

15 S D E

TECHNOLOGY REPORT









SEPTEMBER 2020
CELEBRATING

50 YEARS
OF EXCELLENCE

- long-term experience in the high-security industry
- independent family-owned manufacturer
- portfolio: security threads, holographic foils and laminates
- products in circulation: paper banknotes and high security documents all over the world

HUECK FOLIEN - Creating Unmistakable Identity.

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MOTION SURFACE°

REIMAGINING BANKNOTE SECURITY

MOTION SURFACE is the latest security feature from Crane Currency. It is applied in the printing works and provides endless opportunities to engage the public by bringing to life the security and value of a banknote.

MOTION SURFACE is built on the technology behind MOTION®. Crane Currency's micro-optics technology is widely recognized as the state-of-the-art counterfeit deterrent technology for banknotes.

Winner of Best Currency Innovation 2018 - IACA





CCL SECURE

PAST, PRESENT AND FUTURE: CCL SECURE'S ONGOING INNOVATION FOR BETTER BANKNOTES



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— 09/17

Real innovative breakthroughs deliver a transformational difference, which often consumers don't even know they want until it is presented to them. It occurs across all industries and impacts almost every aspect of daily life, from connecting to the Wi-Fi at your local café, or paying for your flat white with a plastic fiver.

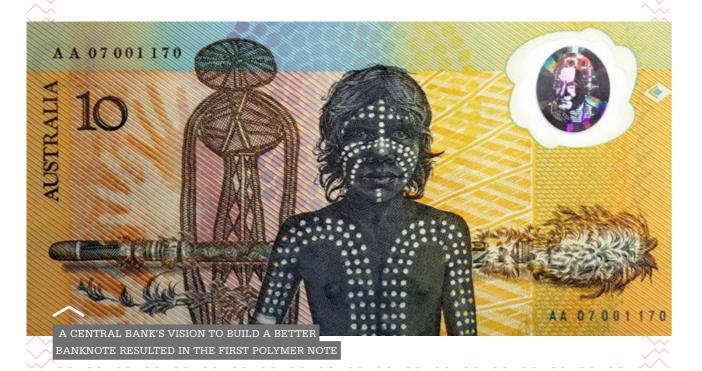
A pivotal moment of innovative, transformational change in the banknote industry came in 1988 when the Reserve Bank of Australia launched its polymer commemorative \$10 note. This was significant because it represented the first-ever banknote to be produced from a polymer base, offering opportunities for increased longevity and greater difficulty for counterfeiting.

The commemorative \$10 note was the result of more than 20 years' worth of research and development (R&D), resulting from the simple vision of a central bank seeking to create a 'better banknote'.

Not only was the polymer banknote unique at the time but it, along with the Austrian 10 schilling, was one of the first to have an applied optically variable device, or in other words a feature embedded into the money that changes form when viewed at different angles for added security.

To the outside world, creating polymer banknotes might have appeared to be a 'Eureka' or 'lightbulb' moment, but for David Solomon of CSIRO and the team of scientists involved, this was the culmination of many years of work and dedication. We now commonly refer to this innovation as Guardian polymer banknote substrate.

Since the first polymer note was issued more than 30 years ago, this important technology has continued to evolve. Many novel inks, features and effects have been created by both CCL Secure and other suppliers to improve the security and usability of banknotes for the public.



And just as the development of polymer substrate was no overnight success, innovations in feature technology have also taken long-term commitment, with incremental improvements happening over time. One such improvement has been the development of Soft Emboss Technology (SET) developed on polymer banknote substrate by CCL Secure.

SET creates a relief structure on the polymer surface, as part of the inline production process of the substrate.

In creating the original SET back in the 2000s, the team at CCL Secure was faced with multiple challenges relating to materials science and machine engineering. First, the group had to develop a resin that would adhere to the polymer banknote core film (known as Clarity™C), then cure quickly once embossed. In addition, the materials needed to be flexible once cured and highly resilient to the usual hazards, wear and tear that a banknote experiences once in circulation. Meanwhile, for machine engineering to be most effective the SET needed to work at high speed and with high accuracy across a wide web with 100% web inspection. That is every single image had to be inspected to ensure it was present and also that the embossing pattern had been reproduced correctly.

CCL Secure's Director of R&D, Marketing and Design, Dr Tim Berridge, said being able to integrate the technology with the polymer substrate production process was another important part of the innovation process.

"It was essential that SET could be applied at the same production speeds and in the same production environment used to produce Guardian," he said. "SET was such an exciting development because it has provided so many opportunities to create intriguing and complex features. It has enabled the use of very complex diffractive effects and lenses that can be integrated with almost complete design freedom, which just wasn't possible before."

So, how does it work? The SET process is used to create a diffractive microstructure in the resin which can then be given a special coating that enhances its reflective properties. This reflection-enhancing coat can be silver or transparent.

Additionally a final protective layer is applied to protect the device from contact copying.

The first actual product to be launched using SET was Latitude™ in 2010. This was an optically variable diffractive device which can create highly visible effects such as a changing colours, as well as moving or changing images. These can be easily spotted and recognised by members of the public

Unlike the previously available foil patches and stripes used for this purpose, Latitude can be integrated into Guardian using the inline SET process in a single pass through the gravure printing process.







Because it is printed rather than applied, there is also no restriction on the shape or location of the diffractive device, meaning designers are enabled to ensure the best integration into the overall banknote design

... a major plus! It also has the advantage of being printable in a single area or multiple areas at no additional cost.

Examples of Latitude in action can be found on notes issued in Poland, Nicaragua, Singapore and Brunei, these impressive examples offering just a glimpse of the technology's future potential.

While Latitude was developed to provide the public with an easily recognisable feature on their banknotes, SET also offers the means to create features for professional inspection by cashiers in banks and retail outlets, for even tighter security against counterfeits.

One of these features is a diffractive optical effect known as $Eclipse^{TM}$. By utilising microstructures to change the phase or amplitude of light, Eclipse creates a pattern when viewed under a point light source, for example the torch of

a mobile phone. SET is used to print the necessary microstructures with incredibly high accuracy. This technology has been successfully featured on the Mexican 50-peso note, which has never been compromised by a counterfeiter ... a great testament to the robust and effective nature of this particular innovation!

Similarly to Latitude, SET affords many advantages relating to the integration of Eclipse into the creation of banknotes, by enabling easy integration of the feature, creating freedom of design, and providing an element that is easy to view and understand. Using the same resin technology, both features are highly durable, suitable for high-circulation environments.

And the impressive capabilities of SET don't end there. It can also be used to create non-diffractive structures, such as lenses, the first generation of which was used to produce the Singapore \$10 commemorative note issued in 2015. This note utilised SET to print a series of lenticular lenses, each one acting as a focusing element to enlarge and display a printed image on the opposite side of the Guardian substrate to the lens.



The SET printed lenses work in conjunction with the Clarity $^{\text{TM}}$ C polymer core film offering high levels of optical clarity and careful control of thickness, as well as a gravure printed image to create a feature that is fully integrated with the substrate. Indeed, the feature needs all three elements of lens, film and gravure print to offer the necessary control in order for it to properly work.

With the first generation of diffractive devices and lens-based products having already shown themselves to be invaluable in the marketplace, the SET platform has proven its worth in mass banknote production.

From an R&D perspective, its development provides a foundation on which to build and develop even more new features in the future. In fact, CCL Secure is developing the next exciting step for SET which is currently entering the final stages of commercialisation.

This new innovation is known as Double Soft Emboss Technology (DSET), and represents the next generation of Clarity $^{\text{TM}}$ C film, developed in combination with unique and bespoke production capability.



DSET will allow CCL Secure to print two SET features on either side of the polymer in perfect register. Each feature can be printed at micron scale with precise dimensions, structure and position. This ability to create microscopic images on both sides of a substrate in perfect register opens up a wide range of opportunities to create not just the next generation of optical features but multiple generations. As with the original SET innovation, DSET is integrated into the inline production process for Guardian substrate. DSET will allow complex optical features to be created as part of the Guardian production process allowing seamless integration of optical effects and substrate design.

In developing DSET, the team of CCL Secure scientists and engineers have overcome a great many challenges. DSET has to run at full production speeds across a wide web, meaning the features it produces need to be resistant to the full range of chemical and physical stresses a banknote endures. In addition, the developers knew it must offer a costeffective process for banknote production.

CCL Secure is excited to be introducing the first DSET features to the market in 2020, offering a mere peek into the potential of this impressive new technology. The launch of the first DSET features will be the culmination of nearly 20 years' worth of R&D by numerous scientists.

Dr Berridge explained this latest development continues the company's history of and commitment to groundbreaking innovations.

"The introduction of the latest evolution in this technology is testament to the hard work of all those involved in CCL Secure R&D. While this is an exciting product, it is just the latest step in the ongoing innovation that is driving the success of future banknotes, something we have remained committed to ever since the very first polymer note was developed all those decades ago," he concluded.

CCL SECURE

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BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20



LANDOART

THE 15,000 RIEL
COMMEMORATIVE
BANKNOTE ON DURASAFE®
COMPOSITE SUBSTRATE
TECHNOLOGY

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20



BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 LANDQART ISSUE) 06.20

The note is printed on Landqart's Durasafe® substrate, the first time it is used in Cambodia and the first time it is used for a circulating note in Southeast Asia. Taking full advantage of the capabilities of the substrate, the note's design emphasises public recognition features by incorporating a see-through window and two halfwindows. The ornamentally shaped full window, with distinctly varying contours on each side of the note, contains an intaglioembossed inkless feature (a floral pattern made from carefully considered linework). The two ornamental half-windows at the back are used to expose the 4mm-wide demetalised security thread with Cleartext, by Hueck Folien, and are delicately overprinted with an intaglio illustration and a minitext intaglio tint. As with all Durasafe notes, the thread is encapsulated by the polymer layer to ensure that it can withstand the rigours of circulation while remaining clearly visible and anchored in the substrate.

Another feature making its world debut in the note is the TRILUMIC™ applied holographic stripe from Hueck Folien that adds to the distinct public recognition features of the note and assists tellers and cash professionals. Remaining hidden in daylight, a brilliant, true-colour image that is perfectly registered on the holographic stripe becomes visible under the UV light. The UV fluorescence within the holographic stripe is complemented with the use of 4 different UV-fluorescent inks to enhance various parts and features of the banknote.

In terms of the overall design, the note represents the first ever attempt to adapt the innovative Durasafe substrate to a fundamentally classical banknote design. By adapting the substrate to the excellent original concept design, the new note fits perfectly into the existing family of Cambodian circulation notes, which is, so far, printed on regular cotton paper.





On the front of the note, the Royal portrait (executed by Jura JSP in software-assisted classical linear engraving technique), displays a remarkably perfect degree of facial resemblance despite its comparatively modest size. It blends harmoniously with the surrounding graphic environment that is dominated by elements encompassing a variety of sophisticated patterns as well as a number of screens and relief elements in both offset and intaglio. These were all combined together in the design, fine-tuned and rasterized with the latest Corvina software to give the banknote its voluminous, "depth of field" appearance.

Because of the high incidence of blindness and other severe eye disorders that remain prevalent in post-war Cambodia, social responsibility has been prioritised in this note. Highly tactile elements abound, facilitating recognition and authentication of the notes by members of the country's visually impaired community.

Apart from the 100micron tall special tactility marks on the front lower left of the note, there are width-modulated parallel intaglio lines at the left and the right edges, and also highly tactile contours to the major numerals and inscriptions on the front side of the note. These are all designed to serve the indicated purpose, and to push the intaglio groove depths towards the upper limits of what's possible, making the overall high tactility of the note's intaglio contents very distinctly pronounced, especially on the obverse side.

The remarkable characteristics of the banknote's in-house design also include the following features:

 A unique see-through perfect register: comprising elements printed with three different UV-fluorescent inks (including one invisible in daylight) and involving some extra invisible ink elements on the reverse, the register is fully (and correctly) readable under UV light on both sides of the banknote; a "more conventional" seeBANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 LANDQART ISSUE) 06.20

through register would only offer mirrored readability of the feature on the reverse side under any lighting conditions.

- A uniquely rare effect of a very gradual colour transition in intaglio, which is most evident within the ornamental background of the headline Royal portrait on the front. The effect has been achieved by using as many as 66 planes of intaglio colour splits among the intaglio chablons on the obverse side (a total of 80 on both sides combined) a pretty unique feat in itself, which allows the visual effect to clearly emerge as a result.
- A rarely seen two-colour serial number combining two different numbering inks, each fluorescing differently under UV light, and involving a unique quadruple (2+2) prefix comprising:
 - a variable part in one Khmer alphabet letter and one traditional Khmer numeral and:
 - a permanent part, namely the "15" in Arabic numerals, signifying the anniversary to which the banknote is dedicated.

It is worthy of special mention that all three of the print features listed above were developed in-house by the Phnom Penhbased team of designers.

The design and the security contents of the note concerned are further complemented with intaglio depth modulation (particularly visible in the lower right Arabic denomination on the front and the lower left denomination on the reverse), intaglio printing over the holographic stripe, numerous finely made formations

comprising the total of 8 various kinds of micro- and mini-texts in both offset and intaglio, a meticulously executed latent image in intaglio disguised within an intricate traditional Khmer ornament at the lower right corner of the front side, to list just a few!

Last, but by no means least, another notable component of the note's security contents is a proprietary covert design feature from Jura JSP, named ICI® (Invisible Constant Information), which has been embedded into the offset print on the left coupon of the reverse side - namely, a portrait of HM King Sihamony alternating, at the focal area, with a "15" numeral in traditional Khmer digits. Each of the two images is made clearly visible with the help of special decoding devices meant primarily for verification by the relevant competent authorities - however, also available to accredited currency professionals upon request.

The dominant colour of the print design is a visually comforting lavender that contributes to ensuring that the banknote fits well with, yet remains clearly distinguishable from, the rest of the current family of the Cambodian notes.

A series of symbolic Cambodian images and traditional ornaments based on ancient Angkorean bas-reliefs — all crowned by the National Coat of Arms of the Kingdom of Cambodia — give the banknote an unmistakably national flavour. At the same time, the illustration on the reverse, depicting a most touching image of an intimate moment of His Majesty's coronation with his parents, gives the note an unparalleled humane and homely feel.

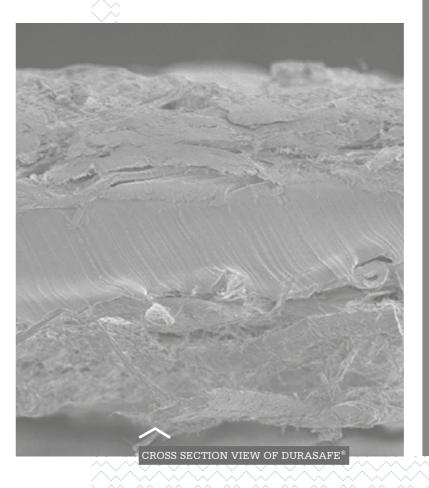
Issuing a banknote as remarkable as this one in Phnom Penh, Cambodia, is a strong statement by the National Bank of Cambodia. All the more so in view of the fact that the note has been brought into being without the involvement of any major commercial banknote printer whatsoever — manifesting the undeniable achievements attained by the still very young banknote printing industry of Cambodia.

LANDQART AG

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DURASAFE AT A GLANCE - THE BEST OF BOTH WORLDS

The structure of Landqart's composite substrate Durasafe is the one combination of paper and polymer that brings together all the advantages of both materials.

Security

- Compatible with all level 1, 2, or 3 security features used in cotton –based banknotes
- The outer surfaces are cotton banknote paper; they can carry different security features, and be different colours
- Endless possibilities and freedom of design for upgrades or new denominations

Mechanical strength

- The composite material has greatly increased tear resistance and double fold endurance, which translates to greater durability in circulation.
- Fully compatible with post-print varnist to enhanced resistance to soiling
- Traditional feel of banknote paper, excellent print tactility on both sides
- Fits perfectly with the "touch, tilt, observe" principle
- Allows consistent use of trusted security features across denominations

Public Education

- Traditional feel of banknote paper excellent print tactility on both sides
- See-through windows are instinctive for the general public to same
- Fits perfectly with the "touch, tilt observe" principle
- Allows consistent use of trusted security features across denominations



www.landqart.com

landSart

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 CRANE CURRENCY ISSUE) 06.20



CRANE CURRENCY

MOTION SURFACE® RE-IMAGINING BANKNOTE SECURITY

Motion Surface® Re-Imagining Banknote Security

CRANE CURRENCY

The micro-optic security feature MOTION SURFACE® saw its first use in the award-winning 2000 som commemorative banknote issued in late 2017 by the National Bank of the Kyrgyz Republic. The feature is notable for the number of secure visual effects that it can support. One of these thought by some to be the most striking is Topo which produces a very strong three dimensional effect. The name Topo derives from the word topography, i.e., the practice of describing relative position, elevation and contour of surface features. MOTION SURFACE® is the latest of advanced security features for the public which is both very easy to use and difficult to simulate.

WHY EASY TO USE?

With all Level 1 public security features, seeing is believing and the strong three dimensional effect produced by *Topo* typically elicits further investigation both visually and tactually, this due to the immediacy and obviousness of the feature's 3D effect. What does that mean for public security? It means that the public is able to verify the authenticity of the feature and banknote easily and quickly.

Just how quickly and easily was put to the test by Secure Perception Research (SPR), Birmingham, UK. Its findings were recently presented by its founder and chief scientist, Professor Jane Raymond at the Optical Document Security Conference, January 2020.



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The cognitive research group carefully evaluated the public's use of the strong 3D effect of MOTION SURFACE *Topo* and verified that they could authenticate it with only a glance. Specifically, a glance can be described as a viewing time of 300 milliseconds. The SPR tests showed not only that the public could authenticate the feature in a glance but with nearly the same accuracy as they identified the banknote's denomination. What's more, additional testing showed that the 3D effect was observable over a range of diminishing lighting conditions.







WHY DIFFICULT TO SIMULATE?

Producing visual effects like Topo on a security feature thin enough to be applied to the surface of a banknote requires materials, equipment and know-how that are each specialized for the production of micro-optic features. On a typical MOTION SURFACE micro-optic stripe of 10 mm in width, an array of over 3 million lenses is aligned precisely over 3 million icons each of them subtly and uniquely altered to achieve a desired visual effect. The changes in the position of each icon are so small as to be unmeasurable by conventional means, but the three dimensional effect of Topo could not be produced without this tightly managed array.

Creating this unique artwork takes hours of computation using state of the art computer processing; however, this is an improvement over the earlier approaches used to produce the first MOTION® features. Since then, the addition of skilled software engineers to Crane's micro-optic technical design team has produced proprietary software that has sped up the process by well over 100,000 times, allowing for more intricate designs and effects, and more realistic renderings of the final product. Were Crane to use the old computational software now to render MOTION SURFACE® designs, the computer processing time would be measured in months.

Today, by virtue of these advancements in algorithms and computing power, the process allows the creator to fine tune every characteristic of the visual effect. It is possible to revise specific dimensions, shape, and magnification of its moving





images. The strong 3D effect of *Topo*, the curved images one sees in the final feature, is a result of the expertise and equipment that can manipulate every icon to be unique in its size and shape from those around it, and to position each precisely under each lens.

Once the design of micro-optic icons are created and arrayed into position, this master artwork must be delivered to production. In a similar way that digital print files are delivered through the modern

process of pre-press in security printing, the artwork for the MOTION® icon and lens array is created using proprietary technology that ensures no distortions or inaccuracies are introduced into the process.

At such a scale, the production tolerance between the lens and icon are critical; the smallest misalignment will destroy the effect and distortions must be limited to within nanometers. For a sense of scale, if one magnified the icon layer of a 12 mm MOTION SURFACE® stripe and made it the width of a two lane road, the production process could tolerate a distortion no greater than 17mm. In fact, because the distortions cannot be measured by conventional means, the only technology currently capable of accurately measuring such distortion is the micro-optics themselves.

Inside the Crane facility, measurement schemes using micro-optics have been developed that allow artifacts smaller than 25 nanometers and distortions less than 10 nanometers to be visible to the naked eye. These tight tolerances drove the need to develop customized production equipment capable of producing multiple layers of millions of individual micro-optic structures while keeping precisely aligned to an original digital rendering. This production equipment keeps the angular alignment between the lens and icon layers extremely tight, e.g., smaller than the movement the hour hand on a watch moves in 6 seconds. This control must be maintained while producing hundreds of thousands of kilometers of material, and billions of precise optical microstructures per second.

ЭКИ МИҢ СОМ БУЛААЛЫ ТАПТАП КУШ КЫЛДЫМ КУЛААЛЫ ТАПТАП КУШ КЫЛДЫМ КУЛААЛЫ ТАПТАП КУШ КЫЛДЫМ КУРАМА ЖЫЛЫП ЖУРТ КЫЛДЫМ 2000 1

CONCLUSION

The results justify the investment made to create and harness such a precise compilation of materials and processes. The visual effects of MOTION SURFACE are bold and very easy to use. All of the complexity required to create them and which ensure the feature's security are invisible to the human eye; however, their visual effects are intuitive, and in the case of *Topo*, striking and even fun to look at, even at a glance.

CRANE CURRENCY

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The Future needs Tradition

Gietz stands for reliability in the security industry





Australian memorial banknote



Austrian 5000 Schilling

As a pioneer in Optical Variable Device (OVD) and hologram transfer technology, Gietz supplied the very first hologram application machine in 1986, to apply the world-wide first hologram on the Australian memorial banknote "Captain James Cook".

Also the world's first hologram onto a commercial banknote in 1988, the 5000 Austrian Schilling, was applied on a Gietz NOTA machine.



More than 40 Gietz FSA NOTA machines were exported to governments and banknote printing companies all over the world.

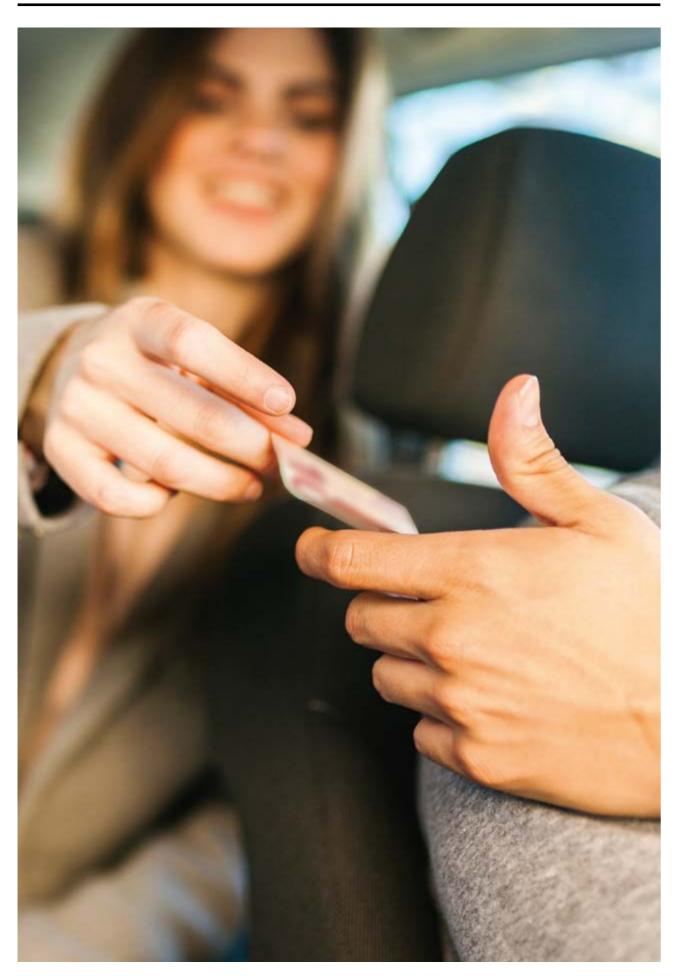
Since the very first days in the hologram application history until today, Gietz is and stays your reliable partner for hologram patch and stripe application onto banknotes. Convince yourself and get in touch with us!



Gietz AG, Mooswiesstrasse 20, CH-9200 Gossau, Switzerland Phone +41 71 388 22 22, Fax +41 71 388 22 23, info@gietz.ch, www.gietz.ch



BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 OBERTHUR FIDUCIAIRE ISSUE) 06.20



OBERTHUR FIDUCIAIRE VHP SECURITY PAPER

BIOGUARD ENHANCETM

AN EFFECTIVE ANTIVIRAL TREATMENT TO COUNTER CORONAVIRUSES ON THE SURFACE OF BANKNOTES

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 OBERTHUR FIDUCIAIRE ISSUE) 06.20



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BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 OBERTHUR FIDUCIAIRE ISSUE) 06.20

BIOGUARD ENHANCE™

Our combination **Bioguard™ paper** + **Bioguard™ for varnish** accelerates the destruction of some viruses, including OC43 which comes from the coronavirus family to which COVID-19 belongs.

- Reduces the survival rate on circulating banknotes.
- Helps protect the public, retailers, cashiers by reducing the risk of spreading infection.



VIRUSES

By using a silver-based component in both the paper and varnish treatments (which are active against bacteria and viruses when introduced into both the paper base and into the varnish) the combination enables significant antiviral activity.

The **Bioguard Enhance™** antiviral activity was assessed against a seasonal coronavirus, the OC43 which comes from the coronavirus family to which COVID-19 belongs. The results showed that our solution offers a significant antiviral protection.

It is also effective against:



BACTERIA

The antibacterial activity has been assessed on the two families of bacteria most commonly found on banknotes (Gram - and Gram + represented respectively by : Escherichia coli and Staphylococcus aureus.)

According to an antibacterial activity assessment conducted on representative bacteria (Yersinia pseudotuberculosis and Vibrio parahaemolyticus) on **Bioguard Enhance™** it has be shown that it was also active against cholera and the plague.



FUNGI

A rigorous method has been used to demonstrate the true efficacy of Bioguard Enhance $^{\text{TM}}$ against microscopic fungi using Aspergillus niger.



Bioguard Enhance[™] has the major advantage that it can be added to an existing series of banknotes **without any impact on the visual** appearance of the banknotes, security features or machine readability.

According to Oberthur Fiduciaire, the antiviral properties of Bioguard Enhance™ have **no effect on the banknote's physical properties**, are unaffected by lithographic and intaglio printing and by washing and maintain their effectiveness in artificial ageing tests.

Oberthur Fiduciaire is making Bioguard Enhance $^{\text{TM}}$ available to all accredited banknote paper makers and banknote printers as part of its commitment to assist the world's fightback against **COVID-19**.





Oberthur Fiduciaire will also provide technical support to all manufacturers who wish to use this antimicrobial solution for the first time. A number of paper mills have already had experience of adding the Bioguard family of products to paper — Louisenthal in Germany, Crane in Sweden, FNMT in Spain, Portals in UK and VHP Security paper in the Netherlands.

In this time of crisis, Oberthur Fiduciaire has built on its well proven Bioguard technology to develop a full antimicrobial protection including an effective antiviral treatment on banknotes against the OC43 family of viruses. This solution can be applied to all new banknote orders and Oberthur Fiduciaire has committed to work with all accredited industry suppliers to ensure that every central bank in the world has access to this significant new technology.

OBERTHUR FIDUCIAIRE

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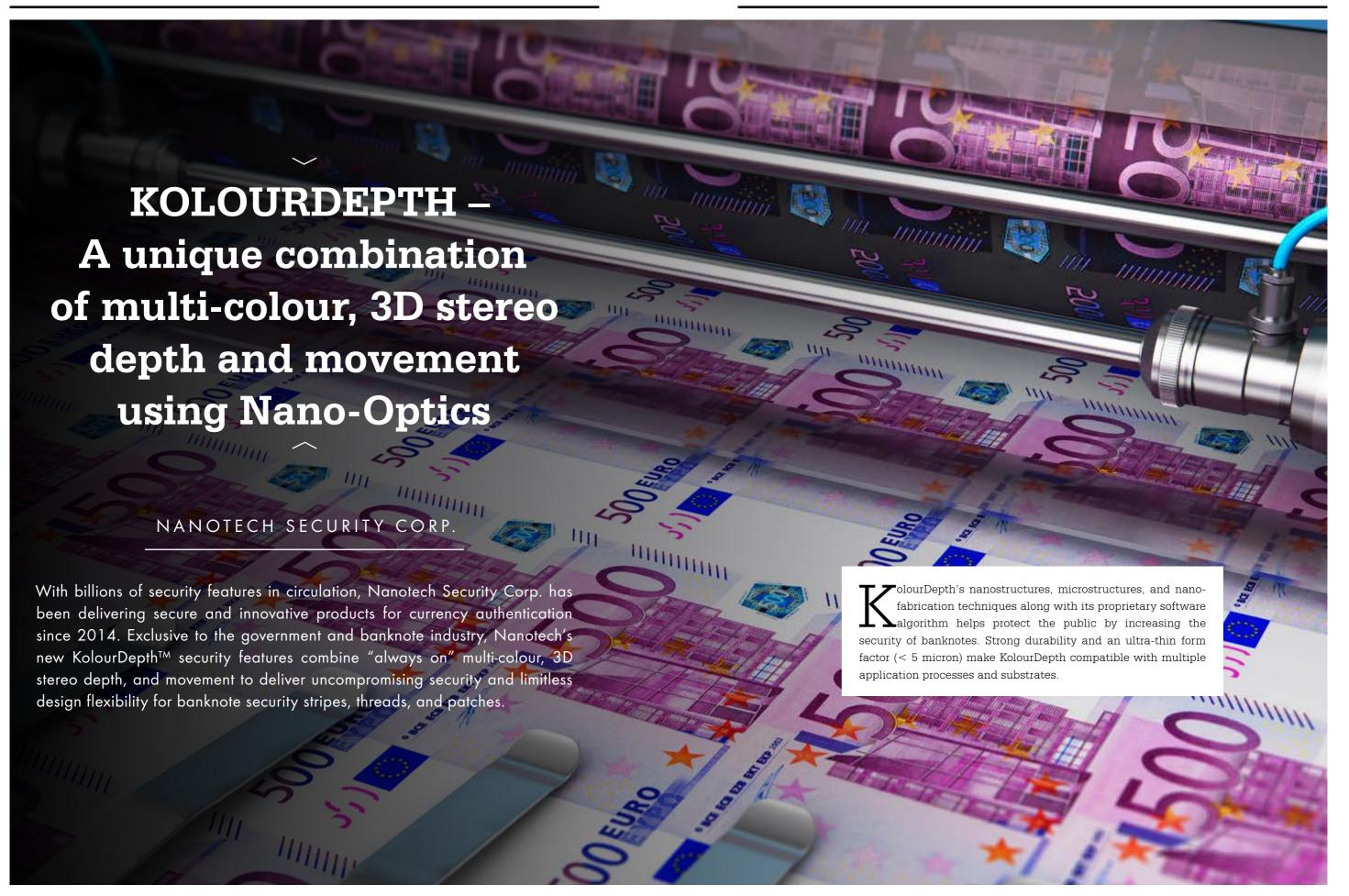
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NANOTECH SECURITY CORP.

KOLOURDEPTH –
A UNIQUE COMBINATION
OF MULTI-COLOUR, 3D
STEREO DEPTH AND
MOVEMENT USING
NANO-OPTICS

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BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 NANOTECH SECURITY CORP. ISSUE) 06.20

SURFACE PLASMONICS

Nanotechnology holds the potential to create new and exciting optical phenomenon. Surface plasmonic resonance is one such phenomenon that occurs in subwavelength metal nanostructures sandwiched between dielectric materials. The structures can change the colour of a metal surface through selective light wave absorption, reflection, and transmission. The colour effect is closer in look to metallic colour pigments than diffractive "holographic" effects.

Plasmonic resonance provides a new way to create colourful surfaces and imagery at a resolution unmatched by any current print, lens-based or holographic technologies. Nanostructures can be engineered into plasmonic pixels which can further be subdivided into RGB or CMYK-like sub-pixels to produce full colour imagery or specific colours chosen from the available colour palette for a true-colour print-like approach to multi-colour imagery.

When implemented in a window of a banknote or security document, the plasmonic colour feature can exhibit different colours on both sides of the window when observing the image in reflection. Additionally, the image can be observed in transmission for a third set of unique colours by holding the banknote up to a light and viewing it through the window. Asymmetrical plasmonic structures, such as nano-pillars, will exhibit different colours on each side, but the same colour in transmission no matter which side the user is viewing.





MICROSTRUCTURES

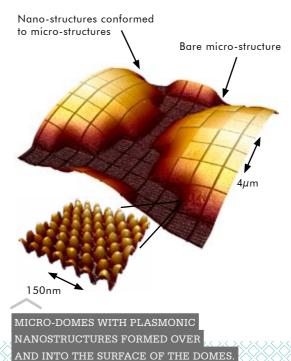
Microstructures come in many shapes and sizes. They are physically much larger than the light waves they interact with, but smaller than what one can see with the naked eye. Microstructures are common in many high-end security OVDs today such as micro-lenses, micro-mirrors, and diffraction gratings. Nanotech's • microstructures are generally thinner than these, but still at the micro scale. Their primary optical characteristic is to diffuse and/or reflect all waves of light in a specific manner. They can be used to control how light behaves on a macroscale i.e. specifying a particular viewing angle that light will be generally reflected towards. Specific applications include diffusing light hitting the surface of a reflective material (e.g. aluminum) such that the surface appears a matte white or can create a mirror-reflection point so that all the light is reflected at a specific desired viewing angle. Microstructures can be treated like pixels, and can create

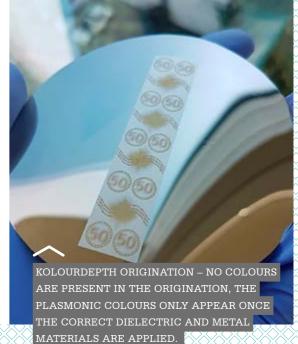
basic 2D monochromatic imagery, however they cannot create colour or depth on their own.

COMBINING MICRO AND NANO TO CREATE KOLOURDEPTH

- Static colour images can be animated
- Colour, depth and movement can be integrated in a single visual feature

Plasmonic nanostructures and plasmonic colour pixels can be formed along the 3D contour of a microstructure. Combining microstructures and nanostructures augments both the microstructure and nanostructure effects by controlling the light at all scales: macro, micro, and nano. In doing so, Nanotech can create many unique effects by combining colour, depth, and movement. Origination of such exotic hybrid structures is extremely difficult and complex and creates an enormous hurdle for the counterfeiter to emulate. Nanotech has invested considerable time and





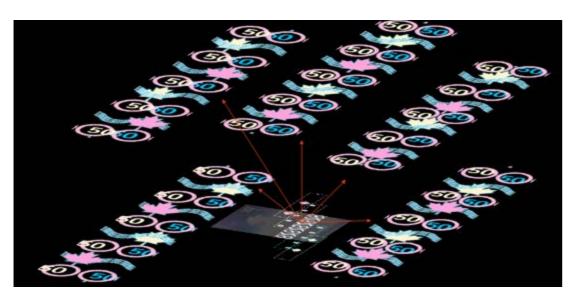
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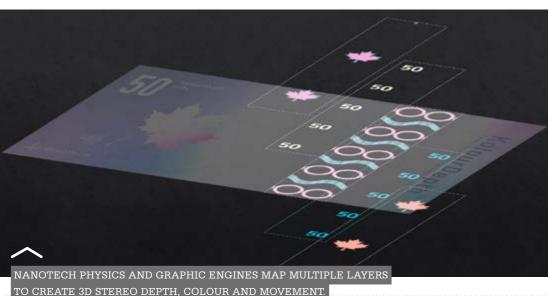
resources into developing a multi-stage electron beam lithography process which has enabled the world-first production of • Multiple application types: threads, these structures on a commercial scale.

Combing the power of nano-scale • plasmonic colouration and angular viewing of micro- structures, opens pathways to a variety of effects: static full colour imagery, simple colour-shifting • films, complex 3D images, and movement can be realized from a single layer of • High degree of freedom for design and embossed aluminum-coated structures.

ADVANTAGES

- stripes, labels, laminates
- High visibility
- Simple to trigger
- High interactivity
- customization





KolourDepth represents a next-generation nanotechnology OVD security product that

The advantage of this technology is several-fold. Like printed features,

plasmonic colour images are always visible ("always on") and are extremely

easy to see, as they feature deep colour

saturation and contrast. When coupled

with microstructures Nanotech can add

3D stereo depth and other interactive

features. The customization of plasmonic

colour pixels holds no theoretical limit;

Nanotech can deliver multi-colour 3D

imagery in a single security feature,

overcoming one of the main limitations

of today's lens-based features. The

microstructures Nanotech employs are

very thin, ~ 3.5 um in height, and thus

the total thickness of the security feature

can be less than 5 um, making it suitable

for threads, stripes, labels, and laminates.

Together this provides an always visible

and highly unique authentication feature that is easy to trigger and extremely

difficult to simulate or replicate.

provides a unique combination of multicolour, 3D stereo depth, and movement that is memorable and easy to use. Nanoscale structures can be exploited to produce highly unique, visible features in both reflection and transmission. The micro and nano-scale structures introduced here have been shown to have many advantages over traditional grating and lens-based optics. The combination of nano-scale origination, proprietary algorithms, and specialized manufacturing techniques result in a new generation of security features. With Nanotech's KolourDepth, the world's currency issuers can create memorable and custom security features that seamlessly fit into a banknote's overall design while offering the public easy and intuitive authentication. For more information on Nanotech or KolourDepth visit www.nanosecurity.ca

NANOTECH'S KOLOURDEPTH **TECHNOLOGY** Shallow Microstructure

CONCLUSION

NANOTECH SECURITY CORP.

info@nanosecurity.ca Email: Website: www.nanosecurity.ca

advertorial: **Canadian Bank Note Company**

Canadian Bank Note Company, Limited (CBN) is headquartered in Ottawa, Canada. With security printing at its core since 1897, CBN today has an international presence and a varied offering: from currency to fully integrated system solutions. Our highly diversified team of over 1,600 employees is dedicated to meeting or exceeding the needs of customers in over 45 countries. A high-technology company, CBN has produced award-winning currency for Issuers in all parts of the world and across a range of circulation environments.

Great expectations are placed on banknotes today. They must be strongly resistant to counterfeiting, yet simple to authenticate. They must be durable, as Issuing Authorities seek enhanced performance in circulation. Machine readability is required to work reliably with cash handling equipment, especially as Issuers increasingly gather information for data analytics. Features and design attributes must be integrated for users such as the blind and partially sighted. And with an increased focus on the environment, the need to ensure sustainability, from the perspective of the total banknote lifecycle, simply adds to the challenge of creating banknotes today.

Successfully navigating these requirements means working with a trusted partner who clearly understands the challenges these expectations can pose. Developing the right solution means having the experience, technical proficiency and, above all, the creativity to establish designs that balance security, durability and functionality with award-winning aesthetics. At CBN, we routinely integrate diverse technologies into a design printed to the highest standards and pride ourselves on consistently exceeding

customer expectations. As an impartial and trusted partner, our commitment to excellence helps us to build strong relationships that deliver value to Issuing Authorities all around the world.

An example of this commitment is the creation and delivery of the Reserve Bank of New Zealand's Series 7 banknotes. Like any complex project, close collaboration amongst stakeholders was required to deliver a solution within a tight time frame. The desire to integrate a fully-registered holographic patch within the polymer substrate window meant not only working on a design solution with KURZ, who supplied the KINEGRAM ZERO. ZERO® patch, but also with KBA-NotaSys on the engineering modifications needed to enable the precise registration of holographic patches within a window.

More recently, the Central Bank of The Bahamas entrusted CBN to manage the project and deliver their new CRISP Evolution \$50 banknote. The striking new design is based on Durasafe® cotton-polymer composite substrate from Landqart AG. With a window design motif as the fully transparent substrate window, the design includes the first use of the Diagonal Spike effect from SICPA for the SPARK® Live element, and the first-ever integration of RAPID® thread from Crane Currency within the composite substrate and viewable through a window that is more than half the height of the note.

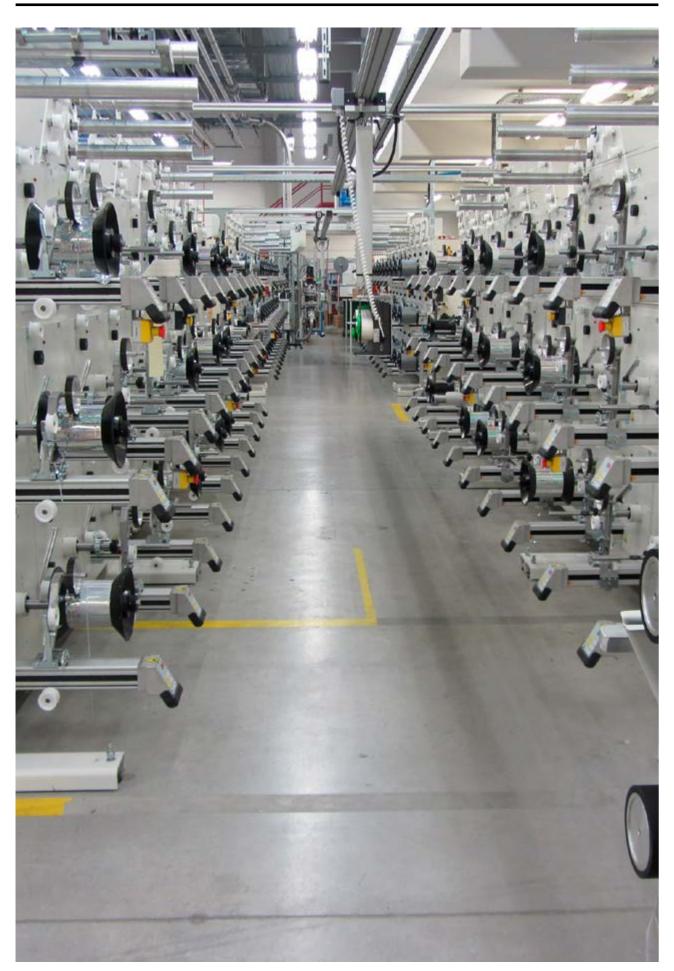
Great expectations deserve great teamwork and even greater solutions. To learn more about what CBN can do for you, visit us at www.cbnco.com or contact us at paymentsupport@cbnco.com



BN is committed to providing a superior customer experience to Issuing Authorities around the world. Merging the newest technologies with our award-winning design capabilities, we focus on creating banknotes tailored to meet the specific needs of each customer. As a trusted partner and advisor, we build lasting relationships that assure the continuity and security of currency supplies. We measure our success by how well we have helped our customers to meet or exceed their objectives in relation to their cash lifecycle. CBN: the right partner, the right solution, the right choice.



BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20



HUECK FOLIEN

CELEBRATING 50 YEARS: SPOTLIGHT ON TAILORMADE FEATURES

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 HUECK FOLIEN ISSUE) 06.20

Celebrating 50 years: Spotlight on tailormade features

HUECK FOLIEN

HUECK FOLIEN is a privately owned, innovative enterprise with high technology standards, a distinctive customer-oriented focus and the ability to realise powerful solutions. Being a coating specialist since 50 years, HUECK FOLIEN has a wide expertise and reached world-wide technological leadership in the field of high security threads and foils for banknotes and high security documents.

he company is a sole feature supplier for the banknote industry and its products are qualified at most of the worlds papermills and printing works. This is a true benefit for the Central Bank to have such an independent supplier. In-house development of innovative high security features and long-time development partnerships with leading international players in the high-security industry have earned HUECK FOLIEN a world-wide reputation for a unique customer support and reliability for technically demanding products and services.

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 HUECK FOLIEN ISSUE) 06.20

TRILUMIC®: HIDDEN HALFTONE DESIGN FOR CAMBODIAN BANKNOTE

The latest of HUECK FOLIEN's top products is an enhanced optically attractive effect incorporated in its holographic security foil SIGNET. It expands the authentication level 1 properties of the hologram with a level 2 feature called TRILUMIC® which is a trademark resulting from a cooperation between HUECK FOLIEN and Banque de France. This complex security feature is placed registered on the holographic stripe and is hidden under daylight. Under UV light source it is showing an extremely brilliant true colour half tone image which cannot be realized on paper surface but on foil. The special technology of the feature in combination with the demetallized area of a holographic stripe ensures

attractiveness for the public, interesting opportunities for the banknote designers and a significant barrier for counterfeiters. Together with Swiss papermill Landqart and the Cambodian National Bank, the TRILUMIC® foil stripe was applied onto the Cambodian 15.000 Riel commemorative banknote which has received the award for the Regional Banknote of the Year 2019.

STRONG PARTNERSHIP FOR BEST RESULTS WITH ORELL FÜSSLI

Celebrating Orell Füsslis' 500th anniversary, HUECK FOLIEN is one of the partners of the special anniversary substrate which shows the passage of time throughout 500 years of printing history. Two security threads of HUECK FOLIEN have been integrated in different







substrates. First the Coactive Thread® combining ColorSwitch™ with Multifly®, a feature which shows optically variable effects in security threads and foils with an easy recognition for the public. This security feature is based on specifically arranged nano-structure which creates a novel optical effect in the 3rd dimension. Multiple moving icons seem to be flying above and below the image plane, rotating one against the other. The second thread is a ColorSwitch™ thread embedded into Landgart's Durasafe® substrate. This product combination is unique in banknotes as the thread can be embedded without any wobbling zone and is visible

in register in the half window of the $Durasafe^{\$}$ substrate.

HUECK FOLIEN CELEBRATING 50 YEARS OF EXCELLENCE

HUECK FOLIEN will celebrate its 50th anniversary this year in September. The company originally started as a printing house but also had an in-house development and manufacturing for rotogravure printing machines. Shortly after the beginning the company started to metallize polymer films for their food packaging customers. The metallization of pure aluminum on polymers arouse

very quickly interest in other markets outside the packaging like telephone cards, labeling and pharmaceutical applications. The step into high security threads for banknotes was then a logical one. The company's first security thread was a metallized cleartext thread for the German Mark. Since more than 30 years HUECK FOLIEN produces and develops new high security threads for the banknote industry. The at first "simple" color printed or metallized threads, were followed by machine readable and holographic threads, then also lamination foils, further followed by bi-metallic aluminium with copper (Safe^{2®}II) threads before in recent years the threads got more and more complex. Just to name some examples, colorshifting threads (ColorSwitch™) based on liquid crystal or printed OVI inks and also thin film technology. HUECK FOLIEN has been the development partner of features such as DualTrack™,

Picture Thread®, FiP (Foil in Paper) and is the only producer and supplier of these features. The trend for recent products are combinations of two technologies in one thread or stripe such as Coactive Thread® or TRILUMIC® - as shown above. The company supplies many customers around the globe in Europe, Latin America, Africa and Asia and is proud their threads secure the EURO and Swiss Franc. Baring this deep knowledge, the company is looking forward to the next developments and customer projects in future.

HUECK FOLIEN GMBH

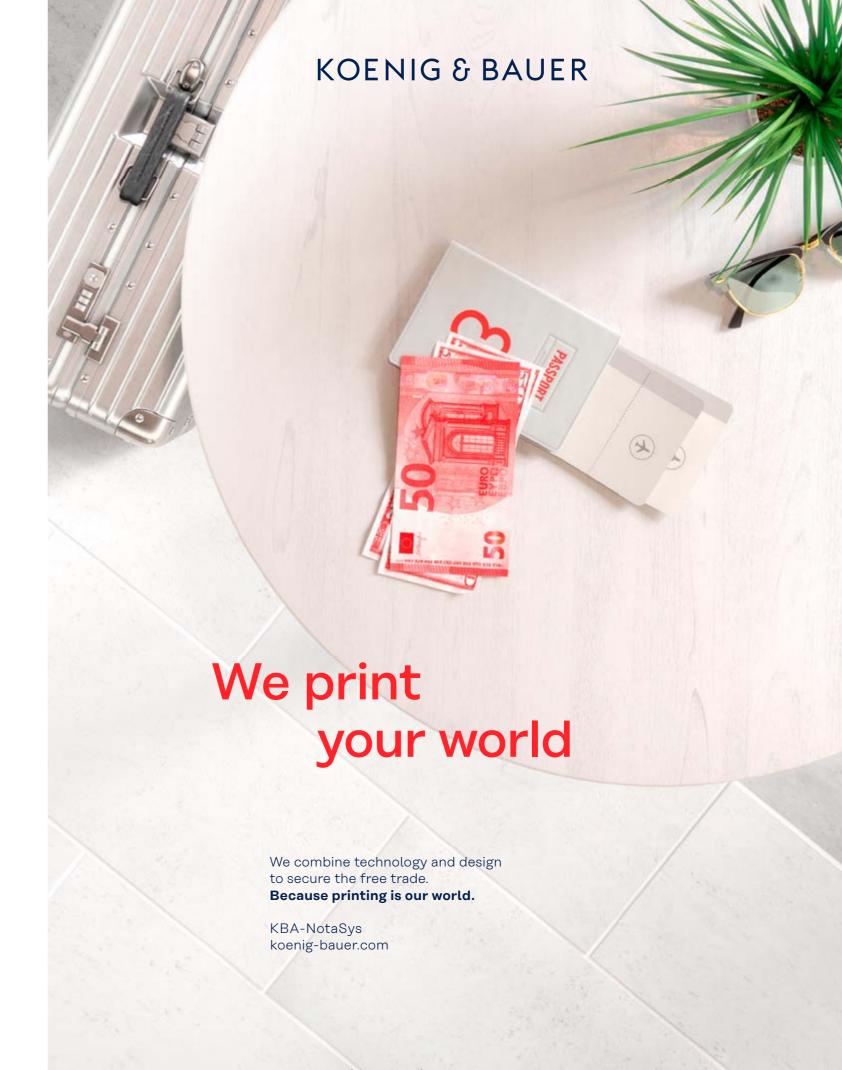
Mr. Jan Hofmann

Email: j.hofmann@hueck-folien.at
Website: www.hueck-folien.at



SWISS FRANC WITH SECURITY THREADS FROM HUECK FOLIEN

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BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 SPECTRA SYSTEMS CORPORATION ISSUE) 06.20



SPECTRA SYSTEMS CORPORATION

MACHINE READABLE POLYMER BANKNOTE SUBSTRATES AND ADVANCED OPTICAL MATERIALS

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 SPECTRA SYSTEMS CORPORATION ISSUE) 06.20

Machine Readable Polymer Banknote Substrates and Advanced Optical Materials

SPECTRA SYSTEMS

In collaboration with a global supplier of biaxially oriented polypropylene (BOPP), Spectra Systems has developed a new covert (level III) polymer substrate for high-reliability, high-speed machine-readable banknote security. The covert taggants and detection system enable central banks to have their own unique codes when paired with a sensor system that detects and verifies the specific signatures.

ubstrate embedded security features have afforded central banks the highest level of security and the ability to verify authenticity at the fastest sorting machine speeds. This has been the case for paper-based banknotes for many years, however, embedding taggants in polymer has been a particularly difficult problem when low haze values (<2.5) are required for the transparent window, the signature public security feature of polymer banknotes.

Spectra, working with a leading global and research driven supplier of BOPP, has produced substrate which meets all of the industry standards while being machine-readable at the highest speeds and with false accept and false reject rates comparable to the lowest values obtained in paper-borne features. The substrates are compatible with all of the other applied security features in the form of inks and foils and exhibit superior mechanical strength, shrinkage, stiffness, thickness control, haze and print properties. As the substrates are corona and flame treated, they have exhibited excellent printing properties both with opacity and anti-static coatings, as well as subsequent banknote design printing. These newly available substrates have multiple signatures allowing for covert level III machine-readable authentication which is specific to a given central bank. Current capacity for these substrates is 2 billion notes annually and will increase to 10 billion by the end of 2020.

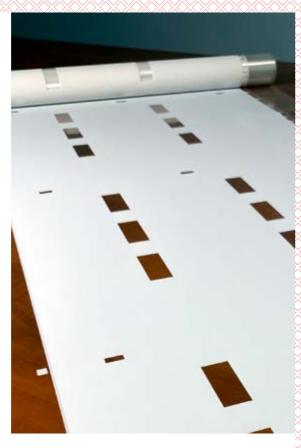
BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 SPECTRA SYSTEMS CORPORATION ISSUE) 06.20

CRITICAL PROPERTIES OF MACHINE READABLE POLYMER SUBSTRATE (MRPS)

The table below compares the physical properties of typical polymer banknote substrates with that of Spectra's new Machine Readable Polymer substrate (MRPS). The MRPS material values point to its suitability for use in polymer banknotes. Additional critical performance metrics include printability/adhesion, and support of foils. Corona/flame treatment during manufacturing is effective in preparing the surface for excellent adhesion of the white opacity layer and application of foils.

AUTHENTICATION SPEED AND READ RATE PERFORMANCE

The authentication sensors, designed in parallel with the development of the MRPS $\,$



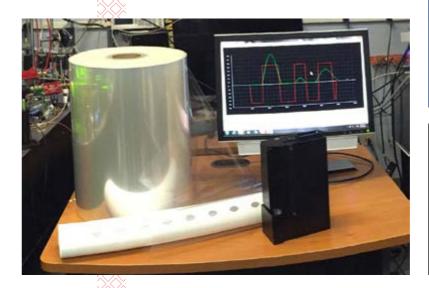
| | Method | Typical Industry Values | MRP |
|---------------------------------|---------|-------------------------|--------|
| Heat Shrinkage | MD | 3.15 | 2 |
| | TD | 1.57 | 0.5 |
| Mechanical (Modulus psi) | MD | 274000 | 370000 |
| | TD | 376000 | 630000 |
| Mechanical (Strength psi) | MD | 18000 | 21500 |
| | TD | 34000 | 46000 |
| Mechanical Strain (Strain %) | MD | 220 | 220 |
| | TD | 50 | 45 |
| Haze | 1 sheet | 2.3 | 2.3 |
| Stiffness (1 sheet, mN) | MD | 52 | 66 |
| | TD | 115 | 140 |

MD - Machine Direction TD - Transverse Direction

- Machine Direction MRP - Machine Readable Poly

MRP - Machine Readable Polymer

substrate, have the ability to detect the feature at speeds of 15m/second, which exceeds the transport speeds of the fastest sorting machines currently used by central banks. Under testing, read rates have been found to have a false reject rate of as low as 1 in 100,000. Owing to the intrinsically robust family of tagagnts, read rate performance will be stable across the life time of the banknote.



ADVANCEMENTS IN LUMINESCENT MATERIALS FOR INK BASED SECURITY

In addition to the covert security of our MRPS, new developments in overt optical materials offer ink based features that can be used in the printing of MRPS banknotes, as well as paper based notes. These include a set of proprietary "gasochromic" phosphors and a newly developed fluorescent Red phosphor. The gasochromic material emits under UV illumination only when a weak stream of nontoxic gas is applied to the area of the banknote containing the material.

Currently available Red phosphors tend to be expensive and limited in brightness and lightfastness properties. A breakthrough



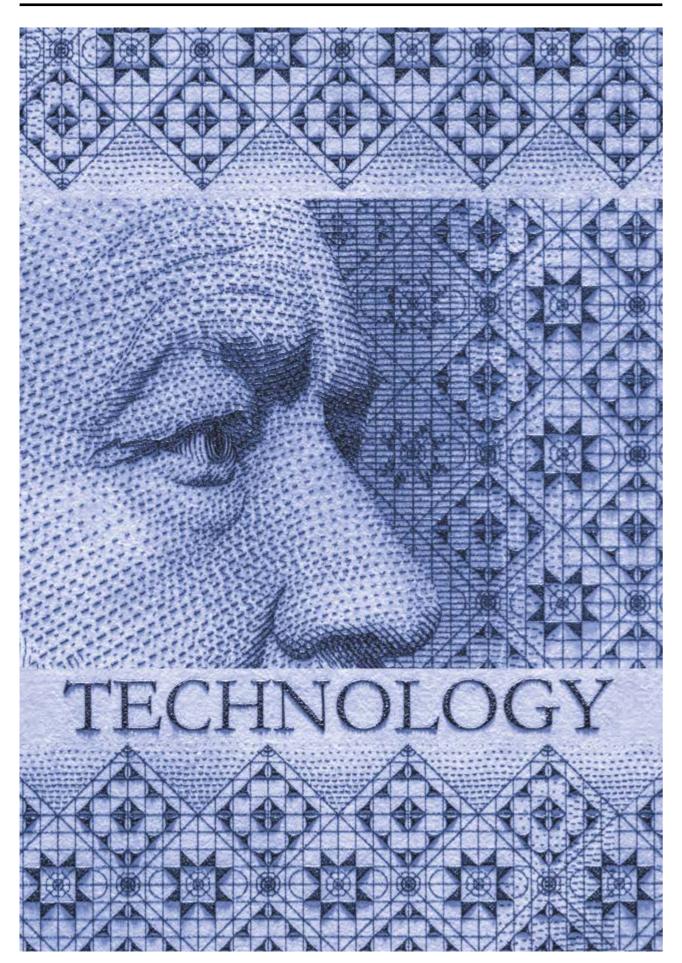




Red emitting phosphour for this specific application has resulted in a colourless, very bright, lightfast (L>5), red phosphor particularly suitable for UV LED excitation.

SPECTRA SYSTEMS CORPORATION

Email: jcherry@spsy.com Website: www.spsy.com BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 KOMORI ISSUE) 06.20



KOMORI

BANKNOTEOLOGY THE STATE-OF-THE-ART SCIENCE OF INTAGLIO PRINTING

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 KOMORI ISSUE) 06.20

Banknoteology The State-of-the-Art Science of Intaglio Printing

KOMORI

Combination technology is at the heart of the Komori brand; similarly, Banknoteology - a combination of 'Banknote' and 'Methodology' - is the cornerstone of the currency technologies that Komori offers worldwide.

Banknoteology encompasses a wide range of solutions including intaglio printing presses.

Komori created its intaglio printing presses after listening to its customers and understanding their desire for solutions to help them with their business challenges.

Banknoteology has driven the design of Komori's intaglio printing press, to make it the most productive and efficient banknote press in the world today.

B anknoteology is the science Komori applies to the study, research and development of its banknote manufacturing processes.

This concept encompasses all the major processes currently employed across the global banknote printing industry, and the systems it generates empowers banknote printers with the potential to elevate their production capabilities to new and inspirational levels.

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HISTORY

Komori developed its first 3 colour intaglio press in 1964 for the National Printing Bureau of Japan, and also developed the revolutionary 5 colour intaglio press in 1971

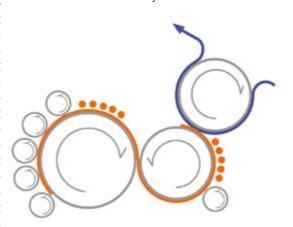
The first multi-process offset & intaglio combination press was produced in 1967 and since this time, all Japanese Yen have been printed with this unique combination technology.

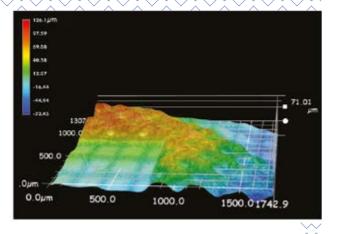
One extraordinary benefit of this is the very tight registration between the offset and intaglio print images.

HERTZIAN CONTACT STRESS

Industry universally agrees that reducing contact stress minimizes mechanical strain. Hertzian contact stress refers to the stress or pressure on elastic contact points between two spheres, two pillars or two curved surfaces — such as printing cylinders.

Heinrich Hertz was a German physicist who in 1881, theoretically analyzed and derived an expression for contact stress by utilizing the results of a case under distributed load in a semi-infinite body.





With this renowned principle in mind, Komori developed and designed the Currency IC Multi-colour Intaglio Press. This machine has an innovative 3:3:4-cylinder configuration. The plate and impression cylinders are three times the size of the chablons, and the collecting cylinder is four times this size.

This configuration embodies the Hertzian contact stress theory. When a 10mm nip width is needed between the collecting cylinder and the plate cylinder, the larger size of the collecting cylinder provides much less stress or pressure to the plate cylinder. Consequently, mechanical strain on the press is reduced, durability is increased and printing accuracy is maintained.

BEYOND MANUFACTURING STANDARDS

The International Organization for Standardization (ISO) is a world-renowned body responsible for many standards in the field of industrial design and manufacturing standards. The equivalent body in Japan is the JIS (Japan Industrial Standard) which also provides standards for design and manufacturing. Komori employs many ISO and JIS standards and it is these which underpin Komori's products.

Komori's strict adherence to these international and national standards gives the company and its customers ultimate confidence in its products.

However, to ensure that Komori achieves the performance that it demands of itself from its components, it chooses to go beyond these standards. Calling upon Komori Corporation's vast experience across the field of print, it has established that certain key components, e.g. drive gears, bearings, grippers, housings, cylinders, beds and side-frames have an important influence on the printing performance and economic life of presses. For such valuable assets, it has enhanced the ISO/JIS standards by developing its own, higher Komori Standard which is incorporated into its QMS (Quality Management System).

For example, in gear design and manufacturing, ISO/JIS defines the highest manufacturing accuracy as 0 (Zero) class, but Komori goes even further than this. To achieve in excess of zero class, Komori created its own gear manufacturing facility in 1967. This ensures the highest accuracy and the least variation in the manufacture of Komori's key machine components. Precision is the Komori culture.

SOUND OF SILENCE

Visitors to any banknote printing works which operates Komori intaglio printing equipment are always surprised and impressed at the 'sound of silence' of the intaglio presses, even when they are running at 10,000 sheets per hour. Precision in action!

Komori presses produce noticeably less sheet distortion than conventional intaglio

printing equipment. For example, the standard deviation of the grip-edge width and back-edge width after printing is only 0.10mm. Banknotes printed on Komori Intaglio presses produce exceptional relief and tactile properties, enabling quick and easy public recognition.

KANDO - BEYOND EXPECTATIONS

Many of Komori's concepts originate from users' ideas and feedback. This ensures its efforts are devoted and focused on delivering customer satisfaction, continually driving the company to produce products of superior quality and reliability.

The Komori R&D team always welcomes hearing and acting upon customers' opinions. The team tirelessly strives to perceive what will be the next revolution beyond the conventional intaglio printing process. Komori is reinventing banknote manufacturing processes — not only now but into the future.

Once we accept our limits, we go beyond them

- Albert Einstein

Komori goes beyond your expectations.

KOMORI CORPORATION

Takeo Uehara
General Manager
Security Press Sales Group

Email: takeo_uehara@komori.co.jp Website: www.komori-currency.com BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20



SURYS

PLASMOGRAMTM BEAUTY, ENERGY AND SECURITY FOR YOUR BANKNOTES

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20

Plasmogram™: Beauty, Energy and Security for your Banknotes

SURYS

Colors are all around us, they are part of our daily life. Colors are captivating, surprising, and sometimes, they are just unforgettable. By mastering plasmonic sciences and the precise management of micro-optical elements, SURYS breaks holography's tradition and unveils the Plasmogram™, a color-inspired technology that reconciles technological complexity, aesthetic beauty and robustness.

Inspired by deep science, developed and industrialized by passionate collaborators, this original technology presents colors with outstanding properties and guarantees a highest safety for your Banknotes.

APPLIED ON POLYMER NOTES, PLASMOGRAM™ REVERSO OFFERS A FINELY CRAFTED SCENARIO FOR A STRONG REFLECTION AND SEE-THROUGH AUTHENTICATION. BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20

AN EXCEPTIONAL COLOR SCHEME

Before a banknote is issued, a lot of time is spent on the design, to select the right form, the right elements and the right colors to ease authentication and increase public acceptance.

Visual effects revealed in a banknote remain the smartest and fastest way for immediate authentication by the general public. High security optical elements, when properly integrated in the banknote design, are the most eye catching features.

The newly-introduced Plasmogram $^{\text{TM}}$ technology has unique visual properties and an immediately recognizable appearance.

By mastering resonant transmission effects, Plasmogram $^{\text{TM}}$ offers the opportunity to select a color combination and a virtually unlimited mix of shapes and surfaces that best fit the design of the banknote.

Achieving such feat requires a high level of scientific expertise in both optics and materials science resulting in a total control of the foil structures. Forms, colors, animated metallic outlines, wave and virtual 3D effects are all strategically and perfectly matched to glorify the design and ease the authentication. The perfect registration of all these elements creates a major technological barrier for counterfeiters as no printing, nor ink technique can simulate such visual appearance.







PLASMOGRAM™ REVERSO THE AUTHENTICATION EXPERIENCE

One of the key characteristics of the DOVIDs is their ability to be easily recognized and authenticated by the general public. From a user's perspective, Plasmogram $^{\text{\tiny M}}$ Reverso for Polymer banknotes, finds it uniqueness in its at-a-glance authentication thanks to the color combinations that vary not only with the viewing angle but, above all, depending on which side of the note they are observed.

With Plasmogram™ Reverso for Polymer banknotes, authentication is achieved by following an extremely accessible control procedure:

AUTHENTICATION BY COLORS:

controlling a set of distinctive, vivid colors on the front side turning into rich shades of gold colors on the back side of the note supports the design and catches the public's attention. Each color also shifts by tilting the note thus making the Plasmogram $^{\mathsf{TM}}$ impossible to be simulated by regular inks or traditional holograms.

AUTHENTICATION BY DESIGN:

controlling the perfect registration of all designed elements: Forms, colors, animated metallic outlines, wave and virtual effects are all strategically registered to glorify the design and ease authentication.

by holding the Plasmogram™ against the light a third unique set of colors becomes visible on both sides of the note, in transmission.

IN A NUTSHELL

Things to remember about $Plasmogram^{TM}$ Reverso for polymer banknotes:

A quick and easy to recognize brand-new feature for the banknote industry, which can be verified by an untrained eye.

Designed to be extremely resistant to common banknotes counterfeiting attacks,



AWARD FOR INNOVATION IN HOLOGRAPHIC TECHNOLOGY FOR MONGOLFIER NOTE WITH PLASMOGRAM™ REVERSO TECHNOLOGY

AUTHENTICATION BY TRANSPARENCY: thanks to the interlocking and extreme precision of the registration between the different colors; The Plasmogram $^{\text{\tiny TM}}$ Reverso can't be imitated with conventional inks or foil due to its unique and highly secure technology.

> It allows a much larger flexibility in design thanks to the possibility to select color combinations and high-definition shapes and surfaces.

> Furthemore, Plasmogram[™] Reverso for polymer banknotes is compatible with the main substrates on the market and can be applied on KBA Optinota™ or GIETZ Foil Commander.

> More generally, Plasmogram[™] technology can be produced in Stripe, Thread and Patch formats. It can easily be integrated into the banknote design and reinforce the trust of the general public in each denomination.

SURYS

contact@surys.com Email: Website: www.surys.com

A THOUGHT LEADERSHIP FORUM POWERED BY COMMUNITY

13 - 16 September 2021, Barcelona Fairmont Rey Juan Carlos 1 & Palau de Congressos de Catalunya

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INNOVATIVE, TAILOR-MADE SOLUTIONS.

WHO WE ARE

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 the 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.

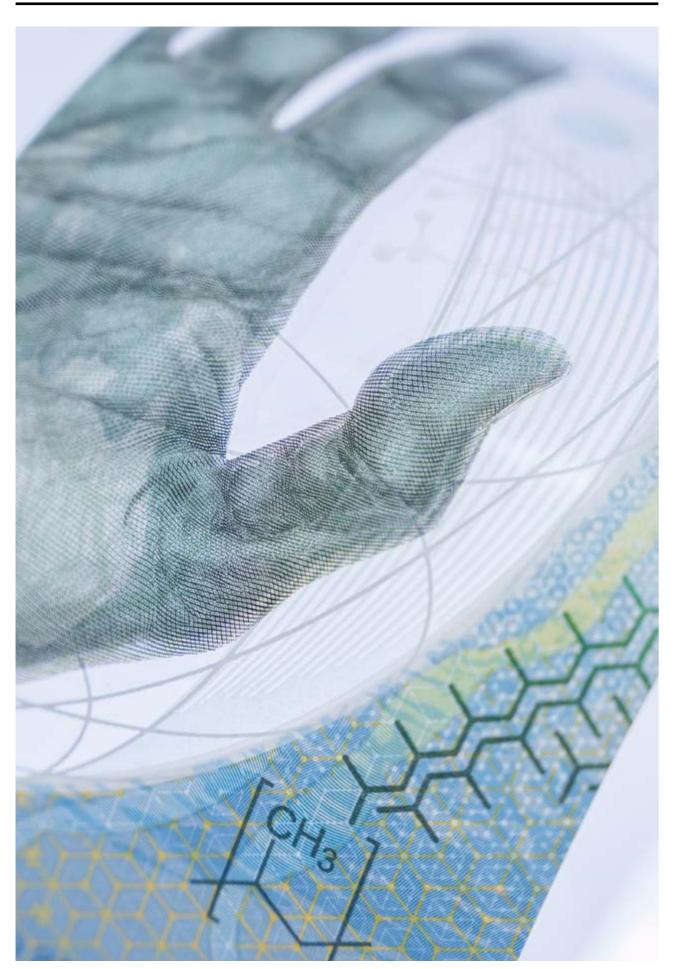
We understand that it can be daunting to change supplier or to introduce new security technologies or features but you can rest assured that we will be there all the way through the process, as your preferred partner and friend. Your success is of the utmost importance to us.

Helio^{SUITE}

We offer four distinct product categories to the market creating a clearer focus for you, our customers, to see how we can support you in securing your document. Whether it is the introduction of a new or upgraded banknote design, a completely new identity document, increasing your tax revenues or securing your brand, our specialists are here to help you with innovative, tailor-made solutions.



BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 NOTE PRINTING AUSTRALIA ISSUE) 06.20



NOTE PRINTING AUSTRALIA

BREAKING THE BOUNDARIES THE 30 YEARS OF GUARDIAN™ NOTE BY NOTE PRINTING AUSTRALIA

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 NOTE PRINTING AUSTRALIA ISSUE) 06.20



Presented by www.banknote-industry-news.com

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In the meantime, other central banks who had made the switch to polymer banknotes in the years that followed, enjoyed the benefit of successive generations of window design as high security printing techniques enabled greater window complexity. This included the development of patterned vignettes around the window edge, and the addition of technologies such as colour shifting inks, optically variable devices, and window embossed security elements.

To accommodate this increasing array of technologies, the size and complexity of the clear window became more evident, with some banknote designs including multiple windows such as the banknote designs from Canada (2011-13) and England (2016-present). This evolution culminated in the RBA's Second Polymer Series, which among other features, included the world's first top-to-bottom window, which took the clear windows to the banknote's edge.

In respect to this trend, the window remains a discrete area of real estate on the banknote. The design teams at Note Printing Australia (NPA) and CCL Secure proposed the creation of a new house note that explored the upper boundaries of windows integration, creating a note that paid homage to the world's first polymer banknote issued in 1988 while demonstrating a whole new way to view polymer banknotes that enhanced counterfeit resistance. The result is the 30 Years of Guardian Note by Note Printing Australia.

The objective of the 30 Years of Guardian Note was to push the boundaries of window design to explore how the impact of scaling-up existing features might offer greater counterfeit resistance, enable a platform for

increased security feature complexity, and for the public to more easily authenticate the note





The NPA design team conducted an initial brainstorming session on design possibilities. In responding to the design brief, the result of this work was fascinating with a number of options put forward to CCL Secure for feedback, ranging from a minimalist, ultramodern design to a concept that offered banknote printed features on one side and substrate features on the other.

The design option, however, that most appealed to CCL Secure was the 'Hand of the Inventor' in which the hand of Professor David Solomon – one of the key inventors of polymer banknote technology – was featured in intaglio, with an environmental theme on one side and a polymer technology theme on the other. They saw the potential to create a super-sized clear window around the hand, and had ideas about combining a positive and negative shadow image using a water theme.





The design was also an excellent option for the inclusion of CCL Secure's new security feature, $VIVID^{TM}$, a UV ink that offers a range of colours and has the option to include Infra-Red machine readability within a clean green ink. With the design idea including a detailed pattern of veins on the back of the hand, the application of VIVID to the veins would create a large and obvious effect when viewed under a UV light.

The NPA Design team took the feedback and created a concept design for the note that increased the size of many traditional security features which had a corresponding effect on substrate-level security features. These included:

- A super-sized clear Window, by far the largest window ever designed on a polymer note to date which changes the visual experience of the whole note.
- The integration of two types of Shadow Image. A Positive blue splash graphic and Negative design that illustrates bubbles coming up from the bottom of the note when viewed in light * transmission.
- An offset printed pattern constructed with hexagonal patterns deriving from the chemical compound of polypropylene, and which also features the reversed out logos for both NPA and CCL Secure.
- A screen-printed wireframe design that creates a globe-shaped effect
- The extremely large 'Hand of the Inventor' in intaglio ink – which remains a unique printing method in our industry – has become the main security of the window

which again breaks the boundaries of conventional banknote design.

- Also in intaglio is the main text '30 Years of Guardian', which is created using the classical font 'Gaudy' used on the original 1988 Australian Bicentennial \$10 Commemorative.
- During the over-coating process the inclusion of covert, recycled polymer beads printed in UV ink. Under UV light, these beads light up brightly to make a statement on the hidden benefit of the polymer banknotes being 100% recyclable.
- On the reverse side of the note, a circular pattern of dots in CCL Secure's VIVID White, which features the 30 dots that represents 30 Years of Guardian on the market.
- The large vein artwork on the back of the hand is a beautiful aesthetic applied using VIVID ink which is printed during substrate opacification.
- The offset colours on the reverse of the note are similar to the first 1988 polymer banknote with the pattern at the bottom of the note kept to a minimum in order to enable the integrated shadow images to be viewed more easily.
- The screen-printing of a large section of the Window in an iridescent ink adds a noticeable pink hue that extends around the globe, giving it additional colour and depth.

"The larger window affords the opportunity to integrate more features, build more complex window edges, and enhances the



connection between the front and back of the note," says NPA Design Manager, Rob Cook. "With the 30 Years note, it's possible to see how larger windows will pave the way for a new generation of designs where banknote orientation becomes irrelevant and the design can be viewed holistically in multiple ways."

With the note manufactured, the original objectives were then reviewed, with the counterfeit deterrence expertise of the Reserve Bank of Australia's Dr Sani Muke called upon to provide an objective assessment of the note.

Dr Muke's initial commentary focused on the fact that no window design should be simple and it should avoid simple contours as this makes it more difficult for the counterfeiter to cut and substitute the window area. This is the very reason why vignettes and window edge designs are so important – besides giving the window a spectacular aesthetic, the mix of complex edges and irregular shapes makes the clear window much more difficult for the counterfeiter to cut-out and replace.

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In considering the original objective of exploring the use of traditional features in which the design of these features alone might enhance the counterfeit resistance of the note, Dr Muke gave three important insights:



The super-sized clear Window, with its integrated security, commands the attention of the user as they naturally use the whole window area for authentication. That is to say, you can't look at half the window area – the whole must be considered, which means that the note user is looking at a larger area of the note.

Technology:

In considering the space in which to place security features, the larger window size creates the platform for more technologies to be used to create a complex window, which also enhances counterfeit resistance. In this case, traditional security features such as intaglio and iridescent ink were designed to cover much larger areas than normal, and were able to deliver an enhanced visual effect in the process.

The same principle can be applied to any combination of security features, with NPA printing polymer banknotes in which a foil or Spark LIVE is contained within the window area.

Counterfeiter:

Given these two factors, the counterfeit challenge is made all the more difficult as the size and complexity of the enlarged window requires the counterfeiter to attempt to credibly simulate more of the note which can also incorporate more security features, all of which the counterfeiter must recreate because the note-user is naturally focusing on this larger banknote area.

Could this represent another paradigm shift in polymer banknote design?

Redefining the shape and function of the window to create a striking visual

proposition for the user and a more integrated and complex challenge for the counterfeiter offers exciting possibilities for future polymer banknote design.

The 30 Years of Guardian Note by Note Printing Australia is therefore a fitting tribute to polymer banknote technology. While honouring the achievements of the past, this note shows that through innovative banknote design, there remains untapped potential for polymer banknotes to further assist the banknote user and deter the counterfeiter.



NOTE PRINTING AUSTRALIA

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BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 CURRENCY RESEARCH ISSUE) 06.20

ADDITIONAL INSIGHTS



The World's Resource for Currency Knowledge

THE CASE OF CASH

Without a doubt, the cash industry is currently in a state of transition. That's why, at the 2019 Currency Conference in Dubai, Currency Research (CR) released the Cash Industry in Transition Report. In it, we detailed our vision for a future less-cash society, as well as the many challenges the industry is facing now and into the future.

The cash industry is now operating in a changing environment with its primary product, cash, experiencing declining transactional use. While banknotes and coins will not disappear as rapidly as the payments industry is predicting, neither will they endure for as long as — or at the volumes — the mints and printers expect. Let us be clear, CR does not forecast the imminent end of cash or the rapid onset of fully cashless economies.

We are a tireless supporter of cash and the consumer's right to choose. But we do point to a trend of declining transactional cash usage and therefore less cash, in some countries quickly and in others more gradually. There is no one-size-fits-all prediction; however, this global trend cannot be ignored or glossed over. Companies, and indeed countries, must step up their preparations for the eventuality of less cash.

While the media tends to focus on the external influences on declining cash usage, such as the rise of contactless cards and mobile payments, internal developments within the industry also have a significant impact on the companies that produce banknotes and coins.

Longer lasting and more secure banknotes are dramatically affecting the bottom line of the banknote production industry. How can the industry keep pace in a dynamic and shifting payments environment?

We anticipate that to keep up, cash will continue to undergo transformation at the hands of innovators. We envision, for instance, a single-use banknote that is destroyed at the point of sale (after imaging and serial number verification, etc.). Or perhaps we will see a digital note that can be switched on and off, thereby avoiding expensive and risky transportation costs. This type of forward thinking by our industry will create new opportunities and will prolong the use of cash as a payment method.

CR sees first-hand which companies are prepared for, or are preparing for, the future. We have assisted central banks, print works, and mints in defining their cash circulation strategies and their "what-if" transitional strategies. Further to this, more than 25 years of hosting events has granted CR an invaluable longitudinal perspective on trends shaping the cash industry over time

Through our Cash Cycle Seminar series, we see the relationship between cash and central banks/commercial banks/cash management companies unfold on a country-by-country basis, a regional basis, and a global basis.

CR's larger events, the Currency Conference and the Banknote Conference, provide us with a window into the latest currency policy and technical innovations emerging out of central bank currency departments, state printworks, and the industry in general.

Our joint ventures, the Coin Conference, Currency News, and Cash and Payments News, allow us to keep up to the minute on developments affecting banknotes and coins.

But it was not until our shift to include digital payments that CR started to understand the profound impact that the payments industry is having on cash and central banking. Now our Central Bank Payments Conference and Central Bank Payments News provide us with a global perspective on policy and technology developments as they affect the central banks and regulators.

And finally, the Global Payments Seminars assist in our understanding of the relationships between central banks, regulators, commercial banks, card companies, payment providers, and fintech firms. We see first-hand the advent of new payments technologies and the disruptive powers they may bring.

From our publications to our events, we see the consumer experience being the key driver for innovation in payments. We also witness both industry and governments focusing on making payments frictionless and cost effective, while also worrying about those increasingly left behind in a digital world.

By means of our core initiatives, CR fosters efficient, secure, and optimal cash production, handling, and usage, while supporting citizens' right to cash as a viable payment option. Equally important, we support the central bank's efforts as an operator, overseer, and/or catalyst for a robust, safe, and secure payment system that balances the demand for both physical and digital payment methods.

In supporting education and knowledge sharing within and between the cash and payments industries, our overarching goal is to help improve the lives of people by supporting their right to access faster, cheaper, and more secure choices in payments, regardless of their economic standing.

Now at Banknote 2020, we release the updated Case for Cash report. Following the first two installments released in 2014 and 2015, the 2020 edition again focuses positively on the case for cash and the critical role that cash, and indeed the central bank, plays in society. As described in the report, CR continues to believe that physical currency is a proactive tool that central banks can use to counter commercial interests that do not serve the common good.

We know that the availability of banknotes and coins ensures that a nation's citizens have an active choice in consumer payments and stored value. Stability and confidence are the recognized pillars of central banking, with banknotes and coins playing an important role as a tangible embodiment of the central banking system. Their everyday use is a constant reminder to citizens of both the stability of the nation and confidence in the central bank and, by extension, the nation's government.

Although cash is in transition, our research indicates that central banks and the currency industry are continually evolving coins and banknotes to meet the needs of citizens and to stay efficient and effective in today's world.

The Case for Cash 2020 also serves as a reminder to the central banks and governments that citizens trust and value cash due to its many social and economic benefits. It promotes financial inclusion and provides

security in times of crisis. Cash encourages responsible spending and fosters national pride, while also playing a role in educating citizens and visitors about a nation's culture and history. Furthermore, it is valued as an anonymous, secure, and confidential payment method and its continued availability to the public prevents social unrest. Economically, cash is an efficient means of payment and provides protection from commercial fees and government interference in central bank policy.

Since our shift to include digital payments, we have found it very enlightening to view cash from an alternative perspective. At our payments events around the globe, CR regularly sees the payments industry comparing its various solutions to physical currency; all payment schemes old and new are inevitably held up to cash as a benchmark. To be considered viable, it is commonly agreed that the solution must be "as good as" cash.

As we first pointed out in the 2014 edition of The Case For Cash, new methods of payment must be: As easy to use as, as flexible as, as secure as, as confidential as, as fast as, as universally accepted as, as reliable as, as high tech as, as unquestionable as, as identifiable as, as reconcilable as, as immediate as, as irreversible as, and most importantly, as trusted as cash.

Despite the proliferation of new digital payments solutions across the marketplace since 2014, we can confirm that the only payment mechanism that solidly meets all of these criteria remains CASH.

CURRENCY RESEARCH

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Website: www.currencyresearch.com



UPCOMING EVENTS:

- CR ASIA CASH CYCLE SEMINAR (ICCOS) | MANILA, PHILIPPINES | 7 9 SEPT 2020
- CR BANKNOTE CONFERENCE | WASHINGTON, D.C, USA | 2 5 NOV 2020
- CR EUROPE CASH CYCLE SEMINAR (ICCOS) | AMSTERDAM, NETHERLANDS | 6 8 NOV 2020*
- CR AMERICAS CASH CYCLE SEMINAR (ICCOS) | ORLANDO, USA | 30 NOV 3 DEC 2020
- CR MEA CASH CYCLE SEMINAR (ICCOS) | JOHANNESBURG, SOUTH AFRICA | FEB 2021
- CR CURRENCY CONFERENCE | MEXICO CITY, MEXICO | 16 20 MAY 2021

* (postponement from March schedule)







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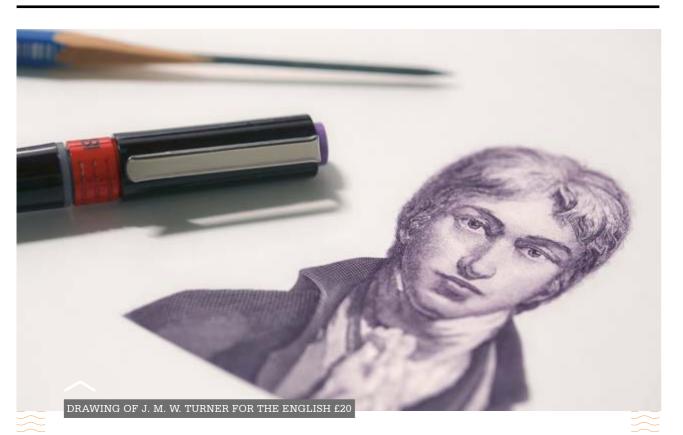
DE LA RUE

SAFEGUARD® - BEYOND CLEAN, GREEN, DURABLE AND SECURE

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THE TRANSITION TO POLYMER

The security, cleanliness, durability and environmental impact of banknotes are an ongoing concern for central banks and to polymer. 1,2

Polymer banknotes are less porous than paper banknotes, picking up dirt less easily and remaining cleaner over time. On average they last longer in circulation as well, with consequent financial and environmental benefits. If notes look better and last longer in circulation they are returned for sorting less often, carbon footprint decreases and the banknote replacement rates go down.1

THE INTRODUCTION OF SAFEGUARD®

SAFEGUARD® was launched in response to central bank demand in 2012 and has become De La Rue's fastest growing product, with 45 circulating denominations already being issued by 24 issuing authorities.

SAFEGUARD® is now well established. Eight issuing authorities, including the Bank of England, have selected it as part of their dual supply polymer strategy. have been the drivers for some to transition
It is provided as finished banknotes to central banks and as substrate to state printing works and commercial banknote manufacturers. Counterfeit rates, 3rd party environmental impact assessments, visual inspections and cash cycle analytics have proven it as cleaner, greener, more durable and more secure than paper banknotes.

EXCEPTIONAL PRODUCT DESIGN

Where SAFEGUARD® goes beyond this is exceptional product design from first concepts to finished banknotes and De La Rue's expert support at every stage of the process to establish polymer banknotes in the cash cycle.

The award-winning Bank of England £20 provides a recent case study for introducing new banknotes on SAFEGUARD® with De La Rue passing the rigorous qualification process and working closely with the Bank on design and manufacture of this technically complex banknote. Sarah John, Bank of England Chief Cashier, said "We have worked very closely with De La Rue on this note, from the initial design through to the mass production, and are very pleased with the result."

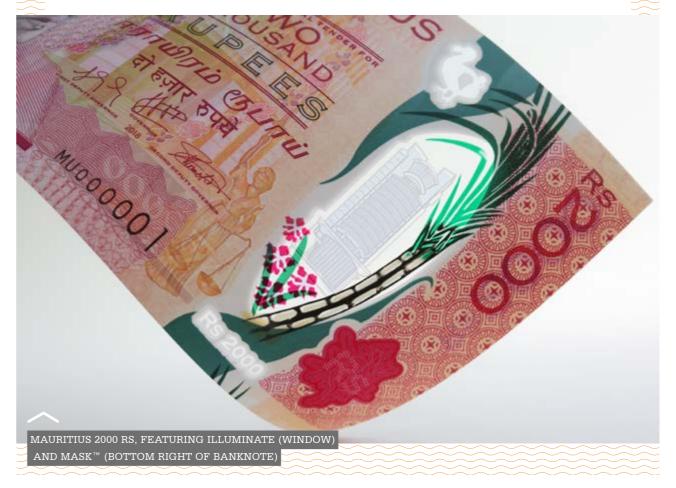
New banknote designs need to bring to life the vision of the bank and in this instance, with artist J. M. W. Turner featuring on the note, it was important to stay true to the spirit of his work whilst capturing the beauty and magnificence of his Fighting Temeraire painting. The incredible attention to detail is apparent throughout, for instance the colourful sunset to the right of Turner is true to the original painting. Every shape

has meaning and purpose related to Turner. Everything featured is functional, designed for manufacture and aesthetically pleasing.

INNOVATIVE INTEGRATION

This attention to detail and seamless integration is apparent throughout all De La Rue banknotes. As the only global banknote printer who also produces polymer substrate the knowledge gained from running print sites in the UK, Malta, Sri Lanka and Kenya is incorporated into the SAFEGUARD® design from the start.

Print designers and substrate designers work in one team, leading to innovative integration, such as having windows in the image of the Mound building in the Bank of Scotland polymer series as actual windows. All-over iridescence and print marks can



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layer the security and replicate themes to amplify the story of the banknote, as seen in the Maldives new series. In the new ECCB banknote series a hummingbird in the holographic foil is positioned close to a flower that it feeds from that is printed in strong fuchsia gravure in the second window. Every SAFEGUARD® banknote bespoke design detail ties together the substrate to the security feature and finished banknotes

EXPERTLY LAYERED SECURITY

Windows are fundamental to the security of polymer banknotes and De La Rue continues to innovate in this area, with more secure and more impactful windows. The Mauritius 2000 Rs banknote was the first example of a polymer window design using a new design technique, Illuminate, to inject vivid colour into the window. Illuminate uses a combination of inks, including matte and iridescent inks, and this example combined coloured gravure and white print marks to generate a striking window, framed by sugar cane.

With De La Rue SAFEGUARD®, banknote security is layered through the substrate and multiple print and security features are compatible with the banknote. Argentum is incorporated into the SAFEGUARD® substrate as free-form silver mirror-like patterns and shapes. $MASK^{\tiny{\text{TM}}}$ appears as a block of pattern when viewed normally but reveals numbers or letter when the banknote is held up to the light. Gemini™, shown as squirrels on the Royal Bank of Scotland £20, allows an image to appear as a single colour in visible light that becomes two colours when illuminated with UV. Malcolm Buchanan, Chair, Scotland Board, Royal Bank of Scotland, said: "Thanks to De

La Rue technology, these notes are cleaner, more durable and more secure than their paper predecessors."

Holographic stripes offer an additional level of security and another way to integrate the themes of the banknote. Great holograms tell a story, using depth, animation, threedimensional images and striking movement to enhance the beauty and security of the banknote. Recent holograms on SAFEGUARD® have raised the bar; clouds appear behind a statue and stars switch on and off in the Bank of Scotland £20 hologram, described by Richard Hill of the Bank of Scotland as their "most impactful hologram to date." A spider crawls across a web and Robert the Bruce appears in photorealistic three-dimensions on the Clydesdale Bank £20. De La Rue holograms require bespoke imaging equipment and are nearly impossible to replicate using commercial technologies.

COMPREHENSIVE END-TO-END SUPPORT

De La Rue has supported new banknote introductions for over a century, having been responsible for the design of 1/3rd of all circulating banknotes in the world and supported countless public education campaigns. As the Eastern Caribbean Central Bank began issuing its new family of banknotes Governor Antoine said "Leveraging its global experience with polymer, De La Rue has been invaluable throughout this process."

Our seamless SAFEGUARD® introduction process involves an assessment of your current counterfeit threat level from a team that serves as expert witnesses in the UK courts, including one who has worked







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for the US secret service. We analyse your cash cycle for the likely impact of moving to polymer using our multi-award winning DLR Analytics $^{\text{\tiny M}}$ team and digital cash cycle analytics tool. Our (also multi-award winning) design team explores the functional requirements of your cash cycle, themes and concepts to ensure that that end banknote will ultimately be one to be proud of.

We go above and beyond to minimise the environmental impact of SAFEGUARD® and our Carbon Neutral Banknote Service is currently a finalist in the IACA 2020 Technology Awards. This service enabled the Central Bank of Samoa to issue the worlds' first carbon neutral banknote. Governor of the Central Bank of Samoa, Maiava Atalina Emma Ainuu-Enari, has said "We are extremely proud of the new commemorative note" and "thankful to De La Rue for their close collaboration

throughout this project and supporting us in developing our first carbon neutral banknote."

For commercial and state printing works our extensive technical support, from qualification to launch and beyond, draws on the knowledge and experience of running banknote manufacturing sites responsible for a highly diverse job mix in Malta, Kenya, Sri Lanka and the UK.

The seamless process, exceptional product design and expert integration of SAFEGUARD® into the finished banknote combine to ensure that SAFEGUARD® goes beyond being just cleaner, greener, more durable and secure.



DE LA RUE PLC

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1.https://www.bankofengland.co.uk/knowledgebank/why-are-nebanknotes-made-of-polymer [Accessed 1st May 2020]

2.https://www.imf.org/external/pubs/ft/fandd/2016/06/currency.htm





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HUNKELER SYSTEME

BANKNOTE DESTRUCTION WITH A SYSTEM SAFE AND RELIABLE

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TAILOR-MADE ENGINEERING

Our Software department is an integral part of the Engineering department. The close collaboration with Sales and Project Management teams ensures custom-designed and tailored solutions, which we integrate into the customer's own operating schedules and processes, as well as into the space available.

MORE ENVIRONMENTAL PROTECTION AT LESS COST

The GreenLineConcept economises on energy and brings about a noticeable drop in running costs. The intelligent control system optimises the performance of the system and reduces maintenance.

WORKFLOW | MONITORING SOFTWARE

When high security documents are destroyed correctly, reliability and process security is of enormous importance. Careful logging records the process: From access authorisation via PIN-Code, through the fully-automatic feed with robot technology on to the ejection of the shredded material in the form of compact briquettes.

THE FIRST CHOICE IN ALL ASPECTS - NEW HUNKELER COMPACT SYSTEM

A noteable bank equips their six branches with new sorting and shredding plants. Hunkeler Systeme AG presented a convincing concept and won the tender. The bank has ordered six plants for the destruction of bank notes from Hunkeler Systeme AG. The bank will install them next spring in six branches in various parts of the island. Thus the bank changes from a centralised to a decentralised destruction of bank notes. Not only will the bank increase security but it will also save on costs, as transport from the six branches to the headquarters will no longer be necessary. The system had to be suitable for installation in small rooms. An automatic process with single- step shredding and a particle size of according to security level P4 was required.

INTERESTING QUALITY-PRICE RELATIONSHIP

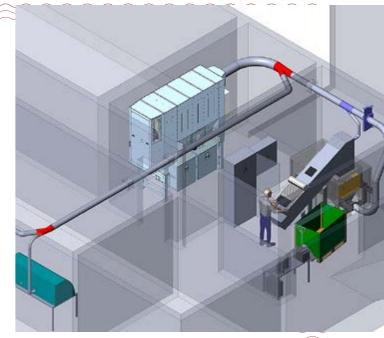
The concept, as developed by Hunkeler Systeme AG, met all the specifications. For the bank, not only the high level of automation and the compact construction, but also the very interesting quality-price relationship were decisive factors for choosing Hunkeler Systeme AG.





SECURE DESTRUCTION ON LITTLE SPACE

The Hunkeler Compact Buffer HCB 600 stores up to 600 kilos of banknotes an hour. It requires four times less space than other systems with a comparable performance. Hunkeler Systeme AG presents the new HCB 600 (Hunkeler Compact Buffer) for the secure destruction of bank notes. The feed and shredding processes take place fully automatically with a shredder and a downstream granulator. Manual intervention is not necessary. The system is fully protected against unauthorised access. The HCB 600 is scalable, possible operating performances range from 200 up to 800 kilos of material an hour. The bank notes packets are stacked vertically and transferred via a Paternoster to a conveyor belt at the back, which transports the packet to the shredder. Thanks to the Paternoster principle, the HCB 600 is a compact construction. It requires four times less space than a conveyor system with comparable performance.



HUNKELER SYSTEME AG DEVELOPS AND SETS UP ROLL SPLITTING SYSTEM

A well-know customer has been working with a new roll splitting system since the spring. It is part of an integrated shredding process which ensures an irreversible destruction of substrates for bank notes and identity documents.

SWISS CUSTOMER IN PAPER MANUFACTURING

By order of state authorities and central banks, the customer produces substrate for identity documents and for the printing of bank notes. The products undergo a strict internal quality control. Substrate rolls which are faulty must not leave the production operation and must be destroyed in an absolutely secure internal process. For this purpose, new roll splitting system was installed in spring. The system shreds the substrate rolls in an automatically controlled process in 20 to 60 centimeter stacks; this value can be set as required.

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SECURE SHREDDING IN A CLOSED SYSTEM

The Swiss customer engaged Hunkeler Systeme AG for the engineering and the installation. The suggested concept has fulfilled in an optimal way the need for a secure and at the same time efficient shredding process, as the customer says. With this statement the customer is referring here to the closed system, which includes not only the splitting process, but also a shredder with two shredding grades and a granulator. The end products are particles, which correspond to security level P5. They are turned into compact briquettes in a press and are re-used as admixtures in the manufacture of various other products.

INTERNAL RECYCLING OF VALUABLE MATERIALS

Previously, the splitting process and the following shredding were not two connected operations. To split the rolls, our customer worked with a hydraulically driven gib head, which had to be manually operated. Shredding was laborious and slow; transporting the material to the shredder plant meant long distances had to be covered. The company took advantage of the investment in the new splitting plant and reconsidered the layout in favour of shorter transport routes and a more efficient shredding process. In contrast with the earlier gib head, the new splitting plant is set up at the cutting area, exactly where the rolls are cut. Additionally, the transport belt exits from the splitting plant in two directions. The forwards and backwards mode means that that scrap material resulting from when a new order run on one of the paper



machines is not sent to the shredder but trans- ported in the other direction to the waste container. This high-quality material is re-used in stock preparation. And because the material is pre-shredded, it disintegrates in the pulper relatively quickly.

THE SYSTEM ENSURES ECONOMIC PRODUCTION OPERATIONS

The Swiss customer has been working with the new plant for almost ten months. What is the verdict? The better speed in particular was mentioned. In that the rolls are split into small pieces, the shredder performance is increased by 20 per cent, compared to the previous system, the customer says. The rapid and logistically correctly arranged system for the splitting and shredding of the substrate rolls is an

obvious benefit for the economic efficiency over the entire production operation.

Large roll splitter with combination of tipping device for all other materials like sheets.

BANKNOTE INVALIDATION

Decentralised invalidation of banknotes with the Hunkeler Banknote Puncher. A variety of punch patterns are available for this semi-automatic compact device.

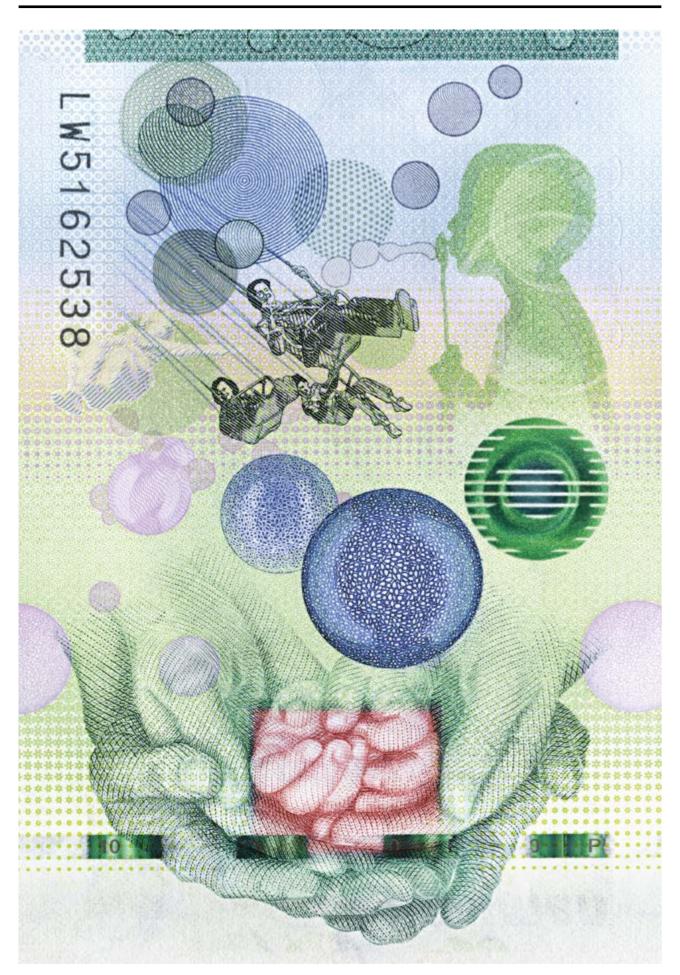
HUNKELER SYSTEME AG

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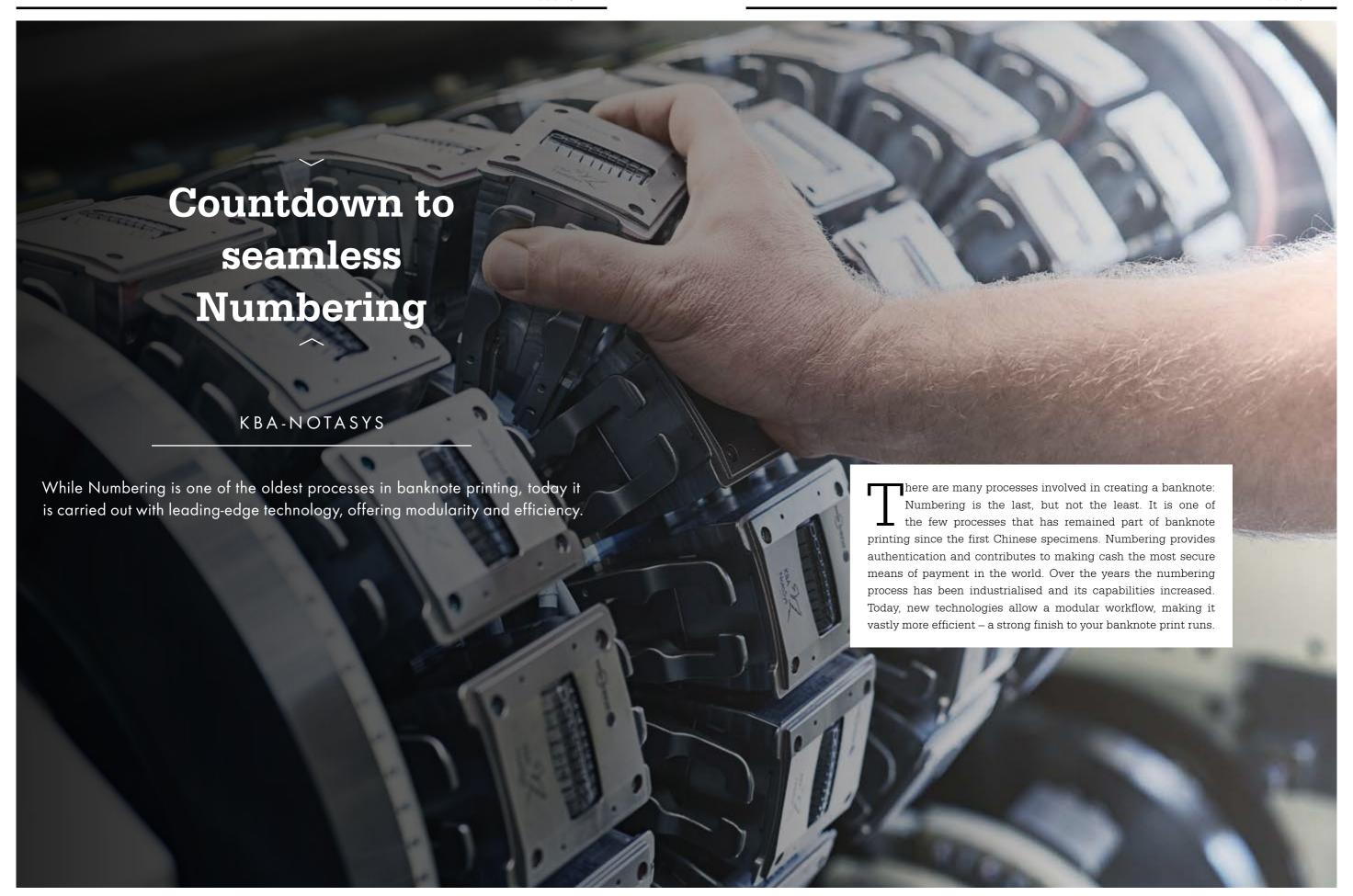
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KBA-NOTASYS

COUNTDOWN TO SEAMLESS NUMBERING

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 KBA-NOTASYS ISSUE) 06.20



BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 KBA-NOTASYS ISSUE) 06.20

THE AIM: A SEAMLESS PROCESS

The serial number provides each single banknote with a unique identity. For central banks, this number allows for authentication and provides information about the issuing country and the printworks. For the public, it is an easy-to-understand feature with a clear and simple purpose: authenticity. For printers, numbering is the final step before finishing, including cutting and packing.

This stage brings certain challenges: sheets have already run on at least two machines, if not four. The result is a mix of good and partially-good sheets that need to be numbered. The objective is to be as efficient as possible and increase uptime, knowing the challenges. The first solution is to combine numbering with other processes, such as inspection and varnishing, in one seamless workflow.

MODULARITY FOR GREATER EFFICIENCY

INSPECTION

Through algorithms, inline inspection systems perform quality controls to ensure that a user-defined quality level is maintained up to the maximum speed of the machine. The operator receives realtime information on print quality through a large screen displaying live images from the current production run. For example, KBA-NotaSys UVSaveXT continuously controls inking and print quality from a single control console. When defective notes are identified, they are highlighted according to a colour code giving precise information on the type of defect: this allows for quick corrective actions on the press.



VARNISHING

With varnishing, banknotes remain in perfect condition for a significantly longer period. A very thin protective layer, a mere 2-3 microns, is applied without any impact on look, feel or functionality, as a varnished banknote is virtually indistinguishable from its non-varnished equivalent. Varnishing is only beneficial for the cash cycle and is fully environmentally friendly.

COMBINATION

A classic numbering machine such as KBA-NotaSys Super Numerota III can be upgraded with modules to combine these processes and become a Check NumeroProtecta. It will inspect, number and varnish banknotes to prolong their lifetime and to guarantee the highest quality. Those modules allow any printworks to build their own combination.

At KBA-NotaSys, we offer up to 7 different solutions to match with your specific needs, either configured from the beginning or with elements added at a later stage as needs evolve. Such integrations allow for significant space gain in printworks while also reducing additional labour.

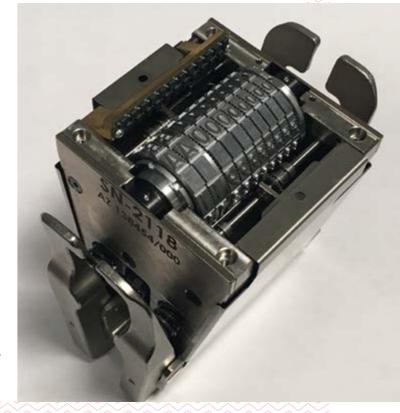
AUTOMATION WITH NBX NUMBERING

Once your machine type has been defined and configured, a second option is available that will greatly influence productivity: numbering boxes. Today, numbering can be performed by two different methods:

 conventional numbering, which is mostly based on mechanical or electromechanical boxes. automatic numbering, which works electronically through sophisticated software and 12 servomotors, each one controlling a single wheel.

KBA-NotaSys NBX numbering boxes belong to this second category. NBX software allows you to set almost any numbering scheme. It automatically determines the positioning of the wheels, drastically reducing manual operations. To gain further improvements, tailor-made programmes can be created and added at any time to address customers' specific needs.

The sophisticated technology and quick clamping system allows NBX to reduce numbering errors and ease job preparation and maintenance, while guaranteeing absolute alignment and therefore precision, all at the same time.



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ALTERNATE NUMBERING SCHEME FOR INCREASED PRODUCTIVITY

As the final step in the banknote printing process, numbering inherits the results of previous work done. Some sheets may contain only banknotes with defects while others have just a few, or none. In any case, all sheets, including defective notes, must be numbered.

With regular systems, partially good sheets need to be sorted in order to be reprocessed later by the same machine: they would then be numbered and the good banknotes recovered. This generates additional work and need for storage, among other disadvantages.

Thanks to KBA-NotaSys's alternate numbering scheme, in combination with our existing inspection and numbering systems, it is possible to entirely skip the sorting and reprinting. When the inspection system detects a defective note, the NBX boxes switch automatically to the alternate numbering scheme. This way, the numbering of the good notes and the block-marking of the notes with errors can be performed at the same time. This technology allows you to fully eliminate subsequent paper reprocessing, leading to an immediate reduction in production time and costs.

- The generation and inventories of paper for reprocessing in numbering are eliminated.
- Risks, delays and cost overruns are reduced, thanks to the single production

NUMBER YOUR WAY

While it has endured throughout banknote history, numbering is constantly evolving and offering new functionality. Options are numerous, with multiple integration solutions, various choices of numbering boxes, and features such as the alternate numbering scheme. All these, however, have the same objective: optimise your production through the highest quality, complete modularity and reduction of labour, storage and space. Today, you can choose to number your way.

At our 2020 Banknote Horizons event, you will be able to learn even more about our latest innovations in this area. Stay tuned!

KBA-NOTASYS

Carole Malet

Email: marketing@kba-notasys.com Website: www.kba-notasys.com



MOTION SURFACE®

REIMAGINING BANKNOTE SECURITY

MOTION SURFACE is the latest security feature from Crane Currency. It is applied in the printing works and provides endless opportunities to engage the public by bringing to life the security and value of a banknote.

MOTION SURFACE is built on the technology behind MOTION[®]. Crane Currency's micro-optics technology is widely recognized as the state-of-the-art counterfeit deterrent technology for banknotes.

Winner of Best Currency Innovation 2018 - IACA



SECURE by DESIGN

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20



PWPW POLISH SECURITY PRINTING WORKS

PWPW HOUSE NOTE "POLISH BISONS" DURABILITY AND UNIQUE SECURITY FEATURES

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20

PWPW House Note "Polish Bisons" – durability and unique security features

PWPW POLISH SECURITY PRINTING WORKS

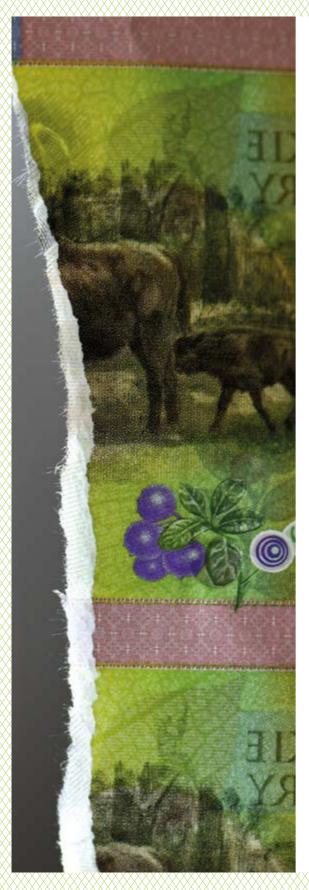
The "lifespan" of banknotes has been the subject of research by central banks for many years. These studies are based not only on the economic aspects, but also on the application of the appropriate security features of the banknotes and even on ensuring their proper cleanliness.

This article addresses the characteristics of the selected possibilities of enhancing the durability of circulating banknotes and it is PWPW's response to the market requirements in this respect.

The first historical references to measures to increase the lifespan of banknotes date back to the 17th century, when natural fibres were used for the first time in production. However, the most significant step took place in the 20th century, when the varnishes were put into production to protect the printing surface (around 1955 in Switzerland) and when synthetic fibres were mixed with cotton fibres.

At present, various solutions to increase the lifetime of banknotes are available. They are characterised by various features which are unique to each of them.

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Local atmospheric conditions constitute the first criterion for selecting the substrate for printing banknotes in a given country. Classic paper would be too fragile and more susceptible to mechanical damage (tears) in countries with high air humidity. In such conditions, the priority was, therefore, to increase the mechanical strength of the paper, e.g. by adding synthetic fibres to the pulp as well as to protect the surface against soiling by applying a layer of varnish.

In island or coastal countries, it has been reported that a large number of banknotes are destroyed by contact with water. A good example is Australia, which developed the first polymer-based banknotes in the 1980's, and the solution itself has become popular all over the world.

The second criterion is the manner of using and storing the banknotes. In many countries people do not carry money in classic wallets or pockets, with the consequence that excessive bacteria grow on the surface of the banknotes. In such case, it is a good solution to coat the paper with antifungal or antibacterial substances (so-called preprint coating) or to apply varnish on its surface.

Ecology has become more and more important nowadays, including in the field of banknote printing. At present, paper or polymer banknotes can be recycled directly, but this does not apply to the multilayer substrates.

"POLISH BISONS" BANKNOTE PROJECT

In response to global trends, PWPW carried out a project called "Polskie $\dot{\mathbf{Z}}$ ubry" (Polish

Bisons), which was based on developing a technological portfolio meeting the requirements of customers from all over the world.

Bison, identified with the strength and power of nature, have always played an important role in the history of Poland. They are present in many coats of Polish cities and noble families.

The same graphic design was used in many technological options. In this way, it was possible to present the differences between the solutions used in printing and suggest the best solution to meet the needs of the potential customer.

The following nine printing options have been selected:

- Classic coated cotton paper manufactured by PWPW (Fortis®), which is the reference point for the other options as the most economic and popular solution on the market.
- 2. Fortis® paper protected with Coat4Note® varnish made by PWPW, it protects both the paper surface and the print against environmental conditions and abrasion. The most popular form of protecting prints and the optimal costs-to-benefits ratio.
- 3. Fortis® paper protected with T-Coat4Note varnish based on the unique production method, characterised by higher protection against chemical solvents and soiling than its classic counterpart. Due to its higher grammage it also has a positive effect on the physical properties of printing.

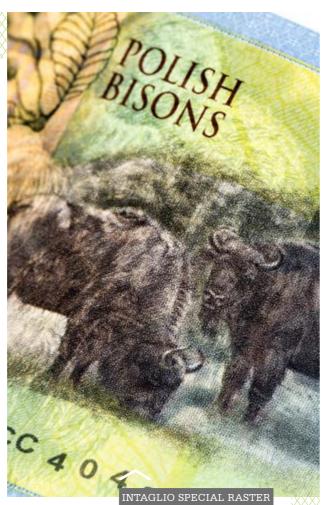




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- mixture of natural and synthetic fibres, which is reflected in better physical properties compared to classic paper (tear resistance, etc.) in harsh weather conditions.
- 5. Fortis® Composite paper protected with Coat4Note® varnish. In addition to the reinforced paper structure, the printing is also protected against environmental conditions.
- 6. Fortis® Pro paper with additional "antisoiling" coating characterised by further barrier properties against dirt.
- 7. Fortis® Pro paper protected with varnish to provide Coat4Note® additional protection against abrasion.

- 4. Fortis® Composite paper, which is a 8. Composite multilayer substrate (i.e. paper coated with plastic on both sides), which has significantly higher barrier characteristic and physical durability, but due to its very high price, recycling problems and poor print protection, it is very rarely chosen. The substrate has been coated with Coat4Note® varnish.
 - 9. Polymer substrate has high barrier properties and increasing the physical durability of the banknote. It is one of the most expensive solutions and characterised by poor print protection. This option uses Coat4Note® varnish protection designed for polymer printing.

In some cases, the differences between the substrates used are not visible at first



glance and can only be seen as a result of laboratory tests or after prolonged use of the banknotes in circulation. In this connection each banknote has a visual identity in the background, which makes it possible to distinguish them from each other.

UNIQUE SECURITY FEATURES IN THE "POLISH BISONS" DESIGN

The result of many years of work is also the application of unique solutions developed by PWPW used for the first time in this project; they include:

Aster4Note® is a security feature, created by combining advanced printing techniques: hot-stamping, intaglio embossing and digital graphic

processing methods. The inspiration for its creation was the desire to obtain an optical effect, the so-called asterism, occurring on the surface of precious stones, such as ruby or sapphire.

- Compass4Note® was created using unique mathematical methods of digital image processing, applied sequentially with intaglio print. It allows for combining multiple hidden images in one graphic element, with their visibility dependent on the angle of observation.
- Mirage4Note® is the result of a combination of digital imaging methods and modern intaglio inks. Unique line layout and ink properties cause the image to be invisible when looking

straight at the print. It is only with rising angle of observation individual elements of the latent image start begin to appear. The unique property of the feature is its independence of the substrate and background element.

- Umbra4Note® (Latin: shadow, eclipse) combines digital image processing methods with the use of modern optically variable inks. Specially designed line layout creates an "extra dimension" to the classic security feature for classic protection. Colours, shape and effect can be individually selected to match the complete design.
- The multi-colour latent image is a combination of offset and intaglio printing. The special line layout, printed as the background for the subsequent processes (intaglio print POLISH SECURITY PRINTING WORKS and embossing) allows for obtaining multi-colour images, which may be visible at an angle or while observing straight ahead.

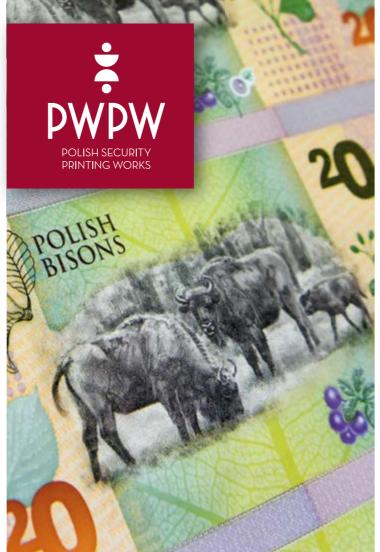
Moreover, many other modern solutions not described above, such as multicolour micro-text screening, screen morphing, embossed micro-text, rainbow printing, iridescent ink, colour shifting ink, seethrough and digital numbering containing a 2D code, were also used.

The "Polish Bisons" project enabled the application of unique technical solutions and security features as well as the development of printing skills on various substrates requiring various production approaches. Continuous improvement of banknote production expertise opens up the new markets and new development opportunities for PWPW.

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







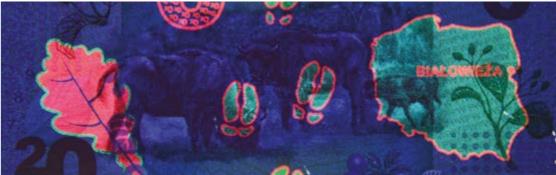


POWER OF THE **SUBSTRATE**









BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 GLEITSMANN SECURITY INKS ISSUE) 06.20



GLEITSMANN SECURITY INKS GMBH

ENVIRONMENTAL PROTECTION CONCERNS US ALL

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 GLEITSMANN SECURITY INKS ISSUE) 06.20

Environmental protection concerns us all

GLEITSMANN SECURITY INKS GMBH

Climate change was the focal theme of 2019, and it has the potential to keep society – pun intended – sustainably occupied for the next few years. The corresponding issue about more environmentally sound behaviour on the part of global society is omnipresent. And this has now been understood by industry as well. Many companies are investigating how they can act in a more environmentally compatible manner in the future. The topic has also gained in importance at Gleitsmann Security Inks (GSI) in Berlin.

"Environmental protection concerns us all," Ulrich Walter, Managing Director of GSI since the beginning of 2019, is convinced. "The environmental impact of the population and economic growth, and therefore also of production processes, is very real and cannot be ignored." Only if everyone makes a contribution, a sustainable improvement can be achieved. GSI began undertaking appropriate measures a few years ago under the lead of co-Managing Director Michael Fischer. "Our production processes naturally already fulfil all the regulatory requirements. But we want to do more and actively make the transition to a more ecologically sound production and greater occupational safety," emphasises Fischer. This is why the topic is now being considered at GSI from a holistic point of view. This includes small-scale activities such as converting to 100%-certified green electricity or installing LED lamps in the production halls. But Walter goes even further:

"Our goal is to double the production volume over the next few years while keeping waste levels and energy consumption constant or gradually reducing them."

mage: Adobe Stock

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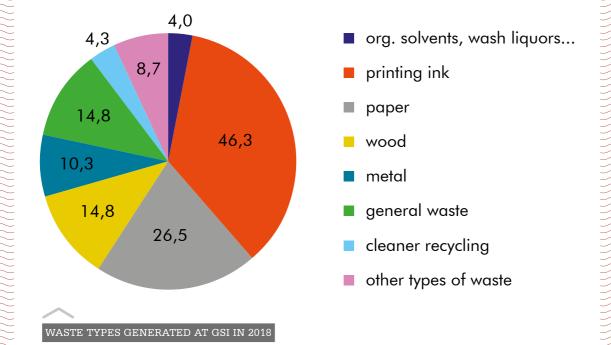
LEADING BY EXAMPLE

In this way, the company aims to be a pioneer in the industry. "We have always anticipated regulatory requirements and introduced improvements before they became mandatory," says Walter. "As an ink manufacturer we are very aware of our responsibility." More environmental and occupational safety has become a key issue for the industry. Several European and Asian customers of GSI have developed activities concerning the product environmental footprint of banknotes, and are investigating the human impact of the substances used during production. They establish regulations for manufacturers, for instance to avoid landfill waste. Accordingly, from 2021 manufacturers may no longer be permitted to generate landfill waste for certain customer jobs. This means that degradable materials must be used in the production. The use of pollutants and hazardous substances should also continue to be reduced.

GSI MEASURES TAKE EFFECT

In 2018, GSI generated a total of 129.7 tonnes of waste for disposal. This resulted in costs of over € 60,000. 40 percent of the waste, including scrap metal and paper, was recycled. GSI already reduces its waste wherever possible. For example, the contaminated washing solution is purified by a contract company and can subsequently be partially reused.

At the beginning of this year, GSI installed a smart lighting control system for the high bay warehouse. This saves the company more than 100 kWh of electricity every day at just one fifth of the previous power consumption. The lighting in the production hall was also converted to LED lamps. Furthermore, the heat distribution of the heating system was optimised and a rolling mill was converted to more economical frequency converter technology. Overall, the CO2 balance has been significantly improved: Compared



to 2016, the footprint was reduced by about two thirds in 2018. In 2003, GSI introduced a quality and environmental management system certified by TUV SÜD Management Service GmbH. It applies to the development, manufacture and sales of printing inks, coatings and additives, and for the application consulting.

NEW METHODS FOR MANUFACTURING INKS

GSI is breaking completely new ground as well: The company now also produces vegan inks. Here, vegetable instead of animal oils and fats are used for the requisite stearic acid coating. GSI is the world's only manufacturer of inks for banknotes to offer a product range of UV-curing, water-based screen printing inks. This is not just about protecting the environment, but also about occupational safety. Positive side effect: The ink has an enhanced colour change effect and a more pronounced sheen than conventional solvent-based inks. The water-based ink has been sufficiently tested and is technically easy to use. Banknote manufacturers only require a different screen quality in their machines," says Fischer about the new product. Waterbased ink is not only beneficial for the environment, but also for the banknote production employees. This is because it is odourless and no vapours containing harmful substances are emitted during evaporation in the drying process. The ink can also be washed out with water and does not require organic solvents.





DOCUMENTED VERIFICATION

GSI recently signed the "Responsible Care Global Charter" of the International Council of Chemical Associations and now follows its guidelines. Among other things, GSI commits itself to the safe management of chemicals throughout their entire life cycle. "Our goal is to better protect people and the environment by continuously improving the safety of our machinery, processes, technologies and products while keeping an eye on the entire supply chain," says Walter. Accordingly, the company also wants to approach its suppliers and partners and discuss with them how the handling of chemicals can be improved even further. Incidentally, at GSI more conscious behaviour involves not only environmental protection, but also compliance. The company is investing in this area as well. In November 2019, GSI became an accredited member of the Banknote Ethics Initiative (BnEI). This verifies that GSI complies with the most stringent international ethical standards in its business practices and the fight against corruption.

ACTION REQUIRED ON MANY LEVELS

The company has also set its course for the future with numerous measures to protect the environment. Among other things, it plans to create a fire water BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20



retention bulkhead in order to increase the volume for collecting substances hazardous to water. Other topics currently being evaluated and planned include the usage of machine waste heat, avoidance of overproduction, reusing excess production of inks, reduction of mineral oil, and the usage of more materials made from renewable resources. Organisational changes are also under discussion, such as a consistent switch to the "paperless office", forgoing the use of diesel-powered vehicles, or reducing the number of flights being taken. "We would like to fly less and instead hold video conferences more often. But to do this, we need the support of our partners and customers, who would have to agree to participate and who could also deploy digital communication technology. If we manage to fly less and communicate more via video, we will all benefit," says Walter.

USING UPCOMING EVENTS FOR COMMUNICATION

This initiative should not fall on deaf ears.

"I have observed that our customers in Asia in particular are formulating calls for tender

in which greater environmental protection plays a role," says Walter. Meanwhile, some calls for tender include checklists with evaluation criteria for more ecologically sound production processes. GSI views this development very positively. "We can achieve much more together than on our own," explains Fischer. Although the company has already implemented many measures, it certainly does not claim to have expertise in every area. This is why GSI wants to begin a dialogue with its partners on what the industry can undertake collectively, but also about what each individual company can do as well to achieve sustainable change. From Ulrich Walter's point of view, upcoming events such as the Global Currency Forum organised by the International Currency Association, which will be taking place in Barcelona in the autumn, are also the right and a key platform for sharing ideas and information. "We are looking for practical ideas on this topic, and we want to talk about the expectations for us and about new ideas for the industry as a whole. Both I and all my colleagues at GSI are prepared and willing to do so."

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Email: info.gsi@hubergroup.com Website: www.gsi-gmbh.com



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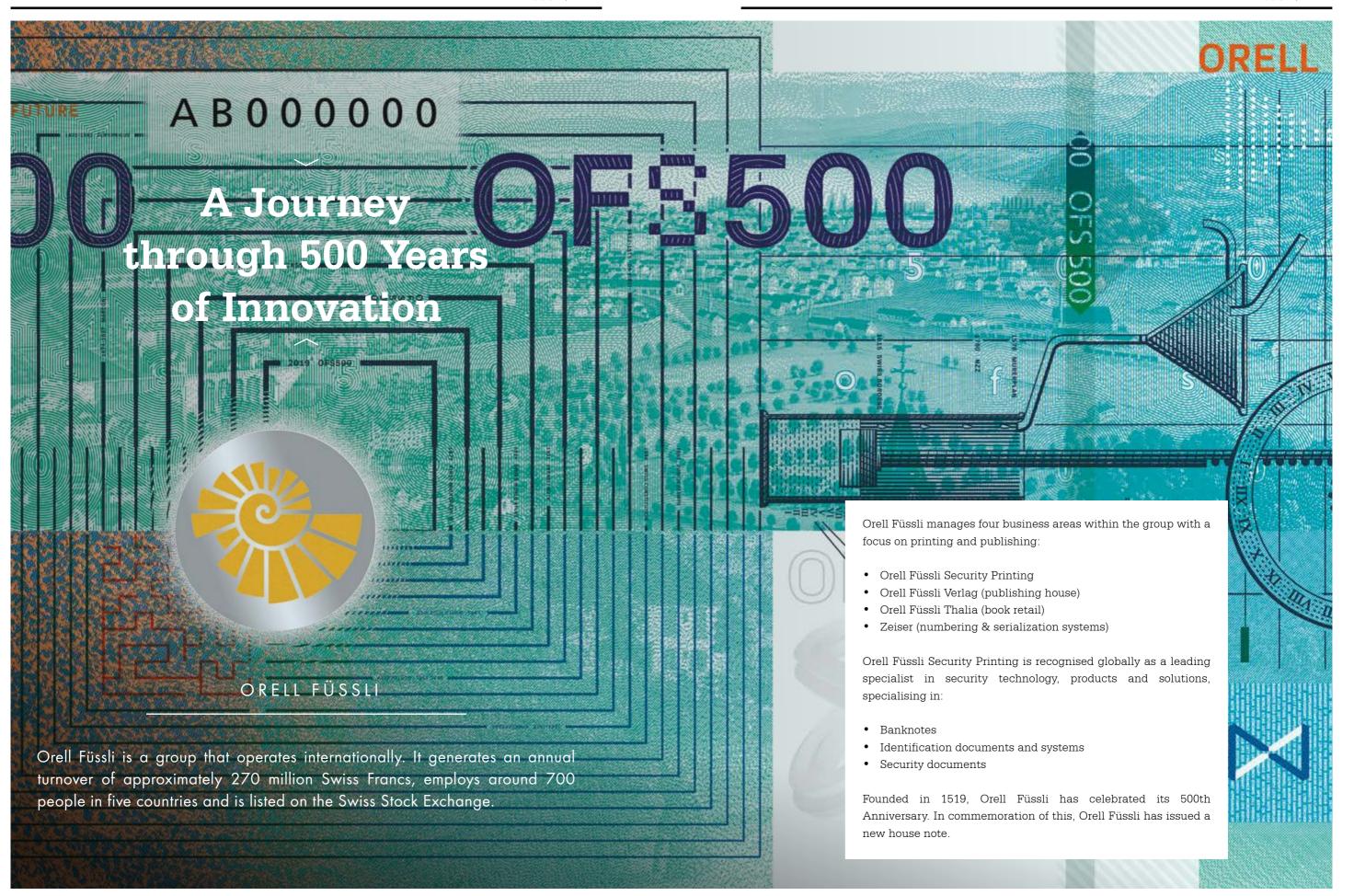
BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 ORELL FÜSSLI ISSUE) 06.20



ORELL FÜSSLI

A JOURNEY THROUGH 500 YEARS OF INNOVATION

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Orell Füssli has in fact produced three separate notes to commemorate this special occasion, each one differentiated by the choice of substrate. Their design is inspired by one basic theme: "Time".

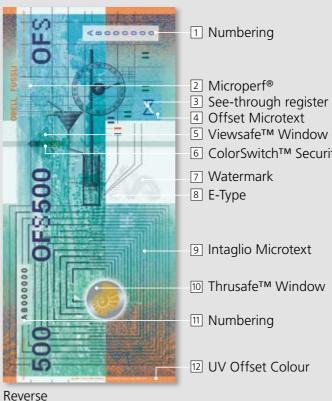
With a contemporary touch conceived by the Swiss designer Christophe Métroz, the uniqueness of the note consists of one single integrated design adapted to the technical requirements of the following three different substrate types: Cotton, halfmillenial event! Durasafe[®] and Guardian $^{\text{TM}}$.

The design is integrated and adapted according to the individual characteristics of each substrate. This underlines Orell Füssli's expertise in creating a wide range of tailor-made solutions for its customers.

Orell Füssli believes that its new house note is a fitting tribute to the unique skills of its printers, designers, scientists and staff, who along with Orell Füssli's customers join in celebrating this

THE FEATURES ON DURASAFE® AT A GLANCE (FRONT) 1 UV Offset Colour 2 SPARK® Live, Truespin dynamic effect 3 Microperf® 4 See-through register 5 Viewsafe™ Window (single-sided window) 6 Watermark 7 E-Type 8 TwinTilt Latent Image Thrusafe™ Window (fully transparent window) 10 OVI® printed on Polymer core 11 Intaglio Microtext Front TwinTilt Feature

THE FEATURES ON DURASAFE® AT A GLANCE (BACK)



- 1 Numbering
- 2 Microperf®
- 4 Offset Microtext
- 5 Viewsafe™ Window (single-sided window)
- 6 ColorSwitch™ Security Thread
- 7 Watermark
- 9 Intaglio Microtext
- Thrusafe™ Window
- 11 Numbering
- 12 UV Offset Colour

SPARK® is a trademark of SICPA

KINEGRAM® APL is a trademark of Leonhard KURZ Stiftung & Co. KG ColorSwitch™ Security Thread is a trademark of HUECK FOLIEN GmbH Guardian™ is a trademark of CCL Secure Pty Ltd Durasafe® is a trademark of Landgart AG

Durasafe®

The composite of paper and polymer, Durasafe®, has two outer layers of cotton banknote paper, fused together with a central core of transparent polymer.



The Thrusafe™ Window (fully transparent window) is overprinted with OVI®.

Cotton

The well-known properties of cotton guarantee a recognisable tactile feel.



KINEGRAM® APL, the innovative window patch solution from KURZ, is combined with a KINEGRAM REVIEW® feature.

Guardian™

A pure polymer core coated with multiple opaque layers to provide a durable, secure substrate.



The motif is printed on the Guardian™ Window.

ONE DESIGN ON THREE SUBSTRATES.

THE OFS TWINTILT FEATURE

This feature is produced with intaglio printing and is based on 3D relief structures. This latent image is an established and trusted security feature of banknotes, and usually consists of a single motif. If the banknote is observed at a shallow angle, symbols are seen in the printed picture, which in turn cannot be seen with the naked eye when looking directly at the note. Depending on the tilted angle, different symbols will be visible in lighter or darker colours.

From a flat viewing angle, the image flips from positive to negative when rotated from 0 to 90 degrees. Orell Füssli Security Printing Ltd has further refined this microstructure, by adding a second hidden motif that appears at the 45- and 135-degree. This special feature TwinTilt offers extremely high protection against counterfeiting by preventing reproduction using xerographic copying or scanner technologies.









TWINTILT™ FEATURE

ORELL FÜSSLI

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Bringing together key officials from Central Banks and Monetary Authorities

The first Currency Conference was celebrated in 1992 at the request of Central Banks and Issuing Authorities responsible for the Currency and Issue function, who recognized the need for a unique platform to address their specific interests and challenges, as well as their desire to network with their peers from other countries. Eighteen (18) very successful conferences later, the Currency Conference remains the premier industry conference for Central Bankers and Issuing Authorities.

The Currency Conference brings together key officials in the currency issuing and distribution departments of Central Banks and Monetary Authorities, printing works, and leading currency industry suppliers from around the world to share experiences and network with each other in a secure and engaging environment. We believe it is critical that we continue to provide a neutral forum for industry leaders to meet and discuss policy, efficiencies, best practices, and new strategies, as well as the latest technologies and solutions that benefit their operations.

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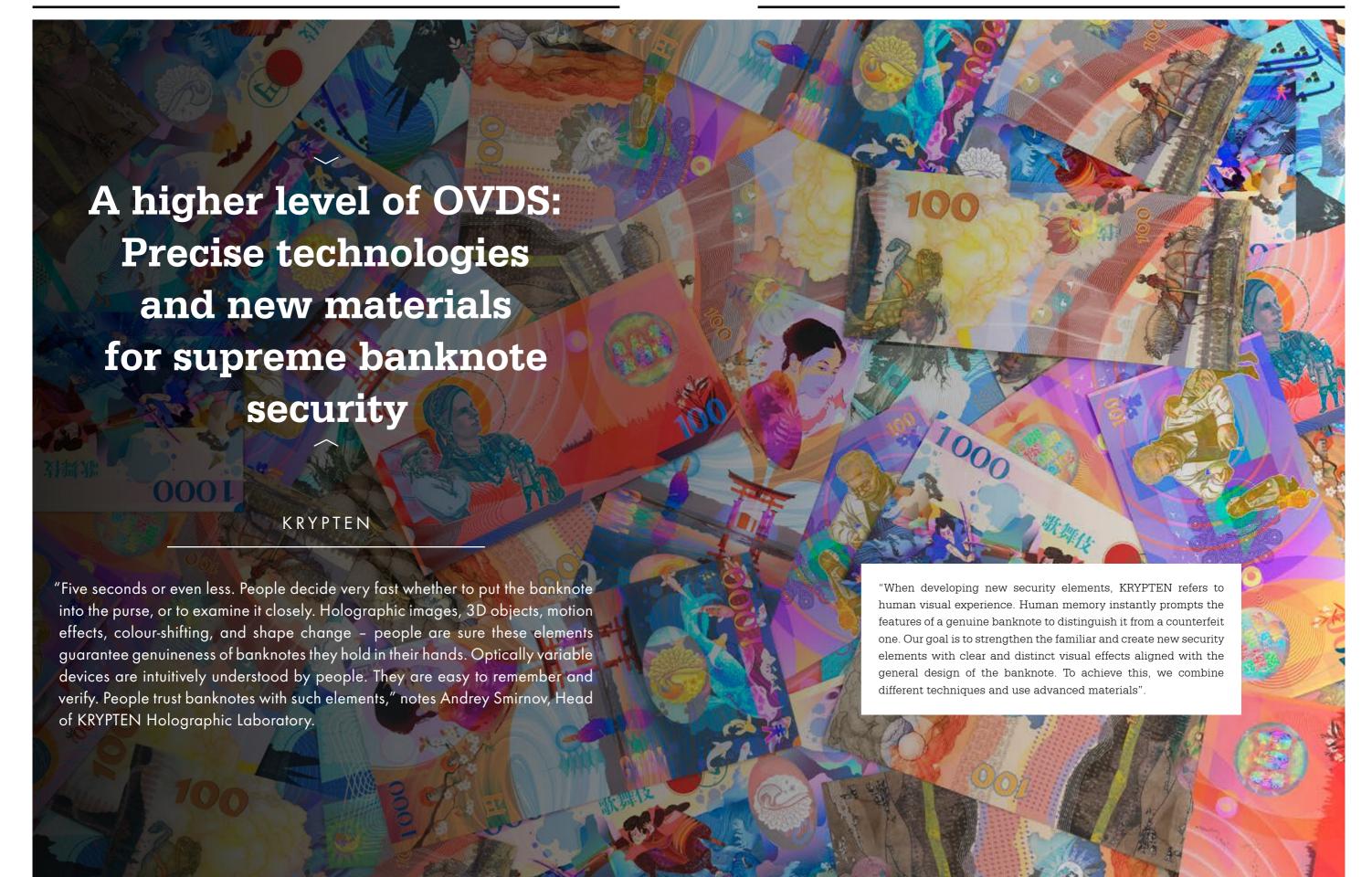
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KRYPTEN

A HIGHER LEVEL OF OVDS: PRECISE TECHNOLOGIES AND NEW MATERIALS FOR SUPREME BANKNOTE SECURITY

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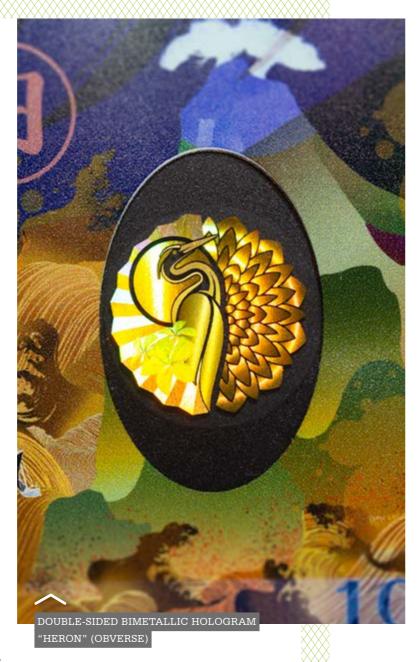
DOUBLE-SIDED BIMETALLIC HOLOGRAM

KRYPTEN has developed double-sided holograms that may be used for paper or polymer banknotes with windows. The new security elements are available in two variants. The first one is a double-sided bimetallic hologram with identical images on both sides of the element. The other one is a double-sided silver hologram with different images on the opposite sides of the security element.

Bimetallic holograms are made by spattering of different metals on the opposite sides of the item: gold on one side, silver - on the other. Complex technological processes allow 100% image tolerance between two sides of the holographic image. We obtain a two-sided element where the front side holographic image is inversely duplicated on the reverse side. Use of different metals in one item makes the element more technologically complicated and improves its security features.

Holographic optical element is made by high-precision micro-demetallisation (HPMD). This technology allows reproduction of design of any complexity. It may be an individual object or a composition. HPMD creates a highresolution image with precise details and distinct visual effects. Combination of different optical effects in the hologram design ensures extra security of the element.

The security features of a two-sided element are presented in a sample banknote "Samurai Clash". The bimetallic hologram reproduces an image of a angles. The colour contrast imitates a



heron in rays of the rising sun (obverse) and in the moonlight (reverse). Microdemetallisation creates distinct optical effects in different parts of the composition. The petals of the full-blown flower radiate iridescent colours.

The images of heron and sun (moon) change the gradient smoothly at different Japanese fan. A bas-relief effect is used to emphasise the flowers.

The concept of bimetallic double-sided hologram is apparent to people. The element's security features are based on the traditional contrast between gold and silver. People easily memorise the idea of the security feature and compare the hologram visual effects with interest.

DOUBLE-SIDED HOLOGRAM WITH IMAGE CHANGE EFFECT

"Russian Dolls" (Matryoshka) two-sided hologram displays the effect of image change on the opposite sides of the element. When looking at the front side of the hologram you see Russian Dolls. If you turn the banknote over, you will see a visual pattern of the nominal value -"100".

Only a few optical secure element suppliers in the world can make twosided holograms with different images. Manufacturing of secure elements with such features requires accomplishment of complex technological tasks. You need to reproduce two different images on the front and reverse sides of the hologram using the same mask, and to ensure precise positioning of different objects on the opposite sides of the element. This unique optical effect is successfully reflected in the "Russian Dolls" hologram by KRYPTEN.

Image change in the two-sided hologram attracts people's attention to the security feature. A clear visual effect does not raise any hesitations about the genuineness of the element. Two wellknown national symbols in one hologram



DOUBLE-SIDED BIMETALLIC HOLOGRAM "HERON" (REVERSE)

- HIGH-PRECISION MICRO-DEMETALLISATION (GOLD/SILVER)
- RAINBOW EFFECT ON "BLOSSOM"
- MOVING GRADIENT ON
- 'HERON" AND "SUN/MOON"
- BAS-RELIEF EFFECT ON "FLOWERS"
- COLOURS CONTRAST ON "FAN"

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contribute to fast memorising and unmistakable recognition of the security feature. Sophisticated manufacturing process almost excludes the possibility of imitation or counterfeiting of the element.

PHOTOPOLYMER STRIPE 3D-GRAM™

The reverse side of "Samurai Clash" banknote displays an innovative security element - photopolymer stripe with 3D-Gram™ hologram. KRYPTEN owns unique patented technologies of manufacturing photopolymer holograms with different optical effects.

Photopolymer holograms attract people's attention with the two features: colour selectivity and 3D effect. Compared to traditional holograms with rainbow colours, the image in 3D-Gram $^{\text{\tiny M}}$ holograms keeps its original colour at different angles. A hologram is originated in the inner polymer layer and recorded from real objects. That is why images have 3D effect and look realistic.

The reverse side of "Samurai Clash" Email: smirnov av@krypten.ru banknote displays a clear relief flower and

bright mirror logo of "Krypten". An intense shining colour and 3D effect attract attention to the images in the banknote. The images are well-seen even in transmitted light.

3D-Gram[™] technology creates elements with different optical effects: parallax effect, flip-flop effect of colours and images, shimmer effect, micro-lenses with kinetic effect, or micro-texts. Familiar holographic effects become more distinct with stable colour of the image. Photopolymer hologram 3D-Gram™ is available in red, green, blue colour, or their combinations.

Photopolymer stripe is made on a transparent layer and is laminated to the banknote. Thus, the image is seen from under the hologram. 3D-Gram[™] stripe is suitable for both paper and polymer substrates.

JSC RPC KRYPTEN

Andrey Smirnov

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PORTALS

SUSTAINABILITY DRIVEN BY TECHNOLOGY

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Sustainability driven by Technology

PORTALS

It's no secret that humans have been consuming resources at an alarming rate, the harmful effects are well documented. As sustainability becomes paramount, we must all play our part in addressing sustainability challenges head-on. In the currency industry, producing banknotes that balance a complex set of requirements; from security and durability, to design and cost effectiveness, has led to a value chain that is high in energy and resource consumption.

As we tackle these consumption rates and look at wider sustainability targets, could technology be part of the solution? Since its re-establishment as an independent papermaker just over 2 years ago, Portals has invested over £21m in technology based initiatives, many with sustainable manufacturing at their heart.

Portals is based in the North Wessex Downs, an area of outstanding natural beauty in the South of England. The papermaker also has the privilege of being located next to the River Test, one of finest chalk streams, world famous for its superb trout fishing. The river is designated as a Site of Special Scientific Interest (SSSI). Portals therefore takes its commitment to protecting its local environment, community and tackling wider industry sustainability issues very seriously. As an accredited member of the Banknote Ethics Initiative (BnEI), Portals also upholds strict ethical practice, which extends to the sourcing and use of raw materials.

The currency industry is responsible for the global production of over 170bn banknotes a year and with the level of cash in circulation expected to continue to grow by 3-4% a year, sustainability is high on the agenda for manufacturers, state printworks and central banks and governments alike. The production of banknote paper requires a substantial amount of energy, water and, of course, cotton. The question is what improvements can be made in these areas to ensure we can protect our natural environment and resources, whilst continuing to drive innovation and without compromising on the quality or security of banknotes?

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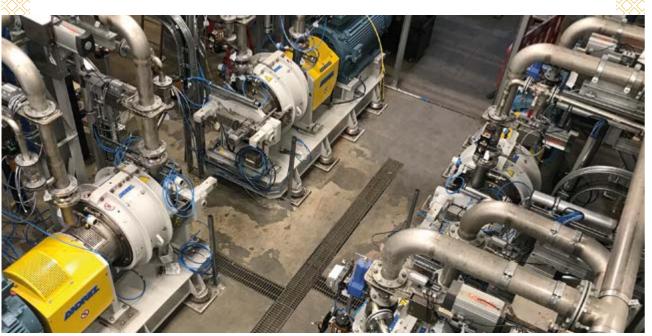
INVESTING IN SUSTAINABILITY

Over the past 18 months Portals has invested in excess of £13m upgrading the capability of one of its three paper machines. The investment programme has seen the removal of obsolescent technology and replacement of much of the 'wet end' of the machine. Working with a number of technology partners, the papermaker has introduced new press configurations and the latest technology. Whilst increasing the paper mill's capability - both in terms of tonnage, but most importantly to meet the evolving requirements of its customers, the upgrade of antiquated technology has also allowed Portals to implement changes to directly reduce their energy usage.

Utilising the latest technology such as energy efficient motors and drivers has allowed the manufacturer to better manage energy usage. With their own on-site Combined Heat and Power (CHP) plant, Portals is also moving towards becoming self-sufficient. In fact, they currently supply the UK National Grid with over 2.5 million kWh of surplus energy each year, enough to power 655 houses for a year.

Portals is also investing in initiatives to offset energy usage and reduce the consumption of water and natural resources. One such initiative is a project known as the fibre recovery programme. Through the implementation of the latest filtration technology, cotton fibres that were previously lost through production processes can now be recovered and fed back into production, therefore optimising the usage of raw materials and reducing variability in stock, ensuring consistent high quality.

At the same time as removing the fibres, the filtration process cleanses the water used, removing any chemical residue used in the paper making process and purifying the water ready to be reused in the production process or for discharge back into the River Test. The advanced filtration system and water reclaim plant offers over 99% efficiency and over the next 12 months is expected to result in an estimated 32% reduction in water usage.



SUSTAINABILITY AT THE SOURCE

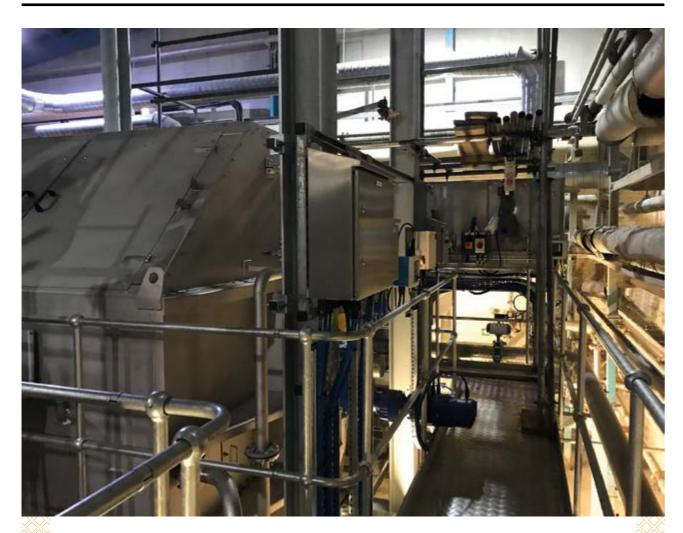
Continuous operational advancements are essential if manufacturers are to commit to sustainable practices. From assessing the technology and energy used throughout the production process; to reviewing the source of raw materials and their associated practices, significant time needs to be invested to accurately appraise where operational improvements can have a positive impact. Equally manufacturers must remain conscious that the adoption of sustainable practices may well impact production and technology requirements in the future. One such example is the impact of the changes being seen in the supply of raw cotton comber.

Banknote paper is produced using a combination of cotton comber waste and

cotton linter pulp. The comber waste is a by-product generated by the global cotton spinning industry, whereas linter pulp is a sheeted product made from the fibres from the cotton seed. Whilst its natural properties make cotton sustainable in essence, truly sustainable cotton also needs to take into account the practices used to grow and harvest it. This means supply of sustainably sourced cotton comber waste that meets stringent quality criteria is limited. As a result, papermakers wishing to maintain sustainable sourcing practices are having to re-visit supply characteristics (such as fibre length) in order to optimise fibre availability. This change in the raw materials inevitably has a knock-on effect on production processes, as papermakers strive to maintain consistency in their paper.



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Portals is tackling the changing world of cotton supply and sustainability head-on with the development and implementation of a world-class stock preparation and refining process. The new technology and flexible stock preparation process provides the capability to pre-empt the impact of changing market conditions and cotton comber supplied, in order to continue to be able to deliver high quality banknote paper, without compromising on ethical standards.

The new system includes the implementation of advanced cylindrical refiners, whose geometry combines gentle and uniform fibre treatment through controlled intensity refining. Emphasis remains on preparing the best possible cotton stock for the paper machines.

The move to a continuous stock preparation process has also enabled a 50% reduction in machinery, with outdated batch process equipment being replaced with the latest technology. Offering a more energy efficient system, a continuous stock preparation process has helped Portals reduce their energy usage further, resulting in a 4% reduction in carbon emissions.

At the same time the continuous process provides the additional benefit of greater consistency of prepared cotton stock, which in turn ensures high quality standards can be replicated time and time again.

At the centre of the revised process is a new state-of-the-art distributed control system (DCS) which acts as a core enabler control system for the entire stock preparation process. Incorporating the latest software the new DCS offers a platform on which to develop long-term capability and incorporate future technology updates.

The investment is testament to the fact that cotton stock preparation remains at the heart of banknote papermaking and demonstrates that with adequate foresight and an agile approach sustainable manufacturing is achievable.

INVESTING IN THE FUTURE

As we look to the future of the currency market, despite the uncertainty surrounding many market conditions and political environments, one thing is

certain – that as long as there is a need for cash, there will be a need for secure banknotes which will require energy and natural resources to produce. If we are to secure a sustainable future, those in the industry must continue to evolve and adapt and ensure sustainable practices remain a key consideration.

For Portals, technological advancements have proved to be the enabler driving sustainable change, but this is just part of the solution and there is an exciting journey ahead.

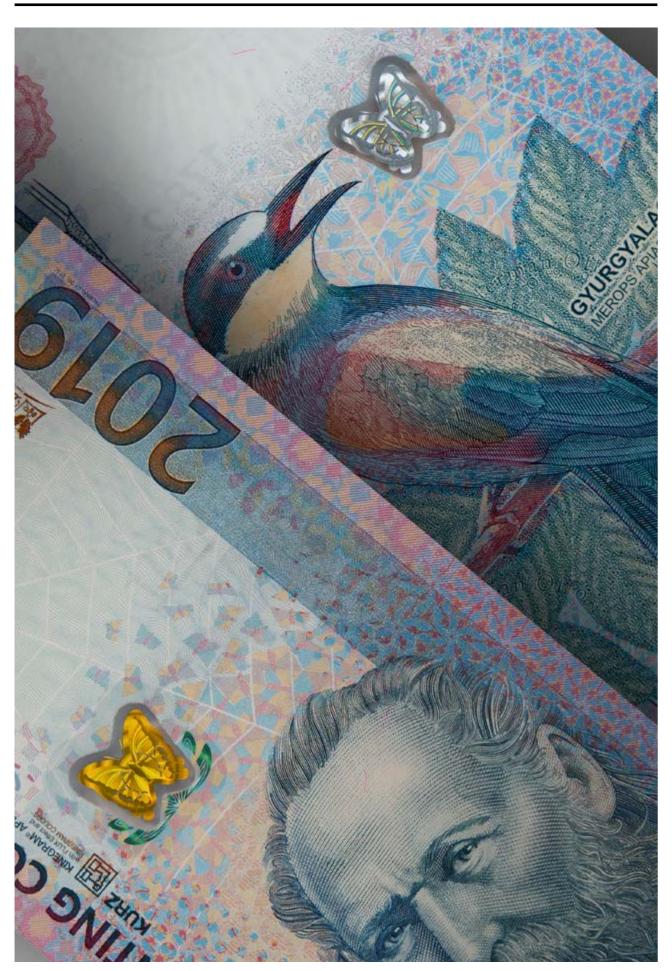
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LEONHARD KURZ STIFTUNG & CO. KG

WINDOWS – A VIEW INTO THE FUTURE

BANKNOTE TECHNOLOGY REPORT ISSUE) 06.20 LEONHARD KURZ STIFTUNG & CO KG ISSUE) 06.20

Windows – a View into the Future

so are the opportunities for innovation open to printers, paper mills, as well as feature suppliers.

The demands that suppliers such as KURZ are faced with are high, as security elements are not

The demands that suppliers such as KURZ are faced with are high, as security elements are not only supposed to protect a currency against even the most sophisticated counterfeiting attacks, but also to blend in harmoniously with a note's design, while being attractive and prominent enough for users to examine and easily work with.

he design and security requirements of central banks worldwide are ever evolving, and

Surveys from the Eurozone reveal the most successful features in this regard: Beside the watermark, foil has been and continues to be the primary security feature that people know and use for authentication purposes. This has only become more significant in the recent past, with the introduction of the second Euro series and its window notes.

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KURZ pioneered the use of windows as a key security feature for banknotes. Now, the technology has reached a new level with the latest available window banknotes from large-scale industrial productions. The combination of a window with a security foil is uniquely suitable for catching the attention of the viewer and helping him to identify the banknote as genuine. In recent years, KURZ has not only set new quality standards for laminate foils for window banknotes and reached all-time high application speeds. In 2018, KURZ unveiled the novel KINEGRAM APL (Applied Patch Label) feature, allowing for the first time the creation of window banknotes with a foil patch instead of a stripe. As an additional novelty, this window feature can be produced at a banknote printer's instead of during the papermaking process. In cooperation with the Hungarian Banknote Printing Shareholding Company / Pénzjegynyomda Zrt. (HBPC) and Orell Füssli (OFS), three banknotes carrying a KINEGRAM APL have recently been produced successfully on a large-scale industrial level.

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WINDOW FOILS FOR MULTIPLE SUBSTRATES

The research on window technology started years ago in 1994 with the cooperation between KURZ and the German Central Bank. The initial idea of punching a hole as window in a paper substrate and adding a security feature that appears in transmitted light was realized in the early 2000s by KURZ's laminate foil, which covers the window. The technology is successfully utilized in the second series of the Euro, using a registered KINEGRAM REVIEW foil stripe. The KINEGRAM REVIEW technology allows to see different effects at the foil's and thus, the banknote's - front and back. The foil deploys a see-through feature, which shows - analogous to the watermark - a portrait of the goddess Europa.

Therefore users can do a quick parallel check of the security foil as well as the watermark.

The new 19-zloty commemorative note, an illustrious house note project marking the 100th anniversary of the founding of the Polish Security Printing Works (PWPW), has used the foil over window technology to good effect. The note was issued in October 2019, to great acclaim by the industry and the public. Just as the second series of the Euro, it is equipped with a registered KINEGRAM foil stripe which covers the window. Manufactured with the novel KINEGRAM High Definition Metallization (HDM) technology for unique partially metallized designs, it displays exceedingly precise metallic shapes and a beautiful greyscale image.





19-ZLOTY COMMEMORATIVE BANKNOTES

By combining proven window technology with a KINEGRAM HDM foil stripe, the industrially produced banknote offers a one-of-a-kind composition of security-enhancing technologies. A resolution of below 10 μ m offers new degrees of freedom in creating sophisticated design patterns and motives, as is beautifully demonstrated by PWPW's commemorative note.



As proven in multiple currencies, security foil is also an optimal addition for clear windows in polymer substrate, such as the brilliant registered-image KINEGRAM ZERO.ZERO foil stripe in the new Australian banknote series, or the KINEGRAM ZERO. ZERO Patches on New Zealand's "Brighter Money" series.



UNLIMITED WINDOW OPTIONS

The latest and most disruptive technological step towards making window-and-foil features the ultimate banknote security element, was the development of the revolutionary KINEGRAM APL for paper and composite substrates. For the first time ever, banknote printers are in a position to create window features for paper banknotes in their very own premises by using this technology. Where in the past, window features for printing plants were limited to applying foil on polymer substrate, KINEGRAM APL puts the printer in the driving seat allowing to retain both process control and value creation. Printing works are thus empowered to deploy security features that they have previously been unable to access directly. The technology also gives new options to central banks in determining their preferred value chain for banknote production, as well as lending new degrees of freedom to banknote designers in positioning the window in the overall banknote design and in creating novel combinations of window and foil. It is possible to use any geometric window shape for the aperture in the banknote.

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ANNIVERSARY NOTE

The Swiss banknote printer Orell Füssli just celebrated its 500th anniversary and, for this occasion, presented a beautifully designed new house note in three different varieties. One of these carries a KINEGRAM APL patch on its front side, displaying a futuristic snail, and using KINEGRAM REVIEW technology on its reverse. The APL patch was applied in a classic hot stamping process, using Orell Füssli's OptiNota H of KBA-NotaSys. In the process, a laminate patch is transferred onto the windows in the printing sheet. The windows are created either in a separate step or in an inline process right before the foil application. The carrier is then removed as usual, cleanly separating from the laminate patch, which is now sealing the banknote window. The production at OFS was successfully run at standard production speeds under industrial conditions, including full quality testing against rigid expectations.



TECHNOLOGY

INDIVIDUALLY SHAPED WINDOWS WITH KINEGRAM APL TECHNOLOGY

The two most recent sample notes designed and produced by HBPC refer to Herman Ottó, one of the most productive scientists of Hungary and well-known on an international level. Due to his passion for birds, insects and spiders, both sample notes refer to the world's biodiversity. KURZ contributed two KINEGRAM APL features for these sample notes, which were both applied on the latest GIETZ FSA 1060 Foil Commander at HBPC's premises. For the eye-catching butterfly, a KINEGRAM APL was applied over a die-cut window. It uses KINEGRAM COLORS technology, showing different colors on the front side of the foil. The striking FLUX effect shows several eyecatching movements in different directions. Besides the FLUX effect, the foil also contains delicate fine line movements and the virtual 3D effect "Surface Relief".



The second note is enhanced by an extremely naturalistic depiction of a spider in the KINEGRAM APL, again applied over a diecut window, and using KINEGRAM ZERO. ZERO partial metallization technology.

PÁLINKÁS)



(DESIGNED BY GYÖRGY PÁLINKÁS)

KINEGRAM ZERO.ZERO enables to implement filigree line resolutions of down to 40 μm in a design, and to match the optical effects precisely to the metallization.

The authentic impression of the spider is generated by the "Surface Relief" 3D effect combined with pump and transformation effects. On the reverse side the spider is using KINEGRAM COLORS technology. Both demonstration banknotes have been industrially produced under reallife banknote printing conditions, and tested banknote-industry quality against standards. The designs and production are a testimony to the possibilities of KINEGRAM APL technology.

INDUSTRY-LEADING SOLUTIONS

By their latest technological advancements, KURZ has completed an impressive product range of different window features and raised the technical bar to an unprecedented level. Today, KURZ is able to propose foil stripes as well as foil patches which can easily be applied over windows on any and all banknote substrates - be it regular paper, composite substrate or polymer.

Thanks to fruitful cooperation with diverse and highly experienced banknote printers, the revolutionary KINEGRAM APL technology was engineered to perfection and tested successfully on a large-scale industrial level. With KURZ's KINEGRAM APL and other foil solutions, Central Banks and security printers alike now have more design freedom for creating and manufacturing a fully integrated, extravagant design with a highly sophisticated, next-level security feature.

KINEGRAM. **KINEGRAM** COLORS. KINEGRAM REVIEW, KINEGRAM ZERO. ZERO are registered trademarks of OVD Kinegram AG, a member of the KURZ Group.

LEONHARD KURZ STIFTUNG & CO. KG

KURZ Banknote Security

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www.kinegram.com

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■PARVIS■





Banknote track & trace • Sheets barcoding Direct sheets counting inside the presses Numbering control • Materials traceability Warehouse and Finishing Management Quality measurement of security features Data Analysis

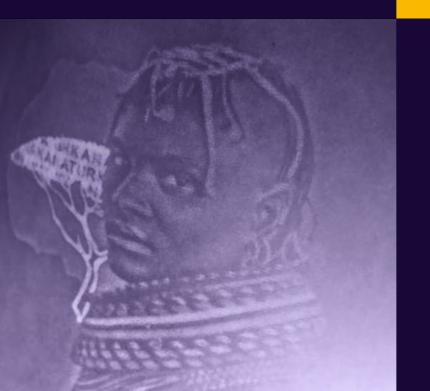
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We offer the flexibility and expertise to help you select the right features to complement your security strategy and currency design.



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The premier conference focused on currency policy and strategy - since 1992



Currency Conference

Mexico City | May 16-20, 2021

Bringing together key officials from Central Banks and Monetary Authorities

The first Currency Conference was celebrated in 1992 at the request of Central Banks and Issuing Authorities responsible for the Currency and Issue function, who recognized the need for a unique platform to address their specific interests and challenges, as well as their desire to network with their peers from other countries. Eighteen (18) very successful conferences later, the Currency Conference remains the premier industry conference for Central Bankers and Issuing Authorities.

The Currency Conference brings together key officials in the currency issuing and distribution departments of Central Banks and Monetary Authorities, printing works, and leading currency industry suppliers from around the world to share experiences and network with each other in a secure and engaging environment. We believe it is critical that we continue to provide a neutral forum for industry leaders to meet and discuss policy, efficiencies, best practices, and new strategies, as well as the latest technologies and solutions that benefit their operations.

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The sponsors of the Currency Conference represent the world's leading suppliers to the currency industry and provide an extensive, state-of-the-artexhibition of their new technologies and products for our delegation.

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