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Guardian™ is
100% recyclable

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From the Editor's Desk

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Polymer substrate secures the future of cash

Paradoxically, as cash transactions decrease in a fast-changing payment landscape, more central banks are adopting polymer substrate.

As Victoria Cleland, Bank of England's Chief Cashier, explained in an interview with the *Guardian*, "Cash is definitely here to stay. That's why it's important we in the cash industry invest in it, even though transaction demand is going to slow down." And that is exactly what the Bank of England did. It invested in a cleaner, safer and stronger banknote.

The bank's efforts to cut carbon emissions and reduce environmental impacts, as well as deterring counterfeiting, were recognised recently when its £5 and £10 Guardian™ polymer banknotes were awarded the Carbon Trust's Footprint Label for carbon footprint reduction. Read more on page 3.

In this issue of SPECIMEN, we look at one of the hottest topics in the industry and examine how Guardian™ polymer substrate can contribute to securing the future of cash in an increasingly mechanised cash cycle. Since the release of the first Guardian™ note in 1988, our polymer technology continues to evolve at an incredible rate and redefine banknote security, but security is just one of the many benefits of Guardian™. Read more on page 4.

In countries such as Mauritania and Vanuatu, where cash is the preferred method of payment, central banks have also adopted Guardian™ polymer for their full series. Read more about their experiences and reasons for switching to polymer on pages 10 and 14.

The Chief Marketing Officer of GLORY, one of the world's largest suppliers of cash technology solutions, gives us his view on the future challenges for cash handling on page 20.

Cash is here to stay and great design is the key to increasing banknote security and maintaining public confidence. Read more about the case of the Mexican \$50 note and the lessons learnt on page 8.

The design possibilities with Guardian™ substrate are endless. CCL Secure's proprietary features can be applied at various stages of the multiple opacification layers to create highly detailed security features. To educate the next wave of creative talents on the complexity of polymer banknote design, CCL Secure launched a Guardian™ design workshop and competition in Guatemala. Find out more on page 18.

Happy reading!

Pilar Ruperti
Editor

INSIGHT

Keeping You Notified

LATITUDE™ Wins 2017 Excellence in Holography Award

LATITUDE™ has won the 2017 Excellence in Holography Award – Best Applied Security Product by IHMA for the Brunei Darussalam and Singapore commemorative \$50 banknotes.

Since its inception in 1993, the International Hologram Manufacturers Association (IHMA) has awarded annual Excellence in Holography Awards to outstanding holographic projects.

The Best Applied Security Product category is intended for products or projects where a hologram is used as an authentication or security feature. Part of the assessment of projects in this category is how well the hologram serves this purpose and how effectively it is integrated into the product.

The recently launched Brunei Darussalam \$50 and Singapore \$50 Guardian™ banknotes commemorate the fiftieth

anniversary of the Currency Interchangeability Agreement. Both notes include the same LATITUDE™ level 1 feature, which can be validated in both reflection and in transmission. This substrate-integrated diffractive optically variable device, which uses nanoparticles, depicts Brunei Darussalam's Istana Nurul Iman and Singapore's Istana.

Unlike foils or other banknote holograms, LATITUDE™ is integrated into the substrate and is therefore not restricted to a conventional applied patch or stripe format. Banknote designers can be more creative, using any desired shape or level of intricacy, as well as working in combination with the opacification layers to ensure the feature fits seamlessly into the banknote.

Highly visible to the public, but extremely difficult for the counterfeiter to replicate, LATITUDE™ represents a significant technological advance. The science behind its development is a step forward for both polymer substrate and holograms.



PHOTO: STEWART DONN

Guardian™ Notes Reduce Carbon Emissions

£5 and £10 Guardian™ polymer banknotes have been awarded the Carbon Trust's Footprint Label for carbon footprint reduction.

The label demonstrates that the Bank of England has accurately measured the carbon footprint of these denominations, and that they will deliver carbon-reduction benefits due to their greatly extended lifetime.

The Carbon Trust has certified that, over their full life cycle, the carbon footprint of a £5 polymer banknote is 16% lower than the £5 paper banknote, while the carbon footprint of a £10 polymer banknote is 8% lower than the £10 paper banknote. This certification was completed in accordance with the international standard PAS 2050, and considers the full life cycle of greenhouse gas emissions related to the banknotes, including

production, circulation and disposal.

At the 2017 Carbon Trust's annual awards, the Bank of England was recognised by the Carbon Trust for exceptional performance in reducing their environmental impacts. "The Bank of England is committed to reduce its environmental impacts, and we have set ourselves a challenging 20% by 2020 carbon-reduction target. The bank is honoured to have been awarded the Carbon Trust's Best Performance in Product Carbon Footprinting award. This is a great recognition of our efforts in cutting our carbon emissions, and the environmental as well as anti-counterfeiting benefits of the new £5 and £10 polymer banknotes," said Victoria Cleland, Chief Cashier.

At the end of their life cycle, unfit polymer notes will be returned to the Bank of England to be shredded, and then sent to be recycled into further polymer products.



PHOTO: STEWART DONN

FEATURE STORY

Guardian™ at the Forefront of Banknote Security

As more central banks adopt Guardian™ polymer banknotes, CCL Secure redefines banknote security.

BY BRADLEY BOOTH

Our company was born out of a central bank's vision to build a better banknote – one that was cleaner, safer and stronger – and this goal has underpinned Guardian™ polymer substrate technology ever since. Following several years of extensive research and development, Australia began the transition to Guardian™ polymer in 1988 with the release of the \$10 bicentennial commemorative banknote. Polymer and the clear window had begun their journey into history.

Since then, the innovative Guardian™ banknote substrate has been used to issue in excess of 55 billion banknotes, gaining the confidence of more than 40 central banks for use in over 160 mainstream and commemorative notes that circulate in some of the world's most demanding cash cycles.

Our polymer technology continues to evolve at an incredible rate. The development of new security features and designs are key drivers of this change. They inspire banknote designers to focus on the synchronisation of polymer and associated security features. However, all the complex elements that ultimately represent and protect the identity of a nation's currency must be adapted to the printing systems. The aim is not to design a complex banknote that is difficult to produce, it is to design one that is difficult to counterfeit.

A window into the future of banknote security
When the first polymer banknote was launched in Australia in 1988, the presence of a clear window represented a new paradigm in security. It was a revolutionary new base material that, when combined with unique security features, instantly prevented casual and semi-professional counterfeiters from reproducing the notes. The film effectively combated photocopying. The clear polymer window has been so successful in deterring counterfeits that it has even inspired the creation of window features on a number of paper substrates. Today, the window remains a key security feature on polymer banknotes. It is highly secure and easily recognisable by the public.

Polymer substrate now has 30 years' proven market performance, and Guardian™ has been at the forefront of polymer development throughout this period. The unique bi-axially oriented polypropylene (BOPP) Clarity™C gives Guardian™ its distinctive balanced tensile properties. These are not only exclusive to the polymer banknote market; they also provide superior printing and handling properties across all banknote-printing platforms.

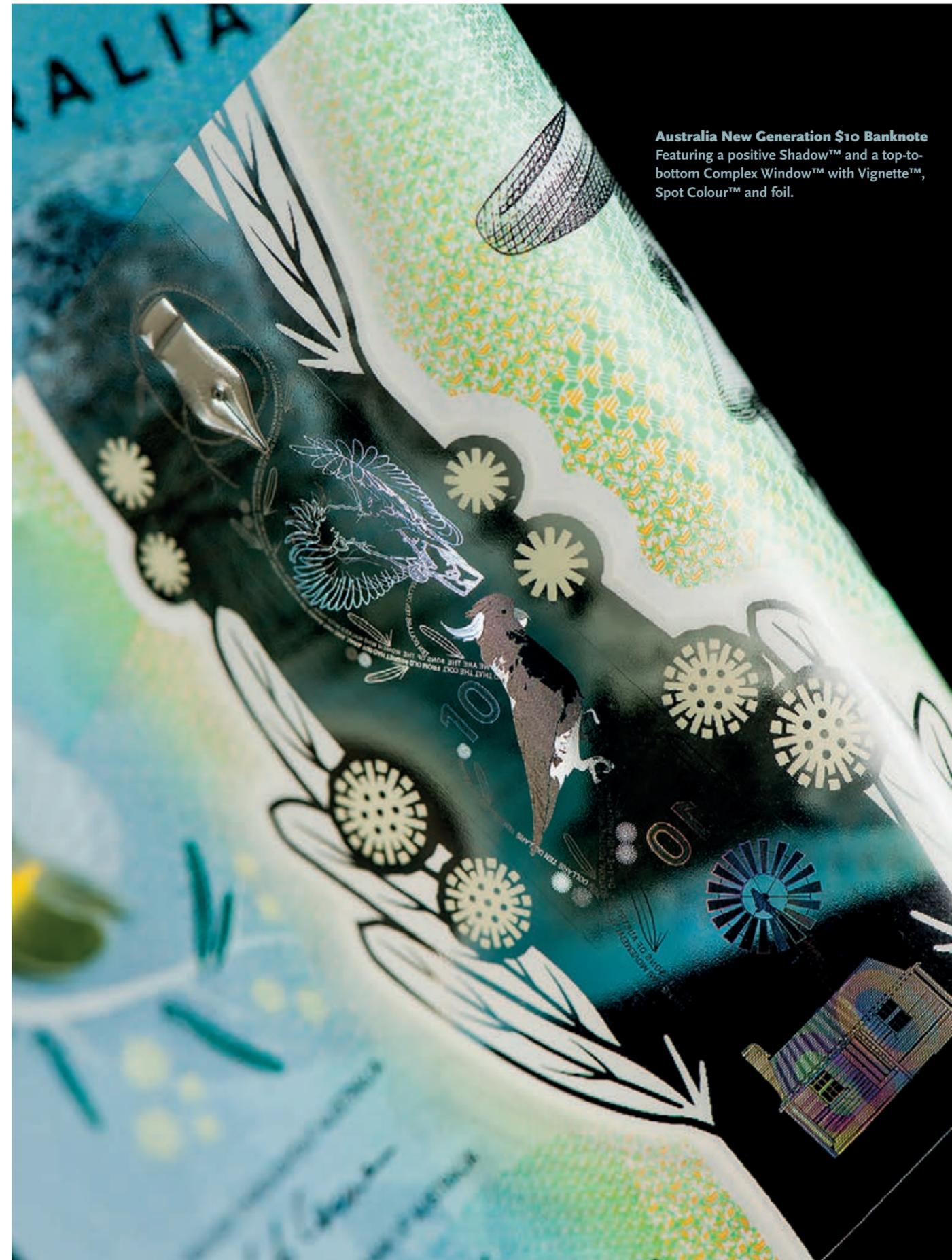
Clarity™C film – in combination with CCL Secure's opacification process, which includes printing and embedding security features on the film, creates Guardian™ substrate.

Guardian™ substrate in combination with security features

The Guardian™ platform allows CCL Secure to include not only a wide range of proprietary features but also third-party features, such as optically variable inks (OVI) and optical variable devices (OVD) applied in windows. These can be integrated within our Clarity™C base film or applied directly onto Guardian™ substrate.

The innovative Guardian™ banknote substrate has been used to issue in excess of 55 billion banknotes, gaining the confidence of more than 40 central banks for use in over 160 mainstream and commemorative notes.

The multiple opacification layers that make up Guardian™ allow CCL Secure's proprietary features to be applied at various stages of manufacture: within a clear window, under one or multiple layers of opacification, on top of opacification, or a combination of all three. This increases feature integration, complexity and security.



Australia New Generation \$10 Banknote
Featuring a positive Shadow™ and a top-to-bottom Complex Window™ with Vignette™, Spot Colour™ and foil.

The new £10 Note.
Featuring a Complex Window™ and Half Window™ combination with CAMEO™, Vignette™, GSwitch™ ink and foil.



Canada 150 Commemorative Banknote
Featuring METALIX™ and a Complex Window™ with Spot Colour™ and foil. This image is a copy that is reproduced with the permission of the Bank of Canada.



PHOTO: STEWART DORN

Examples of features that can be applied in a clear window and viewed from both sides of the substrate are:

- **CAMEO™**: a rich, tonal image printed within the transparent window
- **LATITUDE™**: an optically variable device providing colour shifts and movement within the image when tilted, with the added security of being see-through in transmission
- **ECLIPSE™**: an optically variable device that reveals a hidden message when looking through the transparent window at a point light source
- **AURORA™**: a combination of two OVIs that match in reflection but are different in transmission.

The combination of layers means the design possibilities for Guardian™ are limitless. A banknote designer can allow their imagination to transcend multiple layers, rather than being restricted by the flat surface of a paper substrate.

Other features, such as Shadow Image™, Shadow Image Thread™, Micro Lettered Thread™ and MAGread™, can be applied under one or multiple levels of opacification, allowing designers to hide them beneath banknote printed features, or create tonal effects with different layers.

As CCL Secure's R&D scientists work from the microscopic to the nano-level, this space is getting larger and larger. These spatial characteristics are the key reason that Guardian™ will continue to stay ahead of counterfeit technology far into the future.

METALIX™, IRIsWitch™ and Spot Colour™ are printed on the surface opacification layers for a more obvious effect. Opacification layers also allow features such as AURORA™ and GSwitch™ to be printed in a Half Window™, creating a switching effect on the window side and a tinted substrate on the reverse.

The combination of layers means the design possibilities for Guardian™ are limitless. A banknote designer can allow their imagination to transcend multiple layers, rather than being restricted by the flat surface of a paper substrate.

What are the drivers to switch from paper to Guardian™ polymer?

Security is just one of the many benefits of Guardian™. There are a number of drivers behind a central bank's decision to switch a single denomination or a full series to Guardian™. These include:

- **Increased security** – The use of the Clarity™C film, combined with clear windows and the integration of Guardian™ features, reduces counterfeit rates by a factor of ten when

compared to existing paper banknotes.

- **Cost savings** – Cost savings arise mainly from the increased lifespan of the banknote, which is typically three to five times that of paper banknotes. Improved lifespan also has a knock-on effect on cash cycle savings, with a reduction in the movement of banknotes, sorting and handling playing a significant role.
- **Reduced environmental impact** – By adopting a 100% recyclable Guardian™ product, central banks not only reduce their impact on their local environment, they also save costs by selling used polymer for recycling rather than sending it to landfill.
- **Improved hygiene** – Independent studies have shown that Guardian™ contains significantly less bacteria than paper banknotes, which can help reduce the spread of disease.
- **Customer perception** – A full Guardian™ series adds consistency and reduces confusion for the general public, especially in the areas of touch and feel. The suite of Guardian™ features allows for a coherent theme throughout a series, allowing for faster identification.
- **Cash handling** – A full Guardian™ series creates less complexity at cash processing machines, and gives central banks better purchasing power by providing a cleaner note handling experience for the public.

While paper is a flat two-dimensional structure, polymer substrate is effectively a three-dimensional space. As CCL Secure's R&D scientists work from the microscopic to the nano-level, this space is getting larger and larger. These spatial characteristics are the key reason that Guardian™ will continue to stay ahead of counterfeit technology far into the future.

SPECIAL REPORT

Polymer Counterfeits: The Case of the Mexican \$50 Note

Counterfeit rates drop dramatically when polymer is introduced. However, no banknote is completely counterfeit-proof and polymer banknotes are no exception.

BY GUSTAVO ASCENZO AND JAIME PACREU

There are two main types of counterfeiters: amateurs, and professionals or criminal gangs.

Amateur imitations of polymer banknotes are rare. This is due to the difficulty of printing on plastic and the impossibility of reproducing transparencies with photocopiers, printers or home scanners. To make a window, an amateur counterfeiter must have extremely advanced manual skills in order to cut the substrate and add inserts. Experience shows us that these imitations are rough and obvious.

For professional counterfeiters to be “acceptable”, criminals turn to experts with extensive knowledge in printing. They also have access to either cutting-edge or tailored commercially available printing technology and

enough resources to carry out their crimes. Nonetheless, it is easier for police authorities to catch one criminal gang than many amateurs.

Mexican \$50 note

The \$50 Guardian™ polymer note was introduced in Mexico in 2006. Counterfeits of this note dropped dramatically in subsequent years. However, in 2010, the \$50 note was attacked by professional counterfeiters. Between 2011 and 2012, a large number of professional counterfeiters of the \$50 polymer banknote were found in circulation.

In 2012, two important events played a major role in dropping counterfeit rates. The criminal gang was arrested and a new \$50 Guardian™ note was put into circulation with a

more sophisticated design. By 2014, the \$50 Guardian™ note was again the second-least counterfeited denomination and well below the average level of paper and total counterfeits.

Lessons learnt

After their arrest, the criminals disclosed how they had created an acceptable imitation of the \$50 note.

- **Design and origination:** They used commercial software operated by experts in digital image manipulation and offset production.
- **Substrate:** It took several months to achieve an acceptable imitation.
- **Inks:** They used commercial and automotive inks, but were forced to ask the manufacturer for a special formulation that suited their requirements.
- **Printing:** The process demanded 18 steps of offset, four steps of silkscreen and two manual steps.

Although it was very effective against amateur counterfeiters, the original \$50 note design was not very complex and had not been updated since its introduction.

As part of the solution, Banco de México issued a new \$50 note on Guardian™ with a much more complex design and better security features. These include Complex Window™ with WinBOSS™, Eclipse™ and coloured Vignette™; a second Complex Window™ with SPARK® ink (allowing the optically variable ink to be viewed from both sides of the substrate); and Half Window™. Although they use the same polymer substrate, the difference in the complexity of the design of the two notes is clearly evident to the naked eye.

The importance of good design is essential for banknote security. The advantage of Guardian™ polymer is that the possibilities are practically endless.

The new Mexican \$50 note
Launched in 2012, the new, more sophisticated \$50 note reduced counterfeiting significantly.



Figure 1: Counterfeit rates of Mexican \$50 note (ppm), 2009–2017

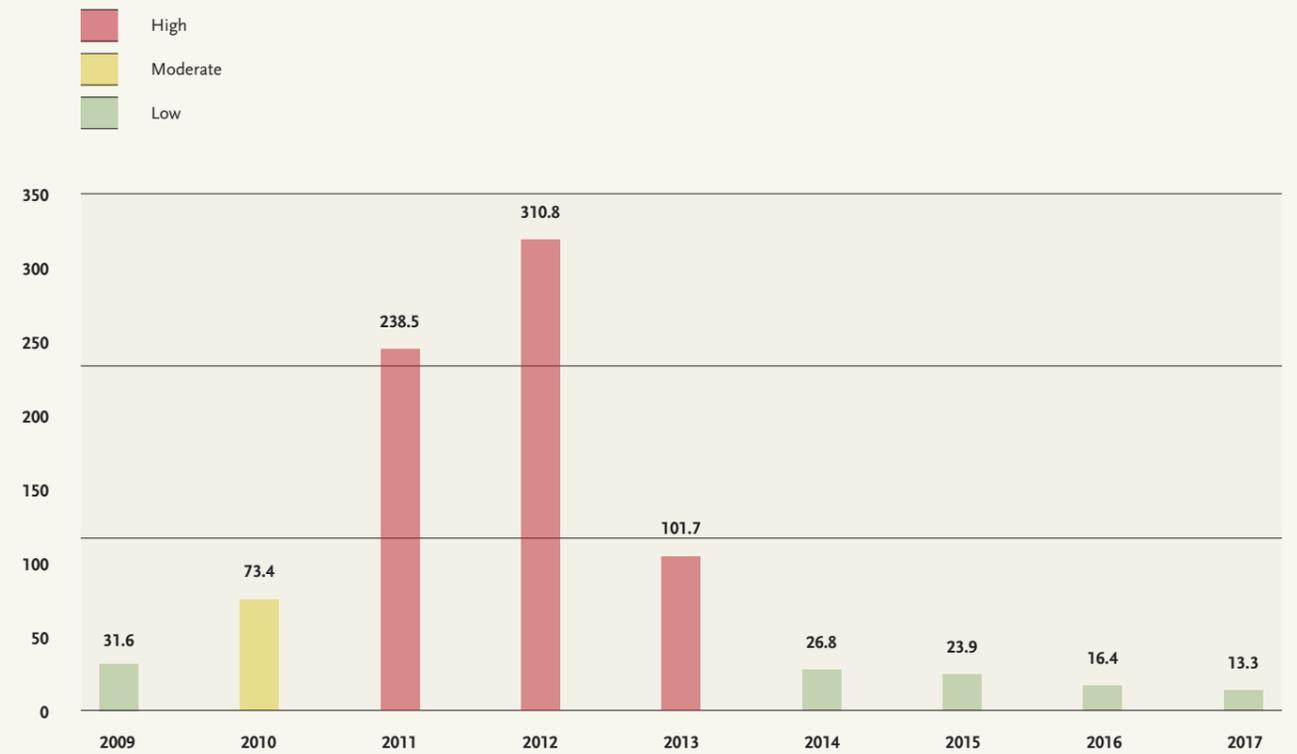
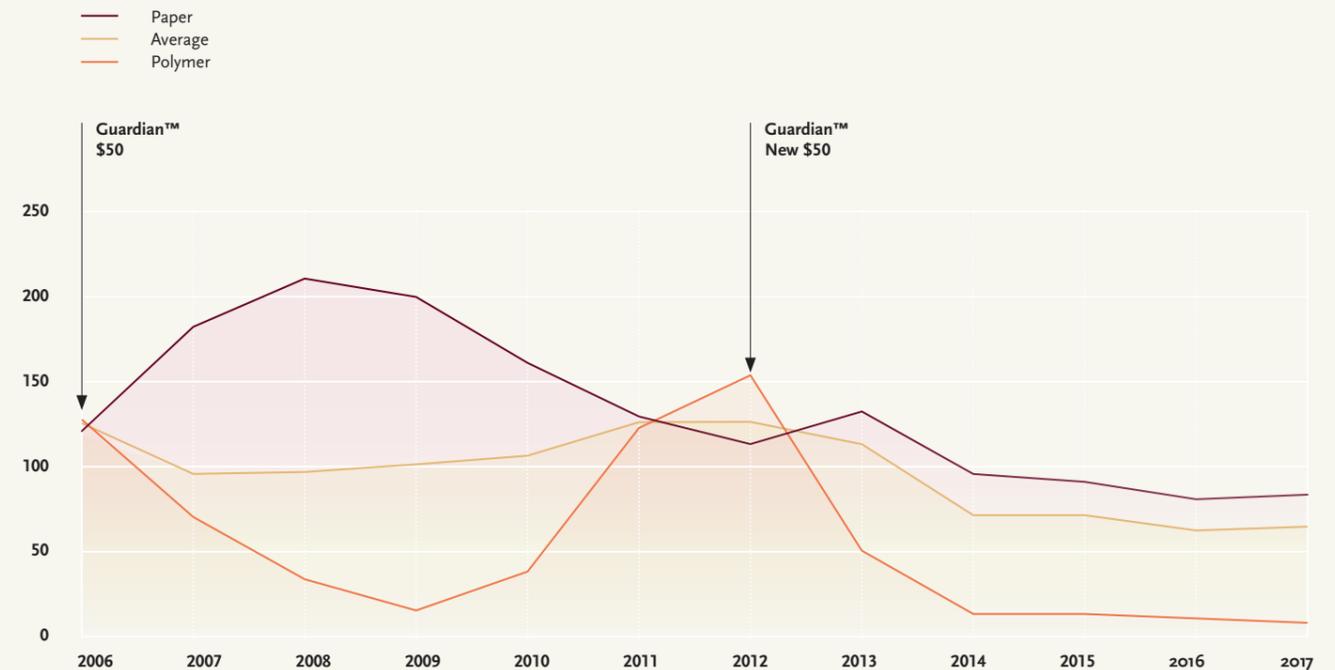


Figure 2: Average counterfeit rates in Mexico (ppm), 2006-2017



Calculated from Banco de Mexico website data.

Denominations on polymer: \$20 and \$50. Denominations on paper: \$100, \$200, \$500 and \$1000

Central Bank of Mauritania's New Guardian™ Polymer Series

On 1 January 2018, the Central Bank of Mauritania began circulating a new banknote and coin family.

BY PILAR RUPERTI

After a period of stable economic growth and relatively low inflation, the Central Bank of Mauritania (BCM) has rebased the Mauritanian currency—the ouguiya—by removing one zero from all denominations. Accompanying the rebasing is a change in the currency designation from MRO to the new MRU. The BCM has also adopted CCL Secure's Guardian™ polymer substrate for their full new banknote series. The rebasing is expected to better control inflation and the amount of currency in circulation, while the adoption of Guardian™ substrate will significantly reduce banknote production costs and the overall risk associated with carrying large volumes of banknotes.

BCM was established in 1973 and it has put four series into circulation since then. Last January, Mauritania became the first African country to issue a full series of banknotes on polymer substrate. All denominations, designed and printed by Canadian Bank Note Company Limited (CBN), feature traditional themes based on the country's flora and fauna, cultural symbols, and main social and professional activities. Security features include CCL Secure's Clear Window™ and Half Window™ with Vignette™, and AURORA™ and METALIX™ inks, as well as CBN's TOUCH® tactile feature, which assists the visually impaired to denominate the notes.

The new banknote family consists of five denominations, ranging from MRU50 to MRU1000. These replace the six denominations of the old series: the three lower denominations were printed on Hybrid™, MRO1000 notes were on Guardian™ polymer, and the two higher denominations were on paper.

BCM's main reasons for the full conversion to polymer were to make the banknotes safer, cleaner and more durable, and retain public confidence. The first Guardian™ MRO1000 notes, issued in 2014, reported no counterfeits and rare mutilations of this denomination. The

polymerisation of the full series will also save BCM "more than US\$4,000,000 per year on banknote management and issuing costs," says BCM Governor, Abdel Aziz Ould Dahi. These assumptions are based on BCM's comparison of the different substrates, according to their experience and rigorous banknote life assessments.

The first Guardian™ MRO1000 notes, issued in 2014, reported no counterfeits and rare mutilations of this denomination. The polymerisation of the full series will also save BCM "more than US\$4,000,000 per year on banknote management and issuing costs."

However, not all that glitters is gold, and with change comes risk—especially for a geographically vast country where cash is ubiquitous. "Inflation, counterfeits, the stability of the cash cycle, were some of the risks we considered carefully. To mitigate those and other risks, the BCM has adopted a clever communication strategy based on the interaction with all stakeholders, maximising all media and communication channels," explains Sidi Mohamed Dhaker, BCM Head of Communication. "We have also adopted a proximity approach in the choice of exchange points for the new ouguiya family, while setting a limit for manual exchange and requiring a

bank account to exchange more than the limited amount in order to increase the rate of banked citizens—a measure that has been proven successful so far."

The central bank also used the advantage of surprise to great effect, taking just one month to implement the measure and one month to manually exchange the higher denomination (the most likely to be counterfeited). "We worked extensively with CCL Secure and Canadian Bank Note Company for months to ensure a smooth transition while keeping the surprise effect, and couldn't be any more grateful to their teams for their help in the successful launch."

As for the new designs and security features, the Mauritanian public have quickly become familiar with their new notes, which they say are more aesthetically pleasing and easier to handle. As part of BCM's public communications, Mauritanian citizens have easy access to the latest and most relevant information through both digital and print collateral, such as a dedicated website (ouguiya.mr), social networks, posters and leaflets, a free call centre and educational workshops for children. The central bank is also planning a public survey in the coming months.

In addition, central bank, commercial bank and government officials also benefited from Guardian™ training seminars conducted in December and January by PolyTeQ—CCL Secure's technical support division—with the assistance of CBN Director of Business Development Bobby Lovric. The seminars, complemented by the new e-learning modules that were launched last year, mainly covered the handling and care techniques for their new Guardian™ polymer banknotes.

BCM will assess their recycling options with PolyTeQ, and continue to monitor this major currency transformation as it strives to foster innovation and be a role model in the region.



AURORA

Large and obvious visual effects using leading-edge ink technology that delivers multiple colour shifts across the life of the note.

METALIX

A brilliant metallic sheen and lustrous rich colour creates a dominant visual effect that is entirely resistant to chemical attack or oxidation.



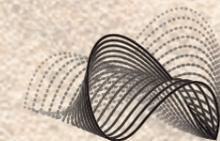
A Premier African Currency

Introducing Mauritania's New Guardian™ Polymer Series.

Mauritania is the first African country to issue a full series of banknotes on polymer substrate. All denominations, designed and printed by Canadian Bank Note Company Limited (CBN), feature traditional themes based on the country's flora and fauna, cultural symbols, and main social and professional activities.

Security features include CCL Secure's Clear Window™ and Half Window™ with Vignette™, and AURORA™ and METALIX™ inks, as well as CBN's TOUCH® tactile feature, which assists the visually impaired to denominate the notes.

The new series were introduced on 1 January 2018, and the old and new currencies will co-circulate until 30 June 2018.



GUARDIAN™

CENTRAL BANK CASE STUDY

The Vanuatu Experience: Full Series Now on Guardian™ Polymer

Peter Tari, the Deputy Governor of the Reserve Bank of Vanuatu, talks about the bank's decision to create a new series of banknotes using Guardian™ polymer technology.

BRIAN LANG INTERVIEWS PETER TARI



In 2010, in conjunction with the thirtieth anniversary of independence in Vanuatu, the Reserve Bank of Vanuatu (RBV) launched the first banknote in a new series using

Guardian™ polymer substrate. The banknote was a new high-value denomination: 10,000 Vatu (VT). At the launch, the RBV Governor paid tribute to Note Printing Australia (NPA) and PolyTeQ – CCL Secure's technical support division – for designing and producing the note in just six months.

The bank also acknowledged the contribution of local artist Mr John Joseph, who was appointed by the bank and worked alongside NPA and PolyTeQ in the design stage. Traditional painting artworks were sourced by a team of locals who represented a cross section of the economy.

Between 2010 and 2017, the RBV added two additional denominations to the Vatu family of notes, increasing the number from four to six, and had all six denominations converted to Guardian™. Today there are very few cotton paper notes left in circulation.

Inset: Peter Tari, Deputy Governor of the Reserve Bank of Vanuatu.

Right: The 2,000 Vatu note on Guardian™ launched in June 2014.

Why did the RBV introduce Guardian™ banknotes in 2010?

At the time, the bank was facing increased costs of issue caused by the short lifespan of cotton paper notes in our humid environment and the scattered geography of the island country. The economic justification for a more durable substrate had received support from the public in a 2008 survey, which also indicated a demand for a higher denomination at the top of the series and a strong push for the counterfeiting challenges to be contained. Another key motivation for a change to Guardian™ was a desire to modernise the nation's currency and cash cycle.

We undertook extensive research in countries where polymer notes were circulating, and that had a proven record of greater durability and reductions in counterfeits.

Following the 2008 survey, the RBV decided to review the creation of a new family of notes.

The review concluded that polymer note printing stood a higher chance of addressing these issues, and that this was the right step to take. The existing family of notes had then been in circulation for 30 years.

The bank is very happy with the performance of the new series. There have been no serious attempts to counterfeit on a polymer or plastic surface. Overall the notes are proving significantly more durable than the previous paper series.

What other analyses did you do before deciding to move to Guardian™ substrate?

We undertook extensive research in countries where polymer notes were circulating, and that had a proven record of greater durability and reductions in counterfeits. An extensive cost-benefit analysis was also undertaken.





Above: Simeon Athy, Governor of the Reserve Bank of Vanuatu, and Peter Tari, Deputy Governor, at the launch of the 5,000 Vatu note in July 2017.



Opposite: The full new series of Vanuatu notes.

Have the polymer notes met your expectations?

The bank is very happy with the performance of the new series. There have been no serious attempts to counterfeit on a polymer or plastic surface. There have been some notes rendered unfit as the public experimented with their durability, but overall the notes are proving significantly more durable than the previous paper series. The cost of issue has declined markedly in the past two to three years.

There has been a significant drop in note-issue expenses in the past two to three years. This is greater than we initially anticipated, thanks to the durability of the substrate resulting in less unfit notes needing replacement.

What key risks did you identify and how did you mitigate them?

Initially, the biggest concern was public reaction. Would people accept the change? To mitigate this risk, the RBV conducted a very significant public awareness campaign and launched each denomination at a major public event. This helped to raise the confidence of the public

about recognising and using the notes. In Vanuatu, these occasions draw large crowds and were attended by respected government and regional officials. The bank also sent staff to the various islands to raise awareness in the remoter areas. This has been quite time-consuming, but has proved very effective.

What is Vanuatu's physical environment like?

Vanuatu has a tropical climate and can be hot, humid and wet, particularly in the summer months. It has a chain of four main islands and 79 smaller islands, 68 of which are inhabited. The main form of transport is by water, thus the waterproof polymer notes are ideally suited in circulation.

Why did the bank decide to convert the full family to Guardian™ polymer?

One of the key drivers was to modernise the currency and the cash cycle. To do this, it was logical to maintain a common approach across all denominations that was suited to the conditions.

How did the bank choose the designs and security features for the new series?

At the outset it was decided that the front of the banknotes would have a common design, and the reverse sides would feature themes that carried special importance for the country, such as family and traditional gatherings on the 200VT note and tourism on the 5000VT note. The security features were selected to take advantage of the polymer substrate and clear

The RBV conducted a very significant public awareness campaign and launched each denomination at a major public event.

window, incorporating a G-Switch™ (colour shift), embossing of the denomination value, a shadow image of the logo of the RBV and a complex clear window design incorporating a shell vignette.

Is the bank planning to recycle the unfit polymer banknotes?

Yes, we intend to recycle granulations of unfit notes when we have a sufficient quantity to transport to a recycler. At the moment, the waste polymer is being stored at the bank.

Has the move to Guardian™ polymer delivered any unexpected benefits?

Despite higher initial issue costs, the long-term benefits are now being realised. There has been a significant drop in note-issue expenses in the past two to three years. This is greater than we initially anticipated, thanks to the durability of the substrate resulting in less unfit notes needing replacement. The notes also portray the country to visitors and tourists in a favourable light.



BANKNOTE DESIGN

Educating and Recognising Guatemalan Designers

CCL Secure recently launched a banknote design workshop and competition in Guatemala.

BY CARLOS ALMENAR

Paper substrates have existed for centuries. Over time, innovations like the development of watermarks, security threads and durability have evolved, but the raw material remains unchanged. Modern substrates, like polymer, have made banknote designs more dynamic and complex. Features such as transparency and opacity can now be integrated to produce highly detailed security features.

Banknote designers interpret the culture and identity of a nation and translate these semantic concepts into the specific techniques required to build a banknote. Their ideas focus on the designs, substrates, security features and printing techniques and they work in collaboration with other specialists in the banknote industry.

Polymer substrates offer a unique design element: the clear window. The invention of the clear window – easy for the public to recognise but extremely difficult for counterfeiters to replicate – was a breakthrough in banknote security. Design innovations have driven a range of changes in the appearance and

functionality of the clear window. Major design initiatives have heralded new generations of the window design and multiple innovative ways of representing a culture.

Guardian™ Polymer Banknote Design Workshop

The one-day Guardian™ Polymer Banknote Design Workshop was conducted last year in Guatemala to support the Guardian™ Polymer Banknote Design Competition. It educated design students and professionals about banknote history, recent developments in banknote technology, polymer design trends and the banknote design process, as well as giving them the opportunity to learn new skills. The aim was to inform designers and artists about Guardian™ technology and its possibilities.

During the workshop, participants were encouraged to design their own prototype of a Latin American promotional banknote that was inspired by local values, folklore, flora and fauna, and the history of the region.

Guardian™ Polymer Banknote Design Competition

Attendance at the workshop was not a requirement to enter the competition, which was launched a month in advance. However, we developed a number of design rules, as well as a concept design that served as a guide for participants to develop their own concepts and enter the competition. CCL Secure was overwhelmed by the interest the competition generated, with many more entries received than had been expected.

A select team of internal experts – including Head of Product Management & Design, Tim Berridge, Communications Coordinator, Pilar Ruperti, and myself – examined the entries. We had the difficult task of selecting ten finalists from the very high-quality entries, all of which uniquely and beautifully represented Latin American culture.

The ten shortlisted designs were displayed at the seminar's gala dinner. A secret ballot of the guests – including central bank and political representatives from throughout Latin America

A secret ballot of the guests awarded two honourable mentions and one winning concept, which received a prize of US\$1,500.



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The judges were astounded by the skill and beauty of all the designs. We were also proud to be part of such a memorable experience for the participants, some of whom were moved to tears by the recognition they received. The central banks were so impressed by the success of the competition that some have expressed interest in hosting one of their own.

The winning concept was designed by Valeria Loarca, a first-year student at University of Isthmus (UNIS). The design featured images of Christopher Columbus and a famous footballer. CCL Secure's experts and the central bankers were fascinated by how close the concept was to real, circulating banknotes. The technical incorporation of security features was also one of the most complex in the group of entries, using windows and holographic effects.

Polymer banknote design – present and future

This was the first time a public polymer banknote design workshop and competition has been held for students, professionals in the field of graphic design. The experience was very rewarding and generated a lot of interest in banknote technology and banknote design as a profession.

For central bank delegates, this experience allowed them to see how local designers can represent their culture through banknote concepts that range from very modern trends to classic designs. More importantly, it demonstrated how designers can interpret and conceptualise the banknote of the future.

The key to Guardian™ polymer banknote design is the technology that allows for transparent, semi-transparent, opaque and complex window designs, and these elements must be an integral part of the design process.

However, banknotes of the future cannot lose their sense of national identity. It is important to educate and involve the public and other commercial interests at the outset of the design process. Involving the public in decision-making processes like the choice of subject matter helps give them a sense of ownership of the final design.

CCL Secure is committed to giving back to the industry to help it grow. We value the opportunity to educate the next generation of talented designers.



Top: Winning entry, Valeria Loarca
Middle: First mention
Bottom: Second mention

INDUSTRY STUDY

Future Challenges for Cash Handling: The View from GLORY

Mike Bielowicz, GLORY's Chief Marketing Officer, discusses the challenges cash handlers are facing today and how the industry is adapting to change.

SPECIMEN INTERVIEWS MIKE BIELAMOWICZ

With GLORY reaching its 100th anniversary, is cash handling still relevant?

We certainly recognise that the future is likely to be "less cash" but not "cashless". There is a lot of conflicting data about how people are settling transactions today. We see a report from the UK stating a preference for small payments digitally, and the next day a report from the USA that small payments are typically made in cash. Payments are 70% electronic in the Netherlands and 70% cash in Germany. In the developing world? Everyone uses everything!

For many people, cash remains the most trusted and most reliable method of payment. It does not rely on any underlying technology and is accessible to all. Most central banks are still reporting growth in the issuance of cash and, most importantly, our customers are still investing in new and innovative cash solutions. The simplest way to look at the challenge is to assume that overall transactions will keep increasing fast enough to allow for all types of settlement – including methods that do not exist yet – and that we will be managing every kind of transaction, and particularly cash transactions, for a very long time.

How committed is GLORY to the future of cash?

GLORY continues to invest significant sums of money in new products. Last year, we spent over 6% of our revenue, or US\$125 million, on research and development. That's a level of investment that few players in our industry can match. We continually look at the overall payments market in which we operate. I strongly believe that new technologies, such as Blockchain, Internet of Things, Cloud Computing and Big Data will significantly increase the value delivered by cash handling solutions, and I expect GLORY to be at the forefront of this exciting new chapter.

What are the main factors driving change?

Companies involved in cash processing – whether they are banks, cash-in-transit (CIT) companies or retailers – are all seeking to reduce the costs of cash. Branch footfall has fallen in some countries as more banking services move online. This has led some banks to reduce the number of bank branches, but merchants still need to deposit their takings. In the past, banks, CITs and ATM operators shaped the cash industry but looking forward we see retailers being in the driving seat, looking for more efficient ways to process their cash.

We will see a greater emphasis on connectivity and real-time data, giving organisations up-to-date information on their cash holdings. For cash to remain competitive, its cost must remain low compared to alternative payment levels, so we will see more automation – more self-service devices and more automated systems in cash centres.

Banks might argue that cash is non-core, but it seems inevitable that the CIT industry will be squeezed. What's your view?

Of course, CITs are heavily dependent on cash, but they are taking robust action to protect their business. Firstly, size counts. The industry is consolidating at a rapid pace in many regions,

allowing the global CITs to think much more strategically about their role and drive greater economies of scale. Secondly, they are adopting a solution-based approach by adding cash management to their traditional transportation and processing roles. This involves activities such as white-labelling ATMs, smart safe deployment and the provision of branch services on behalf of high street banks.

How are retailers' cash habits changing?

Not so long ago, retailers managed cash by hand, whether at the point of sale or in the back office. If machinery existed, it was generally limited to a weigh scale, or simple note or coin counters. This is changing rapidly. At the point of sale, there is a much greater customer acceptance of self-service, particularly in grocery stores. In the back office, smart safe technology has proliferated, simplifying cashiers' start and end-of-day processes and improving accountability.

The drive towards higher levels of automation is enabling greater recycling of cash within the store and driving additional benefits for the retailer, such as improved cash visibility, greater security and, in some cases, provisional credit, where the cash is credited to the retailer's account before it is physically collected and counted.

What is the role of the central bank?

The role of the central bank, indeed all regulatory authorities, is becoming ever more important. In the past, central banks played a much bigger operational role than they typically do today, having outsourced many of the physical banknote processing tasks to the commercial cash centres. However, as their operational involvement has decreased, their regulatory responsibilities have increased.



Mike Bielowicz
GLORY's Chief Marketing Officer

At GLORY, we are seeing a dramatic increase in central bank-driven sorting standards, coupled with regular compliance testing. This is happening across the world, not just in Europe or North America. We believe this is having a positive effect on the industry, driving up performance standards and improving the quality of notes in circulation.

The technology of banknotes is also evolving. Do you see this as a positive?

Absolutely. We want to play our part in ensuring that banknotes remain a trusted payment mechanism, so we welcome new developments that make the counterfeiter's job harder. We also welcome efforts by issuing authorities to collaborate closely with banknote equipment manufacturers, such as GLORY, as new features and substrates are developed. This ensures that

we can fully exploit the potential of the new banknote designs when they are issued. We also see opportunities to discuss our latest detection developments with issuing authorities, which may lead to more secure banknote designs.

How do you see the industry evolving in the next five to ten years?

First and foremost, we believe that cash will still be a significant part of the payment landscape. There is little doubt that the number of electronic payment transactions will continue to increase, but cash will continue to play a vital role in the lives of millions of people worldwide.

What will change, however, is the way that cash is managed. We will see even greater levels of local cash recycling at the retail store or bank branch. We will see a greater emphasis on connectivity and real-time data, giving

organisations up-to-date information on their cash holdings. For cash to remain competitive, its cost must remain low compared to alternative payment levels, so we will see more automation – more self-service devices and more automated systems in cash centres.

Finally, we will see more sophisticated banknote technologies to keep one step ahead of counterfeiters. GLORY is investing in all these areas to make sure our solutions are ready for the challenges ahead.

About the company

GLORY is one of the world's largest suppliers of cash technology solutions. Headquartered in Himeji, Japan, and with annual revenues of US\$2 billion, it is active in more than 100 countries worldwide.

Banknote Confidence in a Mechanised Cash Cycle

Maintaining stakeholder confidence in circulating banknotes is usually a core deliverable or outcome of a central bank issuance department.

BY BRIAN HAYR

In the past, public and retail tellers who handled cash manually provided a key assurance and control point for banknote quality. They ensured that unfit, mutilated and suspicious banknotes were repatriated, withdrawn or reported. In many markets, there are now large deployments of cash processing machines and increasing levels of machine acceptance, authentication and quality control in retail environments. Many traditional central bank or cash centre functions – authentication, fitness sorting and reissuance of fit notes – can now be performed by a small retailer with a desktop machine.

The Bank of Canada has reported a reduction of 45% in processing volumes for polymer notes compared with paper, and their unfit notes are down by 78%.

What then does the future hold for central bank policy frameworks supporting confidence, and banknote users who increasingly rely on mechanisation and more durable banknotes?

Issuance, repatriation and withdrawal of banknotes to a central processing site is expensive and requires specialised secure logistics. In recent years, there has been significant investment by commercial banks in retail distribution and processing technologies, which is often not an area of expertise for central banks. Many central banks have a limited understanding of distribution economics and the key drivers of value.

There is also a trend towards more durable banknotes, which can significantly reduce

issuance and repatriation costs if they are recirculated locally or close to origin.

The Bank of Canada has reported a reduction of 45% in processing volumes for polymer notes compared with paper, and their unfit notes are down by 78%. Retailers and banks will want to capture similar benefits from increased mechanisation and more durable, good quality banknotes.

Central banks need to provide a strong incentive to retailers and banks for the early segregation, separation and repatriation of low-quality machine-unfit banknotes.

However, the challenge for central banks is to ensure that policy frameworks and incentives reflect this new mechanised cash life cycle. Maintaining confidence and circulating good quality banknotes is important, but the policy drivers may have to change to reflect the new reality. The circulation of poor-quality banknotes is not a new issue, with most markets having challenges with low-denomination notes. These may be accentuated by local cultural practices, geography, poor incentives or, in some cases, disincentives (as illustrated in Figure 1).

So what changes with mechanisation? Businesses invest in machines because they are more efficient, effective, safer and more reliable than manual processing. Machines can provide real-time data and reports, saving on administration and reconciliation costs. The challenge for a central bank is to align itself with this trend of more efficient and

effective technology throughout the cash cycle, while maintaining confidence in banknotes. The new technology also improves cash's competitiveness with electronic payments.

Before reflecting on a central bank's policy framework, let's look at areas that might be aligned with the stakeholders and their needs.

Common objectives in the banknote life cycle

Central banks and retail owners have shared objectives that will maintain consumer confidence in mechanised cash transactions.

- **Machine reliability:** Cash-handling machine uptime and availability is important for all stakeholders and a key driver of user experience. Poor user experiences lead to negative perceptions of both the payment method and the machine providers.
- **Data availability:** All machine owners want real-time reporting on value and volume. Machines should deliver real-time value – vs batch or end-of-day value – so that cash competes with comparable cleared electronic funds.
- **Banknote fitness:** All machine owners and users want a fit banknote for issuance and acceptance. It is in everyone's interest to support the early repatriation of unfit, mutilated and suspicious banknotes.

Central banks need to re-evaluate their policy frameworks to be fit for purpose for a mechanised cash cycle.

Areas for improvement

Banks and retailers that accept cash, card or online payments often have small discrepancies,

leakage or write-offs. These are often seen as simply a cost of doing business. However, this is not the case for banknotes that are rejected by machines. This situation creates administration for the teller and, potentially, a negative customer experience. There are often no commercial incentives to withdraw or repatriate machine-rejected or mutilated banknotes. The default option is to, quite literally, 'pass the buck'.

Bank and retail tellers do not generally see themselves as first-line law enforcement for machine-rejected banknotes when they are managed and measured on customer experience. If value was given for suspicious banknotes, as is often the case for card and cheques for disputed low-value transactions, this may accelerate the repatriation of machine-rejected and mutilated banknotes. These notes may still need to be reviewed later, i.e., the teller or machine track and traces the note and customer subject to

specialist or central bank authentication. ATM vendors currently promote this capability with retract/reject cassette options.

A similar process could also apply to accelerating the segregation, separation and removal of machine-unfit and mutilated banknotes. Central banks could consider this type of process and incentive to improve processing efficiencies through the cycle, and at the central bank.

More durable banknotes will lead to fewer machine-unfits and suspicious banknotes – the Bank of Canada has reported a reduction of unfits by 78%. This will reduce the proportion of repatriated notes in circulation and, potentially, make the economics of note repatriation less attractive. Ironically, it is these smaller volumes that need more focus from the stakeholders.

Charging banks or cash-in-transit retailers to repatriate poor-quality or machine-unfit

banknotes will have a negative effect on the quality, efficiency and effectiveness of the cash cycle. Instead, central banks need to provide a strong incentive to retailers and banks for the early segregation, separation and repatriation of low-quality machine-unfit banknotes. The market is making substantial investments in mechanisation and sensors. These investments will be impacted if the machines experience more jams and poor machine unfits and availability. Banknote quality and stakeholder confidence are inextricably linked (as illustrated in Figure 2).

Central banks need to re-evaluate their policy frameworks to be fit for purpose for a mechanised cash cycle. They should understand the value drivers for retailers and banks, and the economics of repatriation. If issuers align their policies with stakeholders, they may find the market will plan for more investment.

Repatriation flows

Figure 1: Traditional model



Rejected or mutilated banknotes need to be authenticated at a central bank or cash centre before value is given. The definition of 'unfit' usually includes:

- worn, damaged or defaced notes (machine processed)
- suspicious notes (machine processed)
- counterfeit notes (depending on policy)
- mutilated or machine-unfit notes (unprocessed).

Issues:

- Two categories of fitness (fit and unfit) may not be suitable for a machine environment.
- Often, mutilated and machine-unfit notes are separated by the public and retail sector then recombined into a single bundle when returned to cash centres and retail banks. The processing equipment then performs poorly when it tries to process mutilated and surplus fit.

- Retail banks and cash centres often recombine mutilated notes back into their processed unfits, which causes further processing jams at the central bank. Volumes are usually low (<1%), but they create a disproportionate processing issue.
- Some central banks charge the market to repatriate unfit notes.

Figure 2: Alternative model



Mutilated notes should be separated early in the repatriation process. Stakeholders should then be encouraged to withdraw or repatriate these different categories of banknotes.

Mutilated and rejected banknotes are clearly not suitable for machine processing, but they will require authentication by an expert before being destroyed.

Benefits:

- Banknote processing capability and circulation performance will improve, increasing public confidence.
- The mutilated numbers are small, but disproportionately disruptive.
- Rejected banknotes continue to be authenticated by the central bank or law enforcement.

- The central bank encourages public repatriation to the retail bank by encouraging acceptance of rejected and damaged banknotes.
- The central bank potentially pays retail banks and cash centres for small losses/incidents – judgement applied as in other payment losses.
- If not already the case, the central bank pays for repatriation costs of all unfits.

TREND ANALYSIS

The Future of Cash: Meaning and Implications for the Industry

In a fast-changing payment landscape, how can we ensure that banknotes remain a trusted payment method?

BY TIM BERRIDGE

Consumers are facing increasing choice in how they purchase goods and services. We are all familiar with the huge changes that have occurred in the retail and entertainment markets with the development of the internet. Shopping for clothes and electronics has moved from high street retailers to online giants such as eBay, Amazon and Alibaba. It has even influenced how we consume entertainment media, with traditional formats and platforms being undermined by on-demand streaming from providers like Spotify, Netflix and Amazon Prime.

Inevitably, the way we pay for goods has also changed. The shift from physical transactions to online purchases will drive an increase in electronic payments. However, this is not the only drag on physical cash. In addition to physical banknotes and coins, we can now pay for goods in a myriad of ways. We use credit cards, debit cards, PayPal, Apple Pay, Android Pay, commercial bank applications, contactless payment and even cryptocurrencies like Bitcoin and Ethereum.

This array of choice creates challenges for central banks and the industries that support banknotes as the most trusted payment method. Central banks now have the arduous task of deciding whether to embrace these changes – and provide a framework and regulatory environment to enable these new choices – or to work with lawmakers to legislate against their use.

Comments by people like Nouriel Roubini, professor of economics at New York University, who said that Bitcoin is “the mother of all bubbles” favoured by “charlatans and swindlers”, have prompted some authorities to clamp down on cryptocurrency exchanges and increase regulation in the market.

In March 2018, Mark Carney, Governor of the Bank of England, said, “In my view, holding

crypto-asset exchanges to the same rigorous standards as those that trade securities would address a major underlap in the regulatory approach.”

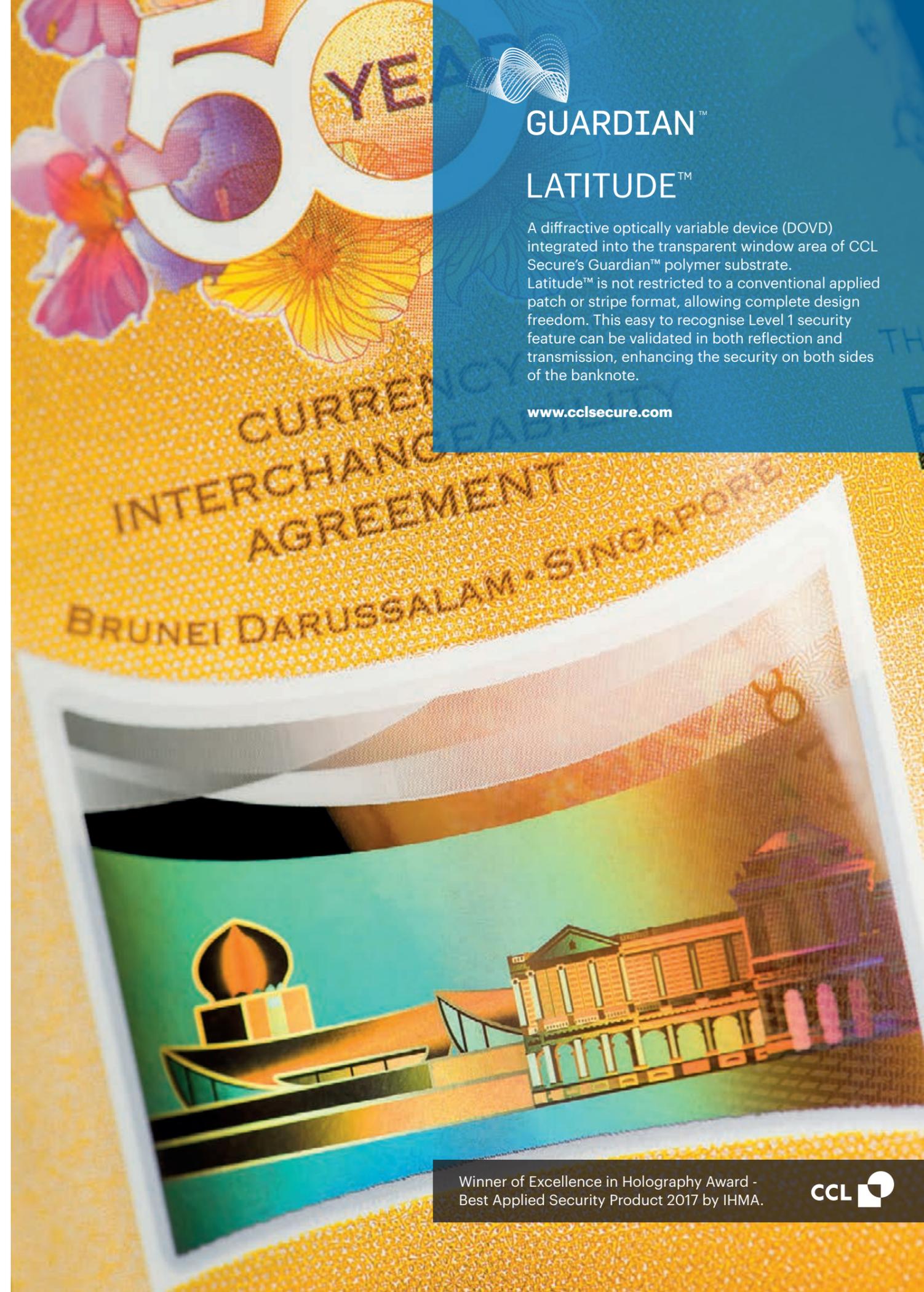
However, several other central banks – including Japan, Sweden, Canada and Estonia – are seeking to embrace cryptocurrencies and implement central bank-backed equivalents to Bitcoin. Still, the majority of them also stress that this work is exploratory and the results could be years away from being implemented.

Confusingly for the public, some banks that are discussing the demise of cryptocurrencies also talk about the potential benefits of the distributed ledger technology that underpins them. What is clear is that the technology behind Bitcoin and other cryptocurrencies is in its infancy. We are yet to see or truly understand the impact it might have.

What does all this mean for those of us who are involved in and supporters of physical cash? It is clear that the choice for consumers and users of cash is only going to increase. We must accept that we live in a world where people can use a combination of payment methods depending on what they are buying and what retail channels they are using.

As an industry, we must ensure that we provide a product to the public that functions in a more automated world and is easily understood, trustworthy and enjoyable to use. We can achieve these goals with technology innovation and, perhaps more importantly, with great design that engages, connects with and delights the public.

At CCL Secure, our continued commitment to world-leading innovation and design for Guardian™ substrate and banknotes is our contribution to securing the future of cash.



GUARDIAN™

LATITUDE™

A diffractive optically variable device (DOVD) integrated into the transparent window area of CCL Secure's Guardian™ polymer substrate. Latitude™ is not restricted to a conventional applied patch or stripe format, allowing complete design freedom. This easy to recognise Level 1 security feature can be validated in both reflection and transmission, enhancing the security on both sides of the banknote.

www.cclsecure.com

Winner of Excellence in Holography Award - Best Applied Security Product 2017 by IHMA.



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