SPECIMEN
As Guardian® continues to evolve and push the boundaries of banknote security, the technology being developed continues to open up new frontiers. A technology that has undergone a transformation is the diffractive optical element (DOE).

Previously used in avionic display applications, it was developed into a banknote feature called WinDOE®. WinDOE® is a level 2 feature easily accessible by the general public in the form of a transmission hologram designed within the clear window of the Guardian® substrate. WinDOE® has been successfully applied on 15 banknotes in five countries (including most recently, Canada).

At a recent industry event, Securency launched Eclipse™ as the ‘evolution’ of WinDOE®. Eclipse™ features a number of improvements over WinDOE® including enhanced brightness and clarity of the hidden image and a substantially increased image size.

The name Eclipse™ represents the feature’s method of authentication, which is to look through it to a distant point light source.

By holding Eclipse™ up to the eye with a distant point light source in the background, the transparent window is transformed into a recognisable image via light diffraction. The sudden appearance of an image is as fascinating to view as an actual lunar or solar eclipse.

In addition to the clarity and brightness, the new and improved feature has enhanced durability and mechanical security and can accommodate non-symmetrical designs, increasing the range of images possible, e.g. dates, numerals, logos and coats of arms.

Key Benefits
- **Accessibility**: Eclipse™ is a Level 2 security feature that is easy-to-use by both cash handlers and the public. It does not require the use of a specialised device for authentication.
- **Novel and Unique**: The novelty of the feature allows for the immediate recall of its presence when a banknote is being checked for authenticity. Its uniqueness is a deterrent to counterfeiters, as simulations for such a feature are not commonly available.
- **Easy to Use**: The large minimum feature width of 10-15mm is usable on both sides of the banknote. It allows for a feature that is easily visible and quick to authenticate.

The evolution of security technology continues with Eclipse™

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**Insight**
Keeping You Notified
Insight and analysis from organisations and individuals experienced in working with Guardian®.

**Specimen Exclusive**
Gerry Gaetz
Gerry Gaetz, Chief of Currency Department at Bank of Canada (BOC) shares with us what has been learnt, the decision making process and outcomes from his work on the Canadian banknote series.

**Industry Interview**
KINEGRAM® – A clearer future
An interview with Peter Mühlfelder, Head of Business Area Security within KURZ and the General Manager of the subsidiary, OVD Kinegram AG.

**Research and Development**
It begins with an idea
In January 1988, innovative research and development culminated with the release of the Australian commemorative $10 banknote, which was the first polymer banknote to contain a window, and in that transparent window was the world’s first hologram for a banknote. The same innovative thinking has been infused into the way that research and development (R&D) is pursued at Securency International.
The use of KINEGRAM ZERO.ZERO by KURZ on the CND100 is driven by the high security requirement evident: As an industry, it stands as a key strategy in countering the threat to Central Banks caused by banknotes with the public and to maximise the aesthetic appeal of the note. However, the turning point for third party features on Guardian® to play a permanent role in the security of a note came in 2003 with the launch of the new Romanian one million lei, and the occasional incorporation of third party features on Guardian®. The application of KURZ foil on the 1988 Australian bicentennial $10 note, then on commemorative notes during the 90s in Singapore counterfeit crime, both now and in the future.

The power of industry collaboration in delivering a bespoke security solution for Central Banks is incorporated of Microperf® by Orell Füssili. It was found that the feature performed better than the security of a note came in 2003 with the launch of the new Romanian one million lei, and the incorporation of Microperf® by Orell Füssili. It was found that the feature performed better than the effect on cotton-paper, with the clear polymer substrate maximising the Microperf® effect. The use of KINEGRAM ZERO.ZERO by KURZ on the CND100 is driven by the high security requirement for the note as specified by the Central Bank, and involved considerable time and effort to have this feature seamlessly incorporated within the clear edge-to-edge window of the note. This focus is opening channels for collaborating on new integrated security feature opportunities like never before. As evidence of that maturity, the recent launches of the Charles Darwin Guardian®, the Jules Verne Guardian® Note (see inside back cover) and the Jules Verne Guardian® Note (see Page 15) sends a strong signal to other methods like replacing a whole series of banknotes with the public and to maximise the aesthetic appeal of the note. However, the turning point for third party features on Guardian® to play a permanent role in the security of a note came in 2003 with the launch of the new Romanian one million lei, and the occasional incorporation of third party features on Guardian®. The application of KURZ foil on the 1988 Australian bicentennial $10 note, then on commemorative notes during the 90s in Singapore counterfeit crime, both now and in the future.

The power of industry collaboration in delivering a bespoke security solution for Central Banks is evident: As an industry, it stands as a key strategy in countering the threat to Central Banks caused by counterfeit crime, both now and in the future.

Paradigm Shift

Is banknote industry collaboration about to reach a tipping point?

Judging from its effectiveness in counterfeit prevention to date, the CND100 could be the catalyst for increasing numbers of Guardian® banknote projects to integrate leading edge security features from across the industry. The feature article on Bank of Canada’serry Gazzzetz starting on p6 provides a first-hand insight into this experience.

Since the invention of biaxially oriented polypropylene (BOPP) in the early 80s, and its commercialisation later that decade, there has been the occasional incorporation of third party features on Guardian®. The application of KURZ foil on the 1988 Australian bicentennial $10 note, then on commemorative notes during the 90s in Singapore counterfeit crime, both now and in the future.

The power of industry collaboration in delivering a bespoke security solution for Central Banks is evident: As an industry, it stands as a key strategy in countering the threat to Central Banks caused by counterfeit crime, both now and in the future.

Environmental Impact Assessment. Polymer, Superior by Every Measure

The Bank of Canada recently released the findings of an independent study on a life-cycle assessment of the environmental impact of polymer versus cotton-paper notes. Environmental experts PE Americas and Tryskele Sustainable Environment, Safety and Health were commissioned to conduct a ‘cradle-to-grave’ life-cycle study in which the environmental impact of polymer and paper substrates were tested.

The life-cycle assessment measured nine internationally recognised categories for environmental impact as defined by the ISO 14040 standards for Life Cycle Assessment. In every category, the expert team found that polymer substrate delivered a reduced impact on the environment by an order of 25-60% as compared to cotton-paper notes. These indicators include primary energy demand, global warming potential, eutrophication potential, acidification potential, and smog potential. The study indicated one of the keys to this result was the significantly longer life of polymer. Based on Bank of Canada data, paper substrate has an average life of three years, whereas the polymer substrate was conservatively judged to have a life of 7.5 years.

An executive summary of the independent study is available at www.banksofcanada.ca/banknotes/bank-note-series/polymer/life-cycle-assessment-lca

The achievement of a significant (quick fix) while the introduction of polymer substrate has enabled Central Banks to enhance the quality of notes in circulation due to their being more robust and durable in nature than traditional cotton based paper, it is still a challenge for Central Banks to manage low denomination ‘high velocity’ notes in circulation in order to maintain public confidence in the currency.

ATM note quality is normally high because commercial banks are motivated to prevent poor quality notes from causing jams to their dispensing mechanisms, thereby negatively affecting the customer experience. However, lower denominations don’t have the same luxury so, the question is, just how do Central Banks go about maintaining the quality of notes in this lower denomination part of the system?

Former Central Banker and now PolyoQA® Services Central Bank Advisor, Dirk Putter says there are three major strategies which Central Banks may consider:

Private Company Cooperation

Central Banks can work with large public-facing organisations, like Cash in Transit companies and large retailers, to participate in a banknote quality improvement/replacement program. For example, in order to withdraw unfit £5 notes from circulation, the Bank of England implemented a banknote exchange program with supermarket retail chains and also improved the functionality of ATM’s to accommodate the lower denomination.

Design Change

Changing the design of a note is one of the few ways to incentivise the public and therefore commercial banks to actively exchange notes by not wanting to be using the ‘old version’. The achievement of a significant (quick fix) upgrade in quality is relatively fast if compared to other methods like replacing a whole series of banknotes with a new family.

Banknote Injections

Our industry’s equivalent of a vaccination against poor quality notes is that Central Banks from time to time force the injection of fresh notes through the national cash management system and only accept back unfit notes in order to maintain public confidence in the country’s currency.

The Ripple Effect of Polymer on Central Bank Operations

The long-term experience of Central Banks using Guardian® substrate banknotes shows that numerous efficiencies and productivity gains are achieved as the benefits of a full banknote series in polymer take effect.

With a cleaner circulating currency and less counterfeiters present, both the Reserve Bank of Australia and the Reserve Bank of New Zealand were able to reduce their requirements for checking banknote quality from eight times a year to just twice per year.

Once fully circulating, this lower banknote management requirement started to significantly reduce costs with both banks being able to close their state-based offices and centralise their operations.

By rationalising the organisation’s infrastructure and centralising the function of managing money, the Banks took the next logical step of moving from being a retailer to taking on a wholesale role with commercial banks and CTFs, pushing the processing of notes back on the industry to become self-managing.

The banking sector owns all the cash, with the function of the Central Banks in these countries now limited to monitoring the currency for counterfeiters and identifying unfit notes for destruction.

“The Bank of Canada will have the same opportunity,” says former RBA official Chris Catlin, now a Central Bank Advisor with PolyoQA® Services. “What Central Banks are given with polymer banknotes is the opportunity to reform a range of functions within the business. Central Banks are accountable to the Government for their performance and therefore are looking to run an efficient and lean operation wherever possible, and always be looking to enhance the value and usability of currency with the public.”

For more information on the transformations that take place through Central Banks that adopt Guardian®, contact Chris Catlin at Chris.Catlin@polyqa.com.
How can we make impossible shapes a reality?

By Lachlan McDonald, Head of PolyTeQ® Print Services

M.C. Escher first studied architecture before changing to graphic arts at the School of Architecture and Ornamental Design in Haarlem, Holland. His foundation of understanding buildings may well explain why years later he produced artwork that transformed images from two dimensional to three dimensional. At this time in the 1930’s and 40’s Escher also experimented with tessellating and morphing figures, and tilting the visual plane to create unique visual illusions which were often quite simple but highly effective, for example his woodcut “Night and Day”.

However, it was not until an English mathematician Roger Penrose, who came up with the impossible triangle as an example of the simplest form of an impossible shape and Penrose’s father developed an impossible staircase, was Escher inspired and later become famous for the creation of impossible figures with prints such as the “Waterfall”.

This piece of history for me captures so much of what we believe in as our design philosophy for Guardian® banknotes. It shows the important relationship between mathematics and art which has been used in banknote design for generations, creating effects such as Guilloche and complex Intaglio and offset line structures. It also shows the relationship between architecture and art, and how thinking architecturally is critical for designing Guardian® banknotes that fully realize their potential.

An architect needs to think in three dimensions but initially bring their work to life as a drawing on a two dimensional plane. They also need to understand how light and windows affect the space they are creating. What is designed on one side of the building or space will have an impact on the opposite side.

M.C. Escher, self portrait. Escher’s extraordinary lifetime of work is the inspiration behind the Escher industry banknote (below)

But how can Escher’s or Penrose’s impossible shapes be made a reality, i.e. real and impossible? By using technology such as multiple colour-shifting inks, diffraction patterns, lenses, opacity and windows in banknotes to bring an impossible shape to life and make it a reality.

The challenge is to make the final combination of design, material science and print “impossible” for the counterfeiter to replicate but simple in its form for the public to understand. Escher once wrote to Bruno Ernst:

“Just imagine, I spent more than a whole month, without a break, pondering over that print (Concave and Convex, 1935), because none of the attempts I made ever seemed to turn out simple enough. The prerequisite for a good print- and by good I mean a print that brings a response from a fairly wide public quite incapable of understanding mathematical inversion unless it is set out extremely simply and explicitly- is that no hocus-pocus must be perpetrated, nor must it lack a proper and effortless connection with reality. You can scarcely imagine how intellectually lazy the ‘great public’ is. I am definitely out to give them a shock, but if it is too high, it won’t work.”

Escher at work, plus some of Escher’s original sketches (including another self portrait), that directly influenced the design of the note

Securency encourages designers to adopt a philosophy of thinking three dimensionally, in multiple layers and balancing windows and half windows front to back. This is achieved by going beyond the current limitations of paper banknote design and using the latest technologies to create simple designs that engage with the public and instill confidence in cash.

With Guardian®, designers can increase the number of security features incorporated within the substrate. Paper features are largely limited to threads and watermarks. Whilst both these features can be imbedded into Guardian® substrate, in addition designers can incorporate complex and multiple windows, half windows, fine vignettes, multiple colours, metallic areas, holograms, lens structures and colour-shifting inks.

All these features are incorporated during the single manufacturing stage, which ensures good registration and integration. It allows the features to weave from above and below the surface. There are also a number of “lock and key” features where part of the feature is added into the substrate while the other part is added during banknote printing such as Intaglio embossments in the window, holographic foils, screen applied colour-shifting inks and see-through features in half windows.

Although the focus is often on trigger and authentication features for the public a significant range of teller assist, machine readable and central bank features are also built into the substrate. Incorporating these features into the substrate allows the designer space to focus on the print features and maximizing the integration of simultaneous front and back registration, screen, two-sided coloured Intaglio, letter press, overcoating and applied foils.

Ultimately the distinctions between substrate, print and applied features are unnecessary with the final objective to ensure a seamless integration of all the banknote layers.

To assist designers and help them to maximise the benefits of this technology, Securency has developed a design guide for Guardian® banknotes. The use of the principles contained in this guide is critical for ensuring a banknote is not only visually impressive but also functional and highly secure.

To roll out this design guide Securency and PolyTeQ® Services are offering tailored workshops for designers in a confidential environment to share our 24 years of experience of designing, printing and issuing banknotes. It’s based on research covering; durability, design, cash processing, banknote production, counterfeiting threats, cash handling/use and a few of our learning’s along the way.

This way we hope to use science, art, print, mathematics and architecture to turn Escher’s and Penrose’s impossible shapes into reality.

To find out more about our design philosophy and the Guardian® design guide please contact Lachlan McDonald at lachlan.mcdonald@polyteq.com or +61 438 232 999.
Bank of Canada’s new polymer series

Gerry Gaetz, Chief of the Currency Department at Bank of Canada (BOC) has been actively involved in the last two changes of the Canadian banknote series. Gerry shares with us what has been learned, the decision-making process and outcomes from this multifaceted project.

“We deliberately spent a long time in the research phase of this new note series program in order to do a full sweep of the technologies for banknotes that were currently available.”
banknotes, an extensive campaign for public education with a law enforcement program in collaboration with The Royal Canadian Mounted Police was implemented. This proved to be very successful with counterfeit rates reducing to less than 50 ppm consistently between 2009 & 2011.

If the initial counterfeiting threat was reduced, why did you invest time and money into a new series so soon? To engage in a proactive approach rather than a reactive one; in 2006-07 a new banknote project was launched with the aim to stay ahead of the counterfeiters and to ensure that Canadians could have trust in their banknotes. This new approach was different to that in the past where the bank was more reliant on its suppliers.

This longer term plan required a team to be built with the requisite technical skills that could look at the options for banknotes with a core focus on security. This is what we see as our change from being an intelligent consumer to being an intelligent team or organisation.

This new approach was helped by some new perspectives founded on the basis that we needed to build a strong team with highly competent individuals. In order to maintain a strong focus and gain alignment, we went public with a target issuance date four years out.

This set an expectation, gained commitment from the team and ensured that the project planning had a defined end-point.

What were the frameworks that led BOC to choose the current designs and security features for the new series? We gave ourselves five years to go through this process as we were taking a more fundamental approach to the new series. We started by establishing project objectives which we had to achieve a significant security enhancement and to issue the banknotes according to the established timelines. As the security can be a little ambiguous, we defined it more clearly as being ‘difficult to replicate while being easy for the public to authenticate.’

We deliberately spent a long time in the research phase of this new note series program in order to do a full sweep of the technologies for banknotes that were currently available including all security feature categories - those for the general public (level 1), those for cash handlers and cash sorting (level 2) and those for the purpose of the Central Bank (level 3). In fact, around half of the project timeline was invested in the research phase.

All of the available options were evaluated by our definition of security which required adversarial analysis to test the difficulty of replication and we used various objective methods to analyse their ease of use. The ease of use was tested both within the bank and with the general public, who both provided the most valuable information and interesting innovative input.

Perception analysis was used with careful attention to the construction of experiments to determine the ease of authentication in environments where the users could only feel the notes, see the notes, or both feel and see the notes.

The research phase uncovered a few needs that the bank would require in order to keep the new banknote series well ahead of the counterfeiters while at the same time being intuitive for the general public.

To further the adversarial analysis and perception studies, more analysis was applied, whereby participants were asked to determine which banknotes were authentic and which were counterfeit within a selection of notes. The hypothesis was tested as to whether the participants could judge the authenticity of the banknote on the basis of their perception of quality. This was performed on holographic elements with excellent results. These ease of use studies were groundbreaking for The Bank of Canada.

The research phase uncovered a few needs that the bank would require in order to keep the new banknote series well ahead of the counterfeiters while at the same time being intuitive for the general public. One development that started as a result of this exercise was to develop a new paradigm in banknote inks.

The scientists in the team looked at various ideas and which partners were most suited to develop and deliver upon them. One notable output of this has been the NEOMAG® intaglio ink system that is now marketed by SICPA, and first seen on the new Canadian banknote series. Another insight from the research was that holography was and still is important for the security of Canadian banknotes, but to take it further by getting more security synergy from leveraging transparency in the base substrate. This led to the next project stage for the development of possible configurations of holograms and transparency. From this, substrates were chosen and narrowed down from there. This differs from the linear approach that is typically taken in new banknote decisions where the substrate is chosen, followed by other subsequent decisions for print features, etc.

In order to achieve an optimal outcome, we chose configurations that used all substrates that offer transparency and holography, as security was our main driver. We performed trials which included the manufacture of test banknotes. Through this process, we judged that Guardian® substrate was able to offer more synergy in security through integration with features derived from other security print processes. In particular, from the perception studies previously discussed the importance of holography on windows was seen as a key goal to achieving the vision of a leap forward in Canadian banknote security. The deciding factor for the banknote’s configuration was established once it was proven that dynamic optically variable devices (DOVDs or holograms) can be applied with the right level of quality on large transparent windows on Guardian® polymer substrate.

In terms of the design, this was run as a parallel activity to the selection of the banknote format and security features. An early decision was made on the basis of this to maintain the same colour and portrait subjects for the new series to provide familiarity between one series and the new for the Canadian public.

The bank undertook a public consultation process in order to make a final selection on images and themes for the reverse design on the banknotes. Through this process we had to consider how we were going to get the most out of transparency and opacity from Guardian® as this was a new experience for us; it required a paradigm shift in order to reach the final outcome. For the next series, we will likely build more time into our plans for design and performing experiments to optimise the results.

Were there limitations/benefits from choosing the Guardian® substrate for the new banknote series? At the time of research, Guardian® had a lower number of security features offered than other alternatives and its colour shifting technologies were judged to lower the security of banknotes in the Canadian context which was a limitation. There was an impressive R&D pipeline for overt security elements, but not many that were commercially available. The other limitation that took some time to establish was the novel...
The benefits for adopting Guardian® were very
taken a very proactive approach with
"simple: We would have a longer lasting product
supply chain with KURZ supplying to Securency
challenge were
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The benefits for adopting Guardian® were very
We: We would have a longer lasting product
are very pleased with the quality of the banknotes
are pleased with the output and with the spirit of
very positive. By and large, we have a culture of
communicate the new banknote series
to the various stakeholder groups? Did
The simple fact is that the story died out in two
days when one news agency, Global Toronto,
decided to run their own tests to prove or
disprove the story. Their test resulted in the
claims of polymer banknotes melting in ambient
to extreme conditions being disproven.
Our strategy in this circumstance was to stick to
our messages and maintain the position that the
claims are scientifically improbable.
The Bank of Canada ran extensive tests to ensure
that the new series of banknotes would be
suited to the diversity in weather conditions that
Canada experiences from -40°C to +35°C with a
range of humidity and precipitation.
It is frustrating that this story had emerged and
was picked-up by a wide range of newspapers,
but could have been made worse if the Bank
decided to make a big deal about the issue to
ask for corrections from the media.
If you had to do it all over again, what
would you change?


In addition to the equipment manufacturers, commercial
banks, retailers and the general
public were all engaged early in the process.


Four rounds of surveys have been administered
and we are now registering up to 77% awareness, which is very high considering only the two high
denomination banknotes have been issued
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Has Guardian® delivered on BOC’s
expectation in terms of security, 
counterfeiting, recyclability etc. to date?
It is still quite early in the process as only the
$50 and $100 banknotes have been issued,
and have been in circulation for only about six
months and a year respectively (ed. note: the
$100 banknote was issued 7 November 2012).
To date there have been only two counterfeits
passed – both of poor quality.
From our past experience, had the series been
printed on paper substrate we would have
already started to see more counterfeits of the
new series.
As the banknotes are expected to last longer
than previous current circulation experiences, it
is too early to say if the durability is meeting our
expectations.


From an environmental standpoint, spoiled
production within the supply chain has all been
recycled but we have not accumulated enough
waste of mutilated or damaged banknotes to
start the process of recycling banknotes.
Thus far, I am happy to say that the new
banknotes have met their expectations, but there are
still some challenges regarding this new
supply chain that has been constructed for the
Canadian banknotes.


There have been claims that Canadian $100
and $50 notes have been melting on car
dashboards. What is your opinion of this?
This is a fictitious story that unfortunately
was run in a national newspaper and then
subsequently picked-up by others. It is a silly
situation as the major newspaper didn’t verify
the authenticity of the claims within the article
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but could have been made worse if the Bank
decided to make a big deal about the issue to
ask for corrections from the media.
If you had to do it all over again, what
would you change?


Without being biased, I think the way we went
through the new note series process was
appropriate. Next time around I think we will
spend more time and provide more oxygen to
the design of the banknotes and also more time
at the production stage. Due to a fixed end-point
we needed to shorten the times available for
design and production.


Despite this, we would not have changed
the management decision to put a pin in the
calendar at a specific date early in the program.
Without that fixed end-point we may well still be
issuing the last series of banknotes even today.

From a team alignment perspective it provided
a unified vision for all to achieve. In order to
deliver the project successfully, we needed to
build a strong team, provide them with the right
tools and space to operate and I have been very
proud of their efforts.
In setting a fixed time for the issuance of the
new banknotes series, it was never our
intention to, in any way, compromise on quality.
If the team had not been able to deliver on
time other options would had to been
considered.

If I could go back in time, I would have
encouraged Securency to work more
productively with other industry players so that
a ready-made security solution could have been
ready for Canada’s new banknote series.
I believe that now that this has become a
major point of emphasis for the business that
product adoption won’t be as limited into the
future as it had been until now.

What is the key advice you would give to
fellow central banks?
I don’t like to give advice to other central banks
in general, but one thing that is paramount to
all decisions is contest, especially the
domestic context. This ranges from the general
culture of the nation, the culture of the bank
and the willingness to innovate as well as the
way in which the board and Governor accept
proposals.
On top of the cultural dimension, it is
paramount to understand what your threats are.
Are your banknotes being counterfeited and by
whom? Are they opportunistic individuals or is
it run through organised crime?
Another important factor to consider
regarding counterfeiters is to understand your
neighbouring countries and what it is that they
plan to do with their banknotes. My opinion
is that you should always try to be different in
your approach to avoid similar counterfeiting
situations spilling across borders, especially for
the cases where organised crime is involved.
KINEGRAM® – A clearer future

Peter Mühlfelder has been working for KURZ for over 17 years. He has many roles within the company which has allowed him to develop a firm concept of the processes involved during the production of banknotes.

As Head of Business Area Security with KURZ and General Manager of subsidiary, OVD KINEGRAM AG, Peter’s responsibilities include all high-security foil products for banknotes and government-issued ID documents.

In an exclusive interview with Specimen, Peter shares the history, transition, and future of the KINEGRAM® technology.

The KINEGRAM® is one of the well known brands in banknotes; what is the history of them?

The first KINEGRAM® on a banknote appeared in 1989 on the 5000 Schilling note in Austria; it was in a patch format carrying an image of Mozart. This was already a project in collaboration with Leonhard KURZ who brought the foil technology, and OVD Kinegram (then owned by Landis & Gyr) who were responsible for the diffractive OVD. It was the basis for many more joint projects and resulted in the KURZ Group acquiring OVD Kinegram in 1999. Key projects include the German Mark, the Swiss Franc, the Euro, the Turkish Lira and more recently the Canadian Dollar, which is applied on Guardian® polymer substrate. To date over 250 banknote denominations worldwide, in more than 70 countries use the KINEGRAM® foil. The KINEGRAM® technology will continue to expand with ever more features to help protect the world’s currencies.

What impresses you about the Bank of Canada designs?

The integration of the foil and window is a new and innovative design. The window allows for the foil to exhibit the same quality, independent of which side the banknote feature is viewed, combined with extremely fine demetallisation and fine details in the foil. Technically speaking, the combination of a full colour portrait with a KINEGRAM® structure used on the building depicted is also a breakthrough achievement.

DOVD’s

Dynamic optically variable devices can be viewed from both sides of the banknote, if designed in a window.

What are the design options for foil-based technologies such as KINEGRAM® when used with Guardian®?

KURZ has been promoting a “Multiple-Patch-Philosophy” for several years. The idea behind it is the flexible combination of manifold effects and design elements out of a wide range of options. Several distinct patch-like areas can be combined in one foil stripe, with different features in each area. The individual feature combination is subject to the choice of the customer. The design options on Guardian® range from the more conventional inclusion of a foil on the white opacified area in patch or stripe form to foil applications embedded partially or completely over the window. A specifically designed window feature is KINEGRAM® REVIEW®, which offers two completely different diffractive images on each side banknote. This solution provides a significantly higher degree of security and in addition avoids issues where text or numerals in the design are seen in mirror image (one could also alternate front and back legible texts). Another new development, KINEGRAM® RECOLOR® shows the diffractive design in silver metallic when viewed from one side, and shows up to as many as three colours when viewed on the reverse side.

What benefits do you see in the new synergy of designing overt elements such as Kinegram’s in transparent windows to Central Banks?

In this case the window in Guardian® by nature lends itself to features and effects that can be viewed from either side of the banknote or in transmission when holding the note against light. The window offers highly secure and visually interesting possibilities that even designers initially have to come to grips with. A certain amount of lateral thinking can yield impressive results, offering features that are both highly secure and intuitively easy to understand for the general public. We are looking forward to the launch of our mutually designed demonstration banknote later this year which very impressively shows the combination of the latest technologies of both our companies.

KURZ is convinced that the best way of increasing security and banknote protection lies in the combination of different highly sophisticated security technologies. In this case the window in Guardian®
It begins with an idea

The specification of an innovative banknote cannot be solely focused on security features as security and design must complement each other. The same innovative thinking has been infused into the way that research and development (R&D) is performed at Securency. The only difference is that with a stronger focus on development, there has been a dramatic reduction in the time for an innovation project to become reality; the timeframe being compressed from 20 years down to a matter of months in many cases. By linking into specialised researchers at other institutions, a broader and more informed development process and program has been achieved.

In the 1960’s, using diffractive structures as a security device, such as holograms, was a long-term vision of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Reserve Bank of Australia (RBA). At that time, they were purely a scientific novelty without any commercial application. However in January 1988, innovative research and development culminated with the release of the Australian commemorative $10 banknote, which was the first polymer banknote to contain a window and in that transparent window was the world’s first hologram for a banknote.

To further its internal skills, Securency operates an open innovation model with around ten institutions at any one point in time. These institutions range from those with several thousand researchers down to small innovative groups. By operating an open innovation model, knowledge and expertise is tapped into which can yield interesting and ground-breaking results.

One of Securency’s owners, Innovia, manufactures the clear polypropylene film that forms the base substrate for Guardian®. Through this linkage it is possible to cooperate in a systematic way to further innovate the properties of the core substrate.

Ideas can come from many areas and one way that we have innovated in banknote security can be seen with diffractive optical element technology, now known as Eclipse™ (previously known as WinDOE®). These devices were previously used in avionic display applications such as cockpit screens for fighter pilots using highly complex optical masters in a solid and rigid state. To translate this to a banknote required the technology to be flexible and durable enough, able to be manufactured at the appropriate speeds whilst maintaining a high quality standard. It also needed to be cost effective to allow a Central Bank to incorporate it in the banknote design.

The most significant banknote 'first' from a security perspective was the transparent window and the hologram for banknotes in the 1980’s. Many other developments have followed on from those innovations.

Previous developments that were completed, but never exploited are in the field of banknote self-verification, micro-laser ablation, in-film marking, nanoparticles as security devices and machine readable holograms. The focus of Securency’s substrate security developments has typically been at the highly overt public security level. This has changed over the past two years to encompass other security feature opportunities and to work with other suppliers to provide Central Banks with additional value and options.

Future innovation will likely be in the new fields of nanolithography and photonics in addition to further advances and exploitation in fields of lenses and holography.

The centerpiece of the facility is a full-scale gravure press for the manufacturing of Guardian® substrate that is dedicated to the development of new feature technologies and is capable of proving feature manufacturing capabilities. The R&D Centre also houses laboratories for wet chemistry, ink formulation, adversarial analysis and forensic detection. This enables risk minimisation through intense testing of all materials.

There is a combined research experience in excess of 160 years in Securency with a diversity of expertise in fields including electrical and electronic engineering, organic chemistry, ink chemistry, materials science, physics, and a support team that are experts in reprographics and adversarial analysis.

Securency invested in a custom built R&D Centre in Craigieburn, Australia which was opened in 2009. The facility was constructed to enable finished banknotes to be designed and manufactured for the purpose of trials of new developments and to allow interactions with Central Bank customers.

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All of the cooperating partners on the Jules Verne Guardian® specimen, Innovia Films, KBA-NotaSys, KURZ, Orell Füssli, Securency and SICPA are proud of the end result; while it is an extraordinarily complex note to produce, it was successfully produced and delivers a banknote of the highest quality, highlighting the possibilities for polymer note design and feature integration, on a platform on which all partners in the banknote production process can find an appropriate base for their features to ensure the best possible banknote - aesthetically attractive and highly secure.

The boundaries in the use of clear windows were not expanded upon intentionally, because this is being increasingly done in the marketplace. Instead this project sought to demonstrate the design integration of both aesthetic and security features on Guardian®.

Bringing the original Jules Verne specimen to life on Guardian® brought many challenges. The result is a fantastically integrated note design that opens up a whole new world for how Central Banks can build security into their banknote supply.

Jules Verne: A New World Of Possibilities

By Michael Blesovsky, Managing Director, Innovia Films Sàrl

At the Currency Conference in Buenos Aires, the idea was born to renew the Jules Verne specimen that had originally been produced on paper, but this time to produce the specimen on Guardian® to showcase the substrate as the ideal banknote platform, highlighting the benefits of using Guardian® to the printing and application processes used in banknote production and to the latest security features available in the marketplace.

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The same innovative thinking has been infused into the way that research and development (R&D) is performed at Securency. The only difference is that with a stronger focus on development, there has been a dramatic reduction in the time for an innovation project to become reality; the timeframe being compressed from 20 years down to a matter of months in many cases. By linking into specialised researchers at other institutions, a broader and more informed development process and program has been achieved.

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Future innovation will likely be in the new fields of nanolithography and photonics in addition to further advances and exploitation in fields of lenses and holography.
Central Banking is a “dream” job. One of its primary functions is to supply a product that is in daily use, has production costs of a few cents and has a selling price that is unaffected by competition. Even further, competition is illegal! The ‘products’ of course are legal tender bank notes. A Central Bank purchases bank notes from suppliers and then sells them to commercial banks at face value. The commercial banks have current accounts at the Central Bank which are debited or credited on a daily basis when they buy bank notes to meet the demand of their customers or deposit unfit bank notes for replacement.

In essence the Central Bank is the wholesale supplier of the product and the commercial banks are the retailer.

For Central Banks the total value of bank notes sold, or the more common term, the value of ‘bank notes in circulation’, is a liability on the balance sheet of the Central Bank. The corresponding asset is Government and foreign investments, purchased with the funds received from the commercial banks. The interest income on these investments is known as Seigniorage.

Seigniorage income that accrues to the State or Monarch has been around a long time. During the era of metal-based money, the monetary base consisted of precious metals produced by the public and converted into coins by the State. The difference between the face value of the coins and the cost of acquiring the metals and minting them generated a financial benefit for the State or reigning Monarch.

Seigniorage income is very significant for a Central Bank. The 2011 Annual Report of the Reserve Bank of Australia (RBA) shows a liability “Australian notes on issue” of $50.1 billion as at 30 June 2011. This means the RBA had received this amount from the commercial banks in exchange for the sale of around one billion notes, as the report says elsewhere.

The funds received from the sale of the bank notes are invested in Australian dollar securities and foreign exchange. The interest received on these investments provided the RBA with (seigniorage) income of $1.9 billion. Meanwhile, total general administrative expenses amounted to $303 million.

Seigniorage income enables a Central Bank to be self-funding and financially independent of Government. This is an important consideration in countries where the Central Bank has been given a mandate to control inflation by using monetary policy tools. In most countries a major part of the Central Bank’s net revenue is transferred to the State in the form of a dividend.

While interest bearing assets corresponding to bank notes in circulation are a source for permanent income for Central Banks and indirectly for the State, coins in most countries are issued by the Government and only brought into circulation via the Central Bank distribution system. In this case the State, as in ancient times, is the direct beneficiary of the difference between face value and production cost including materials.

Thus, seigniorage from the issue of coins does not provide permanent income, as in an accounting sense the value of coins in circulation is treated as a contingent liability. The annual revenue of the State in this case depends on the annual growth of coins in circulation.

Value of seigniorage by Bank, 2010

The Charles Darwin Guardian® Note is a groundbreaking demonstration of highly evolved design that seamlessly integrates market-leading security features into an aesthetically appealing, high security banknote.

Where does this process start and where does it end? Exactly how are specific effects achieved?

These are just two of a multitude of daunting questions that make attempting to counterfeit a high security Guardian® banknote an uneconomic proposition. Predators will target a weaker gene pool.

Survival of the Fittest continually extends the leading edge of innovation with the ability of Guardian® to now accommodate the latest security features from other leading manufacturers. In The Charles Darwin Guardian® Note, SPARK® by SICPA, KINEGRAM ZERO.ZERO® by Kurz and a range of security features exclusive to Guardian® display a powerful never-before-seen feature combination.

Stocks are limited. To request your Charles Darwin Guardian® Note, contact:

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