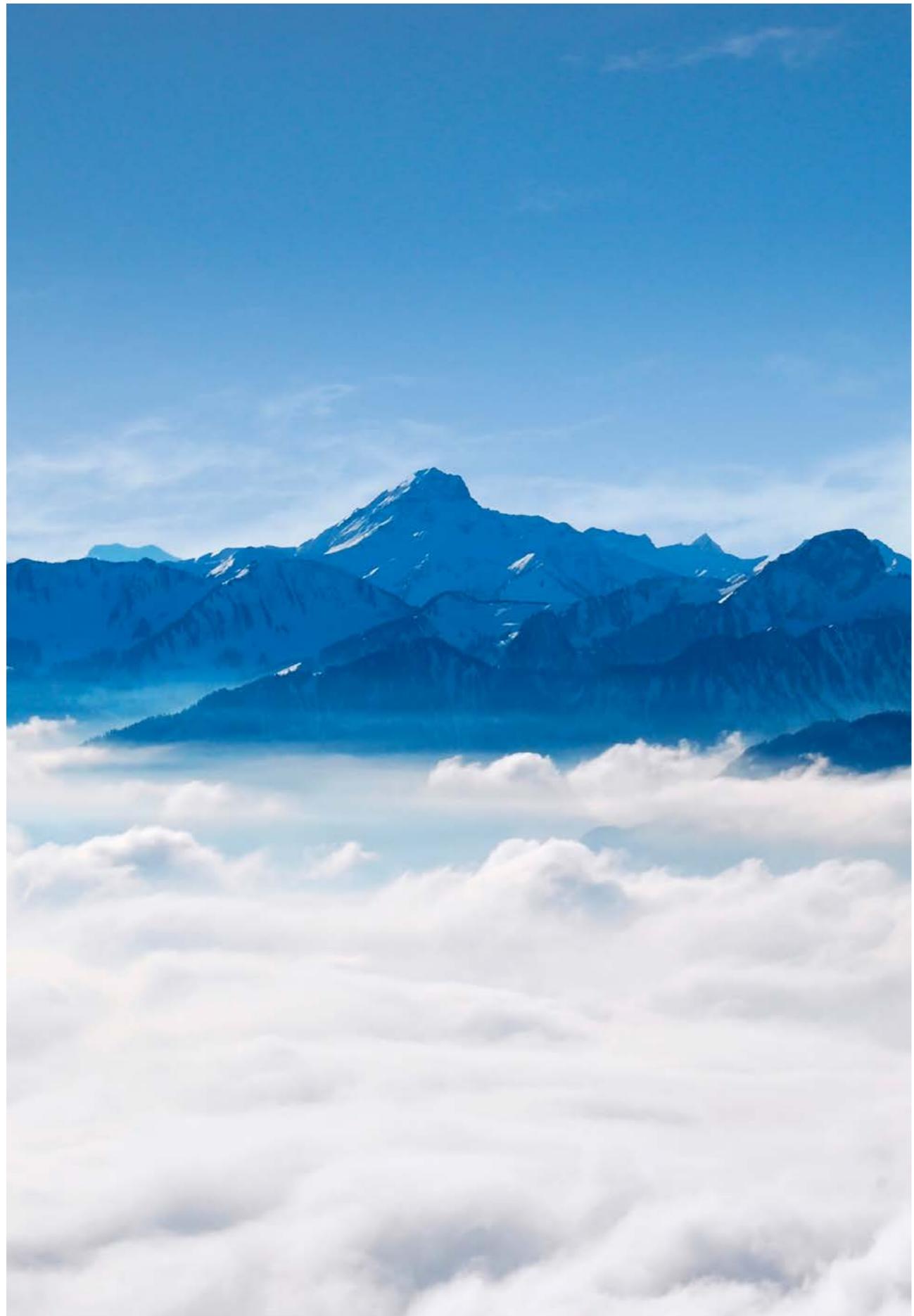
Mr. Gerben van Wijk  
Email: gerben.vanwijk@luminescence-scs.com  
Website: [www.luminescence-scs.com](http://www.luminescence-scs.com)

[www.luminescence-scs.com](http://www.luminescence-scs.com)

The advertisement features a woman's profile in profile on the right side of the page. On the left, the Luminescence logo is displayed above the company name "LUMINESCENCE Sun Chemical Security". Below the company name, the slogan "INNOVATIVE, TAILOR-MADE SOLUTIONS." is written in large white letters. To the right of the slogan, four orange ovals represent different product lines: "Helio<sup>NOTE</sup>", "Helio<sup>ID</sup>", "Helio<sup>MARK</sup>", and "Helio<sup>SEC</sup>".

**EQUIPMENT &  
SERVICES**

**CD  
E  
Z  
IPM  
CPRV  
CS**



HUNKELER SYSTEME

THREE TYPES OF  
DESTRUCTION –  
FIT FOR RECYCLING

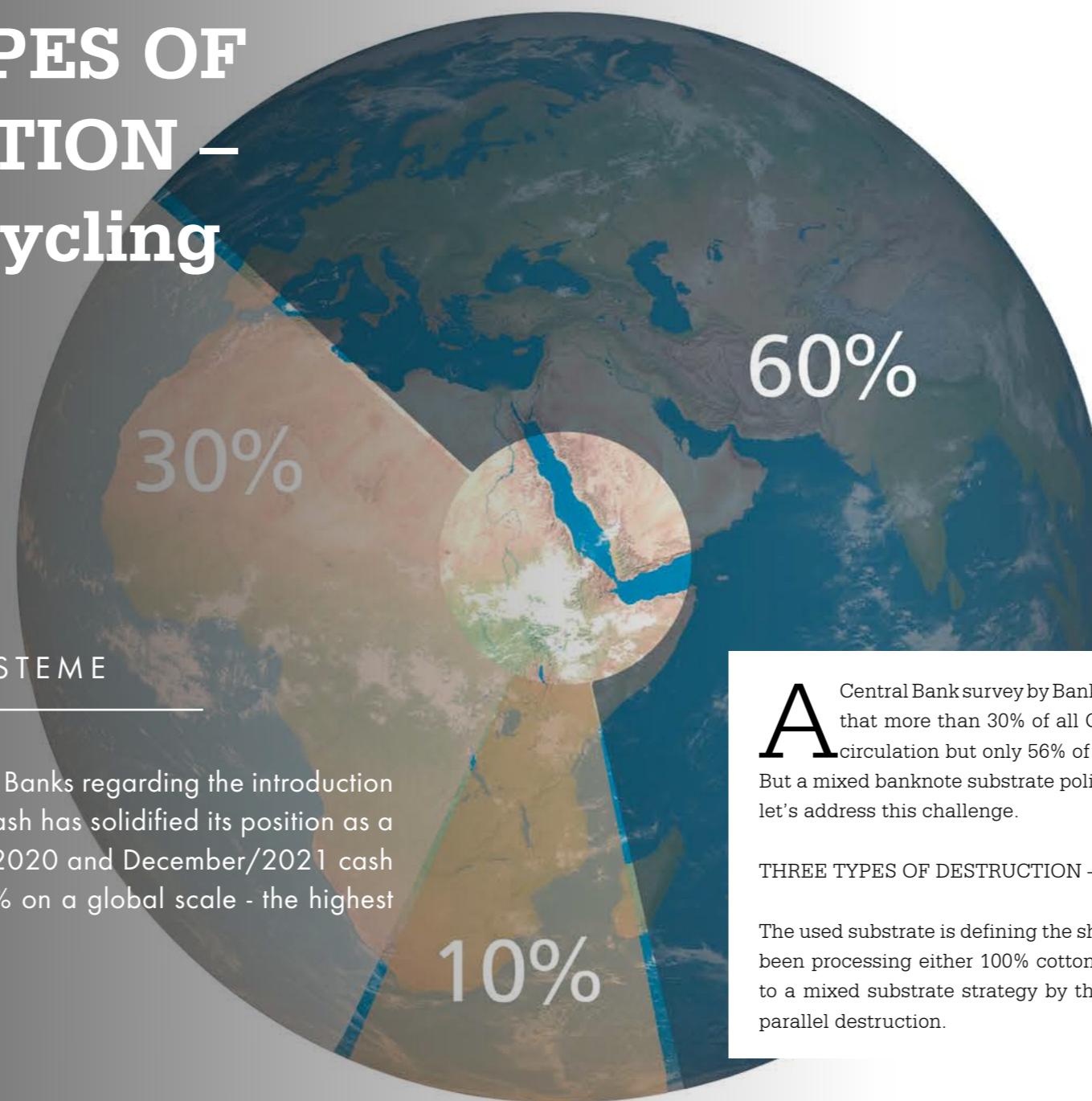
# THREE TYPES OF DESTRUCTION – Fit for Recycling

Mixed substrates

HUNKELER SYSTEME

Despite ongoing discussions amongst Central Banks regarding the introduction of a Central Bank steered Digital Currency, cash has solidified its position as a key means of payment. Between December/2020 and December/2021 cash in circulation has been growing by nearly 8% on a global scale - the highest increase for decades.

Full series on polymer/composite



Full series on cotton

**A** Central Bank survey by Banknote Industry News/Hunkeler Systems in Q4/2021 unveiled that more than 30% of all Central Banks having minimum two different substrates in circulation but only 56% of those separating the shredded cotton vs polymer material. But a mixed banknote substrate policy requires a special shredding and destruction process, so let's address this challenge.

## THREE TYPES OF DESTRUCTION – Fit for Recycling

The used substrate is defining the shredding process. Until now dedicated shredding lines have been processing either 100% cotton or 100% polymer banknotes. Due to the increased switch to a mixed substrate strategy by the Central Banks, we can differentiate (I) sequential or (II) parallel destruction.

While for (I) the shredding process is fully dedicated to handle only one single substrate at the time, for a parallel sorting and destruction (II), different substrates can be cleared simultaneously as those system is built up on different 'pipelines' which are automatically switched.

One aspect driving the shredding decision in direction (I) or (II) is based on the actually circulating banknote substrates to be shredded.

Let's have a look at the different substrate destruction option:

#### COTTON AND COMPOSITE SUBSTRATE:

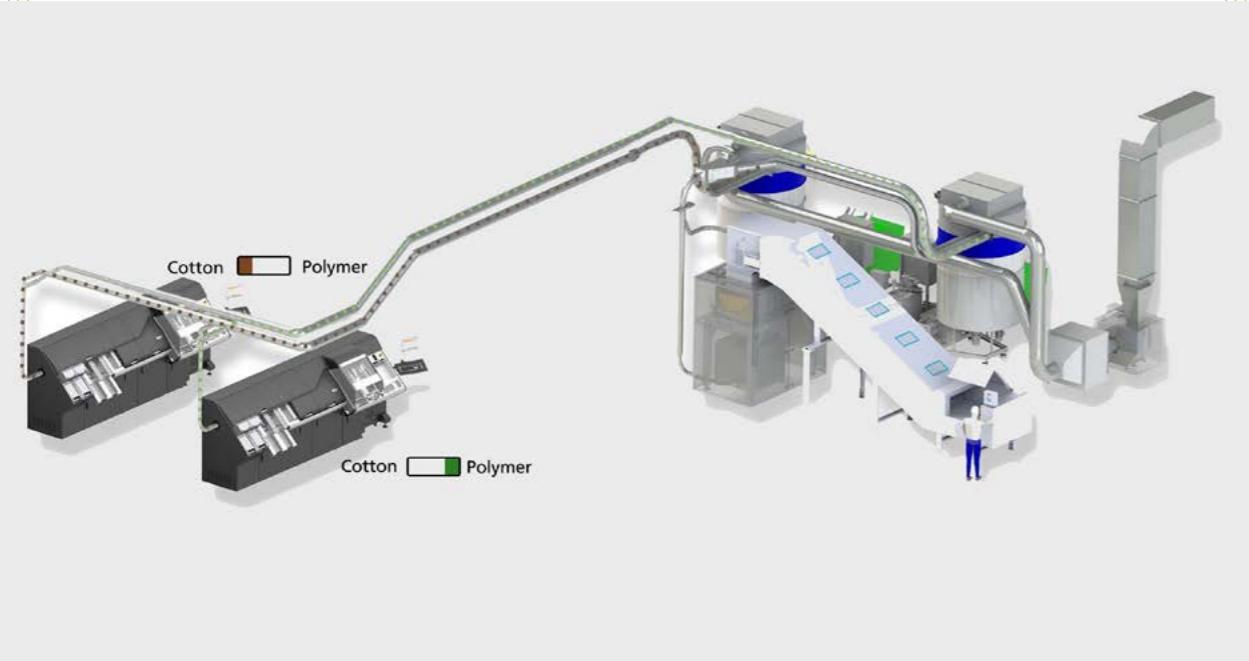
There is no need for a separation and a sequential shredding process is sufficient. Reason why: cotton and composite substrates (up to 30% polymer / plastic proportion) contain the same degree of briquetting feasibility. Additionally, a big bag or container solution can be adapted at the end of the destruction lines provided briquetting is not required.

#### COTTON / COMPOSITE SUBSTRATE AND / OR POLYMER SUBSTRATE

In case a Central Bank is running on a mixed substrate strategy compromising at least one denomination on a polymer substrate, it is highly recommended to adapt the destruction line to a parallel shredding process. On one line the polymer banknotes will be shredded while the other line is fully dedicated to the shredding of the cotton or composite banknotes.

This is evoked by the nature of the polymer substrate, as a high degree of purity is required for the lead into a possible recycling process afterwards. With this purity approach the shredded polymer notes are fit for recycling into other plastic products.

And for the cotton-based substrates (100% cotton or composite solutions) a standard briquetting can be put in place at the 2nd line of the parallel shredding process.



#### 100% POLYMER SUBSTRATE

In this case a sequential destruction line meets the shredding requirements. As briquetting is not possible for a polypropylene material the destruction line should be adapted at least to a big bag solution.

From learnings with shredded polymer banknotes, it is essential to integrate an extraction unit with a material silo and a discharge device to the end of the destruction process. With this, the development of fine dust can be decisively prevented.

Additionally, the static charge of polymer material needs to be considered as polymer tends to get stuck in various places in the system during the destruction process, thus escaping monitored destruction. Hunkeler

Systems is offering here unique protection solutions against material sticking due to the holistically thought-out design for the highest possible process reliability which comprise:

- Antistatic belt at the conveyor belt
- Scraper on conveyor belt
- Non-painted inner and clamping surfaces at shafts
- Potential equalization on all relevant components
- Antistatic filter bags
- Temperature sensor in the granulator



**CONTROL MANAGER**

Independently what substrate is being shredded, the entire disposal process is monitored by the 'Control Manager' - an own developed software by Hunkeler Systems with an open system architecture.

The Hunkeler control and workflow manager is continuously monitoring the entire disposal process during the production time. All the relevant information is being stored and displayed in a central control station. The interface allows a transparent view of the actual production as well as of the history data. The workflow software shows transparently to the supervisor in real time the status of the destruction line and the summary of the production data's within a day or a week. The visualization tool is an extension of the HCM PVS17 software and can be adapted to the customer host via XML, CSV interfaces.

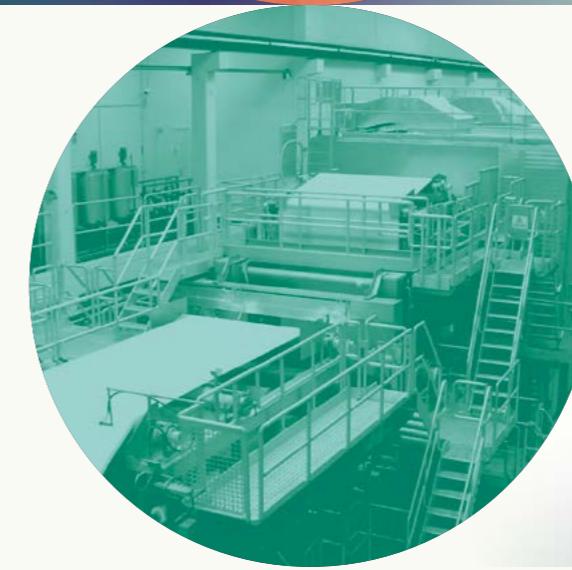
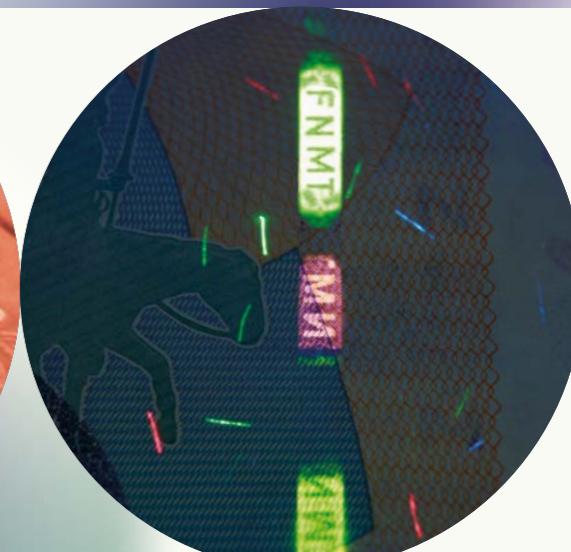
**CONCLUSION**

Whatever substrate drives a Central Bank's destruction process, Hunkeler Systems is offering the complete solution. Get in touch with us:

**HUNKELER SYSTEME AG**

Mr. Erich Hodel  
Email: [e.hodel@hunkelersysteme.com](mailto:e.hodel@hunkelersysteme.com)  
Website: [www.hunkelersysteme.com](http://www.hunkelersysteme.com)

# QUALITY RELIABILITY SECURITY\*



## PAPER MILL\* SECURITY PRINTING WORKS MANUFACTURING AND CONSULTING

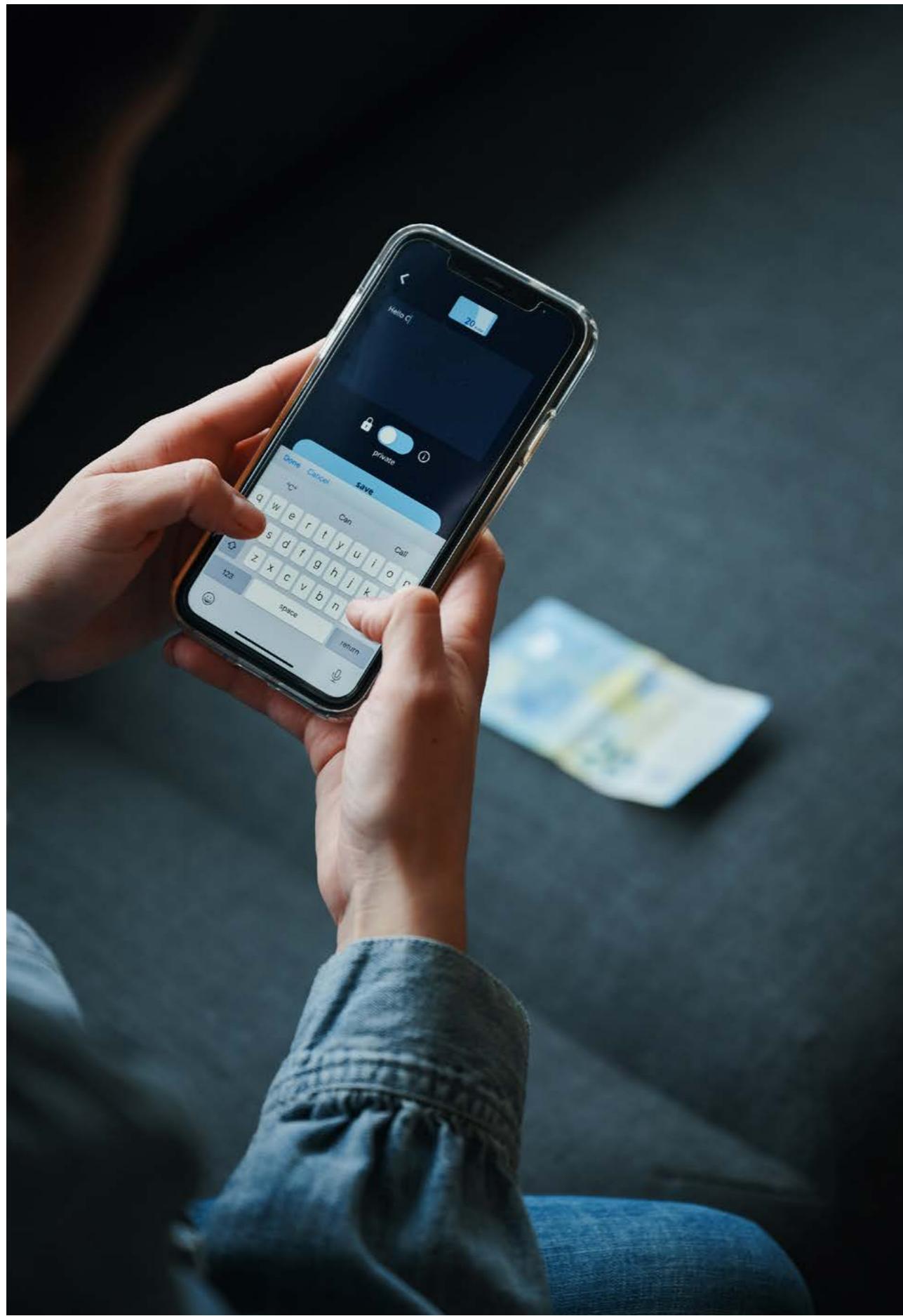
Visit our website  
[www.fnmt.com/paper](http://www.fnmt.com/paper)



Real Casa de la Moneda  
Fábrica Nacional  
de Moneda y Timbre

**FNMT**





▼  
**KOENIG & BAUER  
BANKNOTE SOLUTIONS**

**BRIDGING THE PHYSICAL  
AND DIGITAL WORLDS**

# Bridging the physical and digital worlds

KOENIG & BAUER  
BANKNOTE SOLUTIONS

Unlike many who believe that the rise of new technologies will inevitably sound the death knell of banknotes, Koenig & Bauer Banknote Solutions is betting on the complete opposite: using the digital world to bring innovations to the cash industry, making cash more frictionless to use and adding new functionalities to it.

Too often, the physical and digital worlds are opposed. If one wins, the other one loses. What if they could benefit from one another? In the case of cash, the digital world brings speed and ease of use while physical banknotes are highly secure and widely accessible, which makes them fully compatible. A great match that will bring end-users benefits from both technologies. Taking on this path, Koenig & Bauer has launched new applications bridging the physical and digital worlds to support the use of cash and make it more than a payment tool.

The future may be cashless – although we very much doubt it – or it may be cashtech. Using new technologies to add new functionalities to cash, to make it more fun or even more secure and trustworthy than it already is today. That is the direction of many new developments at Koenig & Bauer Banknote Solutions, where we are aiming to build a new bridge between the physical and digital worlds.

## EASY AUTHENTICATION OF BANKNOTES

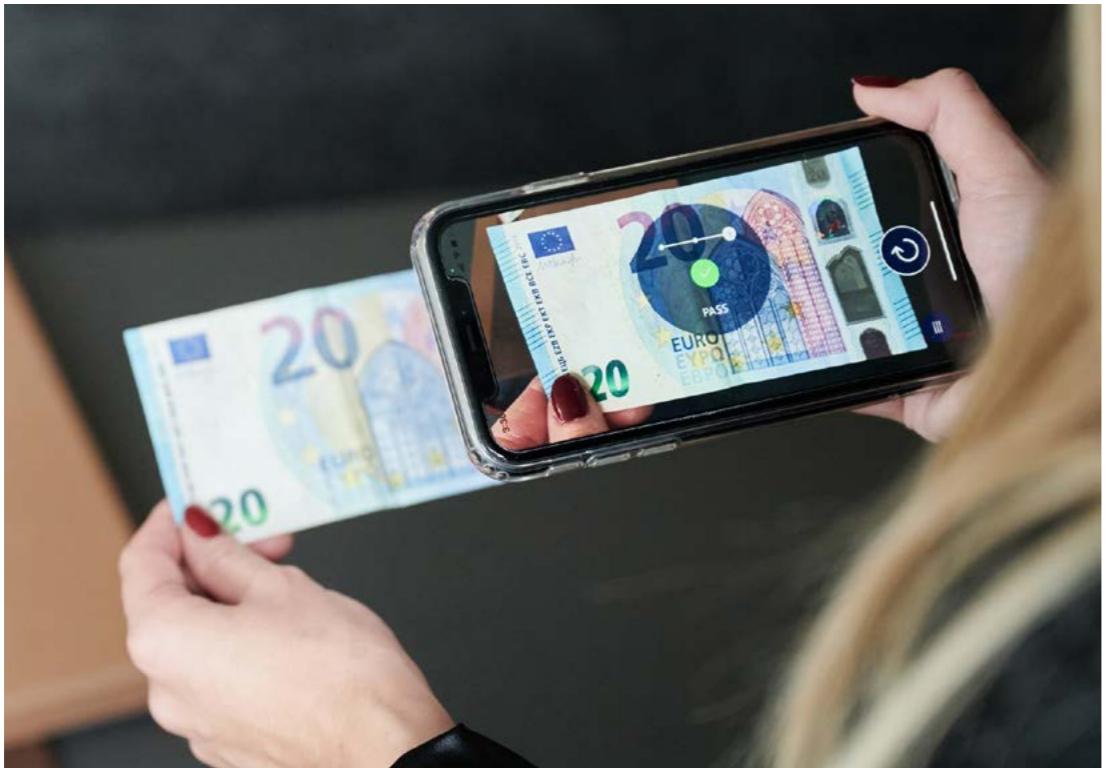
Until recently, thorough authentication of banknotes was too often reserved for experts in the field. Even authentication performed at the point of sale by a cashier or at payment stations is currently quite limited, which means it is possible to dupe the system. Those controls often rely on features that require users to know what they are looking for. Just using a UV lamp will not make for reliable authentication. Solving the issue calls for a

new method: a reliable method that is fast and easy to use as well as accessible to a wide range of people.

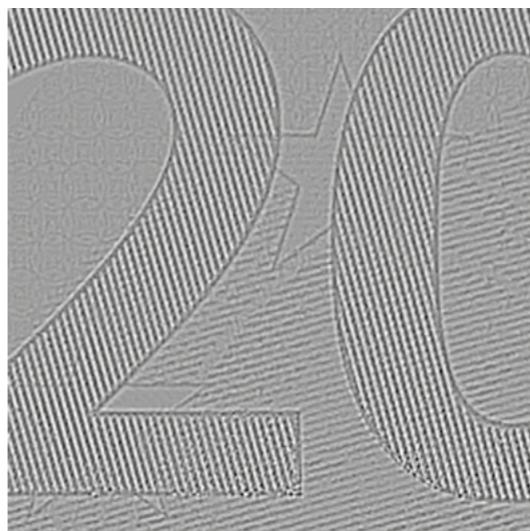
### ValiCash

With the ValiCash® application, Koenig & Bauer Banknote Solutions enables a large number of people to carry a banknote authentication tool in their pockets. And it works in a matter of seconds. At a grand scale, this type of innovation could contribute to simplifying the cash cycle and making it more cost-efficient.

The app works with an algorithm that runs a verification system mainly based on the structural analysis of Intaglio print - Sound of Intaglio® - and more generally on specific optical characteristics of high-security printing processes, like Intaglio, Screen-printed features, or holograms.



Developed by Koenig & Bauer Banknote Solutions, Sound of Intaglio® detects the presence of Intaglio thanks to its spatial frequency characteristics. The system, which uses state-of-the-art wavelet transform, only requires a 2D image.



Based on the sharpness, opacity, and high contrast of the image structure, it can be determined whether Intaglio print was used or not as no other commercially available print method results in such high-frequency details as those of Intaglio. This one-of-its-kind patented technology is unique in the world of authentication and now available to everybody through a simple app.

The authentication does not require any specific inks or hidden features in the design: banknotes already in circulation can be authenticated. The technology can also easily be adapted to other high-security print output like tax stamps, birth certificates, or other governmental documents containing, for example, Intaglio print as a Security Feature only.

Currently, ValiCash® is available on the AppStore and can authenticate all euro banknotes.

As the technology is independent of both the operating system of a device and the image acquisition device, it can easily be made available for other purposes.

## MORE THAN A PAYMENT TOOL

What if tomorrow's cash would allow us to do much more than just pay, like messaging our loved ones, becoming a key to the digital world where each and every banknote is able to have its creative timeline, like on social media? As phones have become our computer, camera and most recently a means of payment, Koenig & Bauer Banknote Solutions has been working on adding new functionalities to banknotes thanks to the support of new technologies.

With Smill™, you can now share digital messages through banknotes. The application works by identifying banknotes thanks to their numbering. The first step is to scan your banknote via the application, writing a message as you would do on any other platform, and possibly enhancing it with pictures, videos, or voice messages, as you wish.

The application offers a choice of public or private messages when creating your Smill:

- Public Smill: Your message travels with the banknote and connects you to many other people. Anyone holding the banknote in his/her hands can read your story or joke.
- Private Smill: Only the person who receives the banknote can read a private message. This keeps the personal content hidden from the public.

In all cases, no user profile is required to use the app, and content is created without asking for personal data.

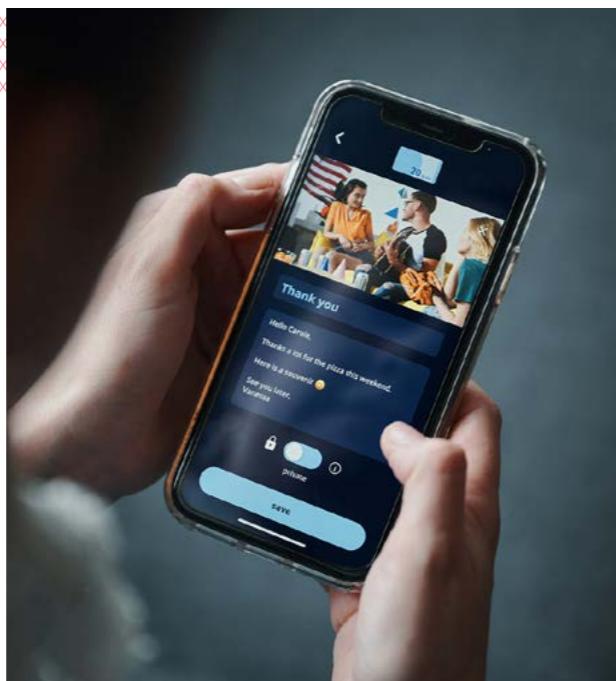
Once your message is created, just hand over the banknote, and the recipient will be able to read your content by scanning it via the application. Smill™ can replace the traditional greeting card shared with brides and bridegrooms or sent to grandchildren for their birthdays, or add a more interactive experience to it with a video. It opens up a completely new world based on the banknotes we use every day. In addition to making a monetary transfer, the banknotes' emotional aspect is further strengthened by enabling messaging.

"Default content" can be stored on the banknotes, and can then be displayed if no user has created a Smill yet. This "default content" can be used as a platform to educate on the use of cash and security features or to spread other messages. You could also use Smill™ as an innovative way to promote a new series of banknotes by launching a lottery or introducing a game in the app, for example. The possibilities are endless!

Smill™ currently works with all euro banknotes and is available on the AppStore.

#### THE FUTURE WILL BE DIVERSE

With this new mindset, there is no longer the need to choose between the physical and digital worlds but rather to make the most of both. Users can also choose from diverse options and pick the best solution for them, which may vary depending on their specific needs or the situation, just as with all current payment means.



New ideas and innovations in this direction will continue to be developed at Koenig & Bauer Banknote Solutions to benefit users, simplify the cash cycle and secure the long-term future of cash. And this is just the beginning of a long journey Koenig & Bauer Banknote Solutions has just recently started!

#### KOENIG & BAUER BANKNOTE SOLUTIONS

Ms. Carole Malet  
Email: marketing-bns@koenig-bauer.com  
Website:  
[banknote-solutions.koenig-bauer.com](http://banknote-solutions.koenig-bauer.com)

Download the two applications on the AppStore!

ValiCash®

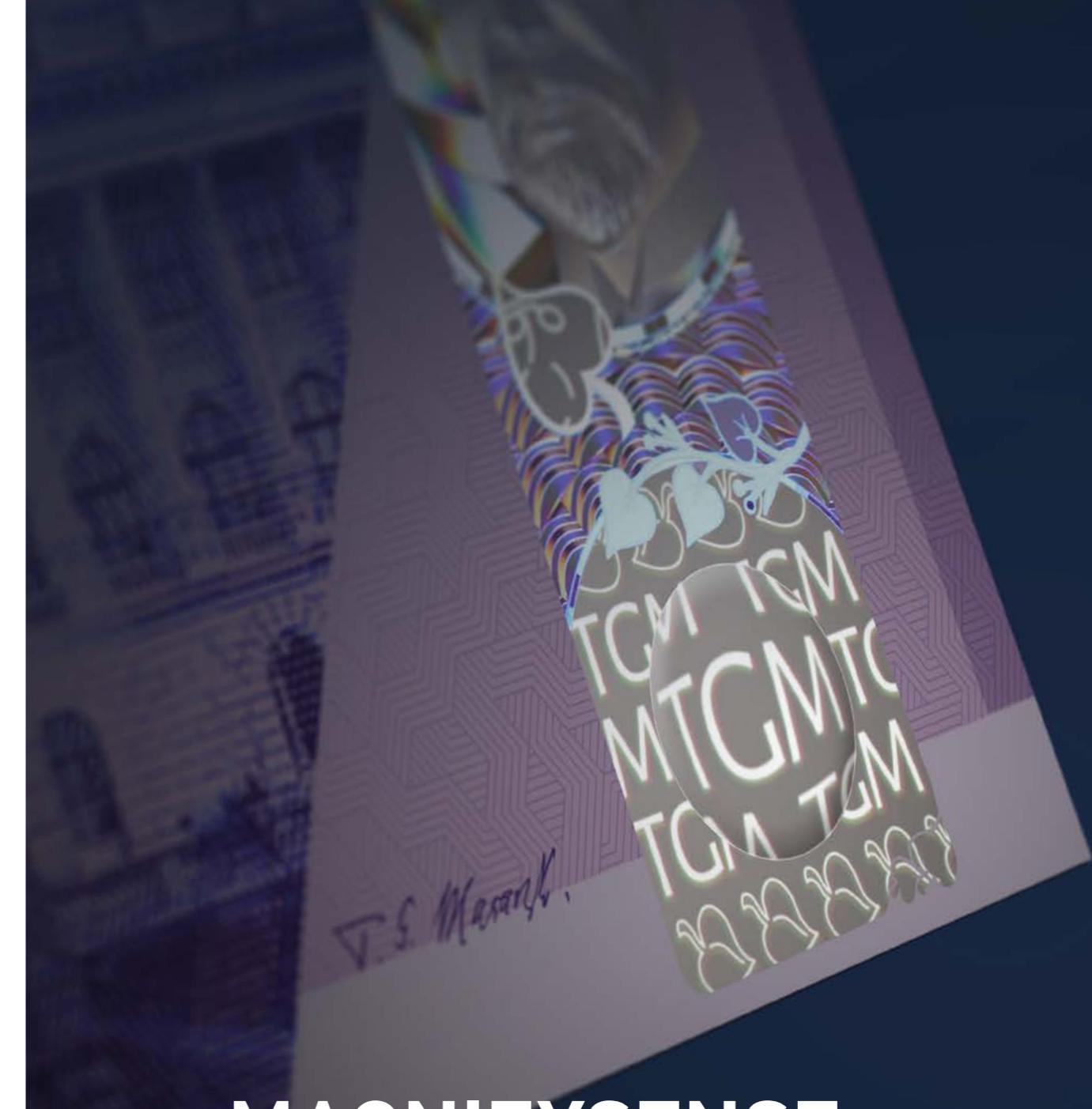


CLICK OR SCAN

Smill™



CLICK OR SCAN



## MAGNIFYSENSE

### Magnify The Joy Of Cash

With our latest optical security feature you'll enjoy cash transactions.

See the article on page 72 for more information.



[www.iqstructures.com](http://www.iqstructures.com)

## ADVERTORIAL:

## CASH INFRASTRUCTURE PROJECTS AND SERVICES GMBH

TECHNICAL AND LEGAL PERSPECTIVES  
ON CASH RECIRCULATION

"Public sector efficiency" confronts Central Banks with the responsibility to optimize their country-specific cash supply chain. One of the first points is the implementation of a banknote recirculation guideline that, on the one hand, supports a clean banknote policy and, on the other hand, regulates the service performance of commercial cash handlers in the direction of cost-efficient cash cycle models.

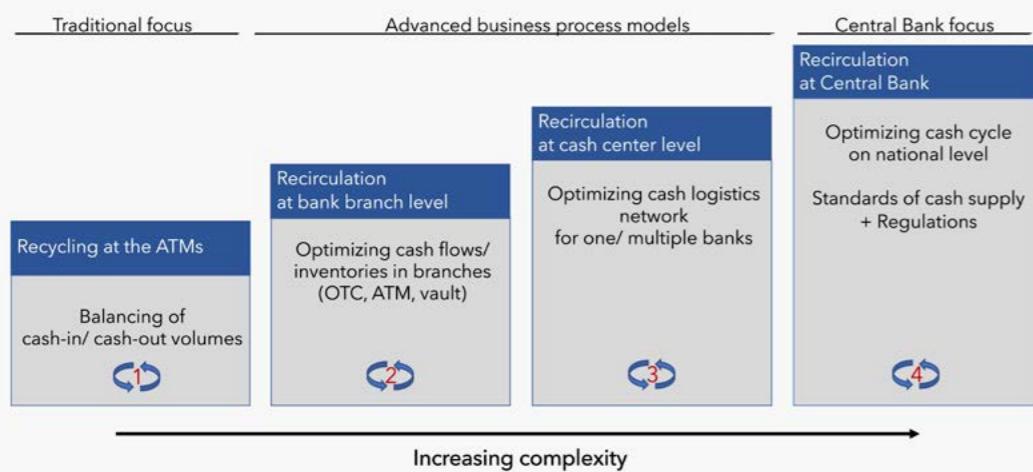
With the advent of ATMs with deposit and recycling function, Central Banks were forced to implement counterfeit detection rules and minimum standards for sorting banknotes by fitness. This enables new models in which commercial banks are allowed to return banknotes to their customers that have been processed internally using qualified technology in accordance with legally regulated procedures. This opens up opportunities for implementing advanced cash cycle models for Central Banks and for commercial cash handlers.

**Logistics processes to shorten the cash cycle**

It can be stated that there is already sufficient technology for cash processing, ATMs, and cash logistics to meet the required standards for cash recirculation. However, integration into an end-to-end process is usually not yet implemented in a way that achieves optimal efficiency. We need to start using technologies that are already available to avoid duplicate cash counting and thus unnecessary transports in the cash supply chain.

The future cash infrastructure is highly aligned with cash flows at each recirculation stage of the cash cycle:

1. Recycling at ATMs – reconciliation of cash-in/ cash-out flows at each site
2. Recirculation at bank branches – optimizing cash flows from over-the-counter and ATMs are linked to cash holdings in branch vaults

**Cash Recirculation**

3. Recirculation at cash centers – optimizing cash logistics within a branch and ATM network for one or multiple banks

4. Recirculation at Central Banks – optimizing cash cycles by delegating services to qualified cash handlers in the form of Notes-Held-To-Order (NHTO) schemes.

The challenges of the cash industry in moving towards greater cash cycle efficiency are not unique, other industries and government authorities have similar logistics processes, uses similar automation as in cash factories, and therefore face similar regulatory and organizational obstacles. It's a question of competence and implementation skills, and we can support your company in this regard.

**Legal drivers for improved cash recirculation**

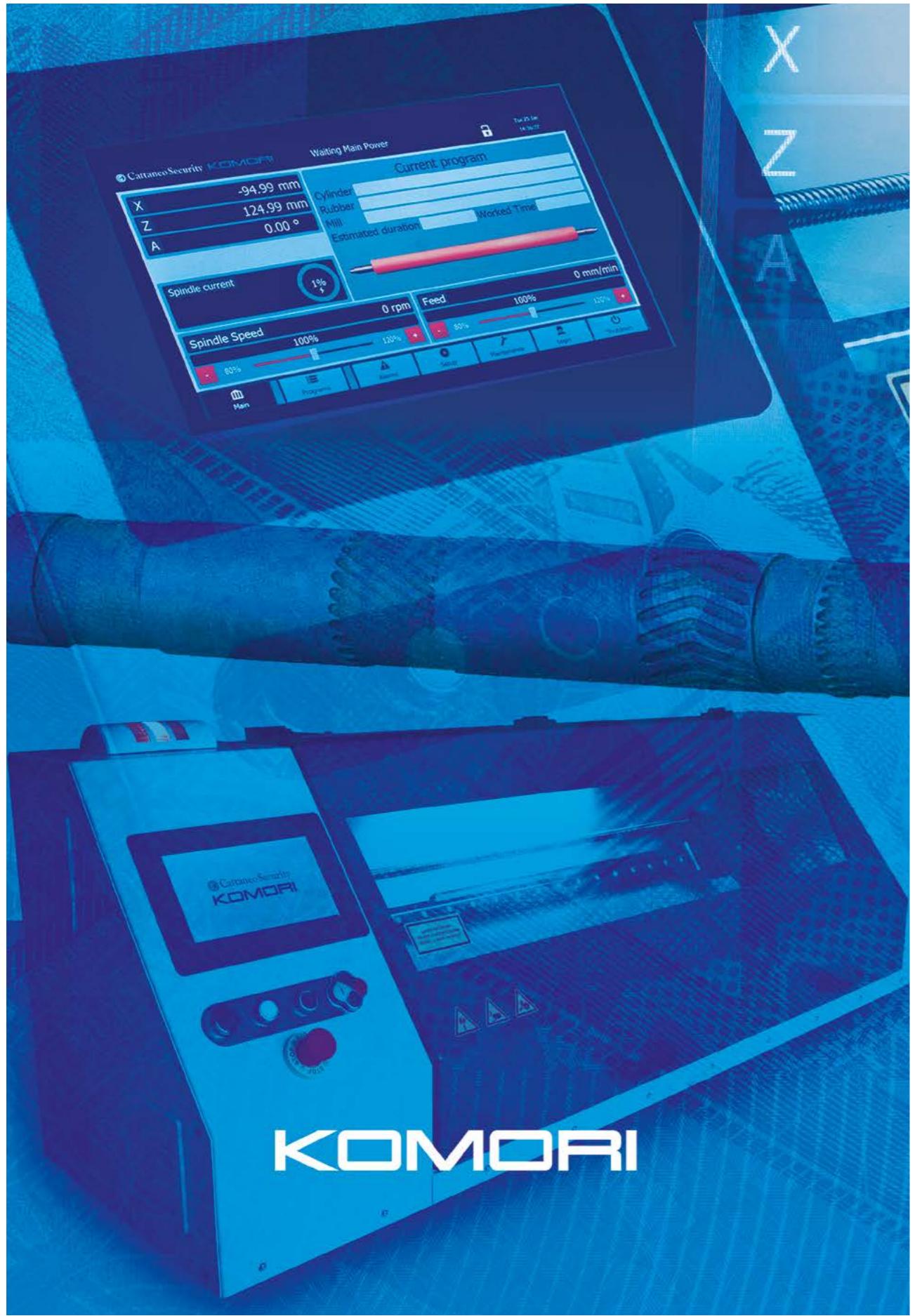
Only advanced Central Banks consider consistent and efficient regulations for all stages of cash recirculation. And in these cases, regulations are usually not adapted to higher standards that support the automation and digitalization of the entire cash supply chain.

CASH INFRASTRUCTURE PROJECTS AND SERVICES GMBH

Mr. Jens Eberhardt

Email: [jens.eberhardt@cashinfrapro.com](mailto:jens.eberhardt@cashinfrapro.com)

Website: [www.cashinfrapro.com](http://www.cashinfrapro.com)



KOMORI

KOMORI

BREAKTHROUGH  
CONCEPTS  
DRIVEN BY  
KAIZEN  
IMPROVEMENTS

# Breakthrough Concepts Driven by Kaizen Improvements

KOMORI

Komori Corporation was founded in Japan in 1923, as a printing press manufacturer for commercial and security presses. Its UK branch, Komori Currency Technology (KCT) was opened in 1986. KCT focuses on press sales to banknote printers, and supplying ancillary equipment needed for banknote production.

The philosophy of **Kaizen**, the Japanese word for “improvement”, is at the heart of Komori. It refers to business activities that continuously improve all functions and involves all employees from the CEO to the assembly line workers.

By improving standardized programs and processes, Kaizen aims to eliminate waste in all areas. It was first practiced in Japanese Businesses most notably as part of The Toyota Way and is now adopted as a quality improvement principal throughout the world.

## A WALK THROUGH THE LITHOCUT CONCEPT

Komori applies Kaizen to enable its customers to improve all aspects of productivity - including the many ancillary operations which are essential to currency production. It is within this culture of improvement that Komori has developed the LithoCut.

One of Komori's machine demonstrators had experience of SMED (Single Minute Exchange of Dies) - a lean technique used to facilitate rapid changeover. Changing over a banknote press to a new job can take at least 24 hours.

Our demonstrator approached management with an idea to automate the Litho and Numbering roller cutting process. The idea generated great excitement in Komori. We then approached Cattaneo in Italy, who specialise in the design and implementation of solutions for the security print industry, in a joint development to manufacture the cutter to our specifications.

## THE OPPORTUNITY FOR IMPROVEMENT

Rollers are cut using either a knife or an electrical handheld cutting tool. The issues with this operation have historically been:

1. Cutting can take up to 90 minutes per roller (each press can use up to 16 rollers, hence 24 hours of work). Some customers do this whilst running a job, although this is not always possible, so others cut the rollers as part of the make ready process.
  2. As this is a manual task, repeatability can be poor depending on the individuals' experience and skill set.
  3. Although PPE (personal protective equipment) is provided, there are significant safety risks using these cutting tools and instances of injury in this operation are not uncommon in the industry.
- Our demonstrator's idea was that this process could be made much safer, faster and repeatable by designing an automated cutting system.



This can lead to variability and quality issues. It is common that once the rollers are cut and put onto the machine, they need to be removed again and the cutting modified. Typically, this operation will waste 2-4 hours per make ready.



A safety cover with viewing capability would be fitted with interlocks to ensure the machine could not be started until the cover is closed.

## DEVELOPING THE SPECIFICATION

The project scope was to produce a machine capable of automatically cutting and engraving rollers of varying sizes and dimensions, up to a maximum diameter of 140mm and a maximum length of 1040mm. The equipment needed to be fully programmable, operate with minimum human interface and be capable of cutting complex shapes with an accuracy of repeatability of +/- 0.1mm.

The machine would be a 3-axis CNC with an integral touch screen allowing the operator to select the cutting profile for each roller. The different profiles would also be stored enabling operators to easily retrieve the programs for cutting different types and sizes of rollers.

A number of features were developed to ensure safety and ease of use:

A graphic of the cutting profile would be displayed on screen for the operator to check before cutting commenced.

The tailstock would be fully moveable to provide the flexibility to cut different size rollers.

A laser would be fitted in a fixed position to detect the diameter of the fitted roller.

The cutting tool would be fitted manually, and a touch sensor would check the cutting tool length to ensure the accuracy of the cut.

The machine would be CE marked and meet the following standards:

- Directive 2006/42/EC
- ISO 60204
- ISO 13849-1
- EN-ISO 12100/2010

## DEVELOPING AND TESTING

The project began with a Komori project team from Japan and the UK visiting Cattaneo headquarters in Bergamo, Italy to discuss the scope, costs and agree the project requirements and deliverables.

The initial evaluation/study was over a 2-month period and included the investigation of different speed motors, different cutting tools and angles of cutting. The operating system was programmed, this would be operated via computer on the basic desktop prototype and via touch-screen on the finished model.

Once the basic prototype was completed it was tested by cutting a Komori roller, to the following specification:

- Divide into three sections containing cutting depths of 3mm, 2.5mm and 2mm
- Areas where 50% and 75% of the rubber is removed and at angles of 15°, 10° and 0°. Each section will also have areas where 100% of the rubber is retained and areas where 100% of the rubber is removed.

Validation of the design was completed by testing the cut rollers on a litho press at our facility in Tsukuba, Japan. This proved the design was successful and enabled the next stage of the project to commence. Unforeseen barriers were COVID-19 which put Italy on lockdown in March 2020. The project team continued with remote working to complete software and design work; the prototype build continued through the lockdown period. Project meetings between sites were undertaken using video conferencing facilities and although there was a small delay this was mitigated by the continued



communication and flexible working procedures put in place by all parties. Once the lockdown was removed, the Komori team were able to travel to Italy and undertake a SAT on the machine. This was very successful. In fact, beyond our expectations.



## THE FINAL MACHINE

The LithoCut is now ready for market. We believe that this device will significantly help our customers improve their productivity and ensure operator safety during the cutting process. The key benefits of the LithoCut are:

1. Reduces roller cutting time from 90 to 60 mins.
2. Reduces the overall make ready time required to change the press over to a new job by up to 8 hours.
3. Eliminates interaction with the operator and any sharp cutting device which could cause injury.
4. Achieves a cutting accuracy of +/- 0.1mm, thereby improving consistency and quality of each roller.

Komori were delighted to receive a commendation in the prestigious Make UK awards for our innovation with this machine. And innovation never rests - we are already looking to see how we can further improve the machine, by enabling the machine to cut rubber rollers from offset pre-press data.

So, the new Komori LithoCut joins the Komori Rollercoaster, Rollermix and Roller Lathe, creating an impressive line-up of pre-press ancillary equipment, essential for machine preparation prior to production.

## KOMORI CURRENCY TECHNOLOGY

Phil Holland  
Sales Director  
Email: phil.holland@komoricurrency.co.uk  
Website: www.komori-currency.com

# Foundation of Trust

A highly secure substrate is the essential foundation of any valuable document. Such a foundation contributes to building and maintaining the public's trust in banknotes, passports, and other secure documents. This in turn contributes to fraud prevention, and reduces the financial and social costs associated with these crimes.

We take this important message to heart in Landqart. Nestled in the safe and tranquil Swiss Alps, since 1872 we have focused on producing substrates for security documents of the highest possible quality and with unrivalled fraud protection. We continue this tradition today, supplying the substrate used by the world's most recognized and secure banknotes and passports.

Made in Switzerland  
Secure worldwide



visit us at  
[landqart.com](http://landqart.com)

## LandQart



Oberthur  
Fiduciaire

[www.oberthur-fiduciaire.com](http://www.oberthur-fiduciaire.com) - contact: [banknotes@fcf.com](mailto:banknotes@fcf.com)

# A plus that adds sustainable value. With unmatched security from within.

## **RollingStar® i+**

RollingStar® i+ offers completely new design possibilities, more dynamics, more brilliance, a clearer color shift, and new, attractive effects. And, not to forget, even more security. In other words: a plus in impact. In addition to many new benefits, RollingStar® i+ also offers something you have known for a long time: the quality and performance you have come to expect from G+D and Louisenthal.

Learn more about the features of RollingStar® i+ at [gi-de.com](http://gi-de.com)