



Security For A Changing World

DuraNote

DURANOTE – Security for a changing world

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1 Choosing DuraNote for the next generation of bank notes

As a decision maker in the currency issuing process, you now have a greater choice of technologies than ever before. This briefing discusses the reasons why you should choose DuraNote, the most advanced polymer substrate, for your next generation of banknotes.

1.1 Security

Faced with a steadily rising counterfeit experience, most of the world's banknote issuers are searching for alternatives to protect their next generation of notes, to ensure that their citizens can have confidence in the authenticity of their banknotes well into the next century. Canada's AGRA Inc. and the US Mobil Chemical Company, a division of Mobil Corporation, have partnered to develop DuraNote, a second generation polymeric banknote substrate. The multilayered substrate is engineered specifically to provide security against the use of colour copiers, laser printers and other forms of reprographics and conventional counterfeiting. The design will allow banknote printers to embed unique security features within the polymer substrate to provide maximum protection against counterfeiting. If desired, existing security features can also be applied to the surface of the note. Since delamination of the substrate is virtually impossible in regular use, because of the high bond strength of the structure, the embedded security features are well protected. Any deliberate attempt to separate the layers will destroy both imbedded features and the note itself.

1.2 Economy

Many of the world's issuing authorities have come under significant cost pressures over the last few years. Since banknote operations represent one of their most significant cost items, many issuers have been examining the scope for cost reduction in this area. DuraNote offers issuers the potential to reduce their banknote costs by a very significant amount. Because of its more sophisticated design, the unit cost of DuraNote substrate is higher than paper. But experience shows that polymer banknotes last up to four times longer than traditional paper currency. This means that issuers could save significant amounts of money on their banknote operations—some as much as 60% to 70% with all denominations converted to DuraNote substrate.

1.3 Design

Many issuing authorities have been searching for designs that will be representative of their traditional national values, as well as their aspirations for the new millennium, while permitting the best use of new security features. DuraNote offers an unprecedented opportunity to accomplish these design objectives. A greater choice of security features is possible than with any other currency substrate. The incorporation of a combination of national symbols in registration with each other within the laminate will produce a unique and exquisite effect.

1.4 Processability

Issuing authorities have always been vigilant to ensure the printability of new series and, in more recent years, have become more concerned that their notes can readily be processed by automated note handling equipment. DuraNote substrate has been extensively tested to ensure its printability and ease of handling, in collaboration with a number of international banknote producers, issuers, ink suppliers and manufacturers of note handling equipment. Testing has demonstrated that the DuraNote substrate is printable by all standard methods, with only minor adjustments in the printing process and with no requirement for protective overlaquer. As well, tests have shown that the substrate can readily be processed on a broad range of commonly used note handling equipment, ATMs and vending equipment.

1.5 Risk

In issuing new series, most issuing authorities attempt to balance the risk of performance failure against counterfeit risk. The former is minimized by retaining traditional materials, processes and security features, whereas the latter is minimized by adopting innovative materials, processes and security features to defeat the techniques used by counterfeiters. With the rising trend in global counterfeiting, the balance is swinging in favour of innovation. DuraNote substrate is well placed to meet this shift in risk preference. Although it is state of the art technology, it has been extensively tested to minimize the risk of new product performance failure. At the same time, it offers a more complete arsenal of overt and covert security features than any other currency substrate, which will allow issuers to avoid the immediate counterfeiting problem that other countries have recently experienced with new issues using conventional substrate and security features.

1.6 Summary

The DuraNote substrate meets all of the security and design objectives that most issuing authorities have for their new series, while allowing them to reduce significantly the annual cost of banknote production. DuraNote is truly designed as the banknote substrate of choice for the next century.

2 The security of DuraNote currency substrate

The DuraNote substrate is a press-ready, polymeric material that offers a more complete arsenal of security features—both overt and covert—than any other currency substrate.

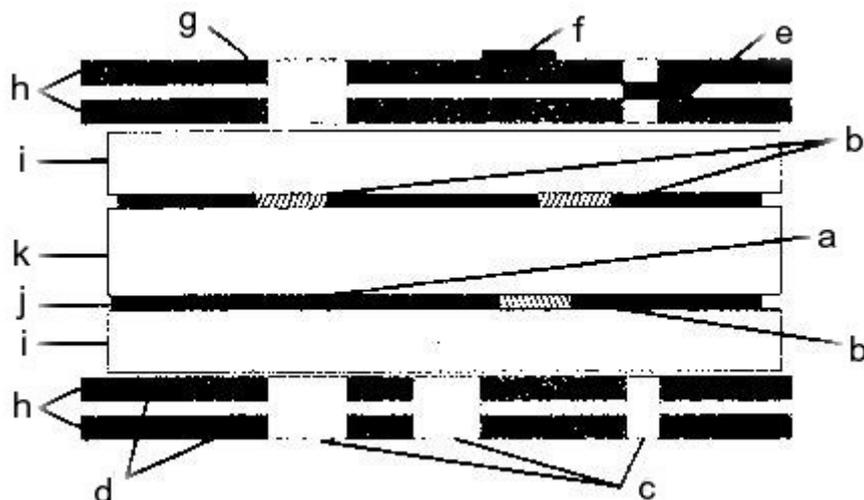
The multi-layered structure of the substrate (shown in the accompanying diagram) protects both printed features and embedded objects from tampering. It also enables a combination of features to be placed in registration with each other to produce unique effects. The final coating layer is printable by all standard methods. No protective overlacquer is required.

The versatility of the laminated structure is multiplied by the wide range of inks (photoluminescent, fluorescent, phosphorescent, UV- and IR-sensitive, magnetic, metallic, thermochromic, photochromic, and pearlescent, as well as conventional) that may be employed.

Delamination of the substrate is virtually impossible in regular use because of the high bond strength of the structure. Any deliberate attempt to separate the layers will destroy both embedded security features and the note itself.

The combination of polymers and adhesives used to create DuraNote produces a structure designed specifically for banknotes. Indeed, this structure provides a unique signature that can be detected using suitable techniques through the windowed areas. DuraNote adds taggants to various layers of the structure for forensic purposes, some of which are machine readable, while others require chemical analysis. The number, type and location of the taggants are defined by the customer. Finally, the unique deadfold characteristic of the DuraNote product results in a performance similar to security paper, but quite unlike conventional polymers. This distinction represents a simple overt feature for the public.

We will be happy to work with you to explore various approaches to the design, inclusion of specific graphic elements, and the selection of an appropriate suite of security attributes for each of your banknote denominations.



Location of various types of security features within the DuraNote substrate:

- a.** Features printed on core: features can be printed in any flexographic or gravure printable inks; conventional inks can be mixed with IR, UV, and magnetic, if required.
- b.** Features embedded in adhesive layer: vertically referenced security fibres, particles, and strips can be embedded in the adhesive; tracers and taggants can be dispersed throughout the layer for forensic identification.
- c.** One-sided and see-through windows: the natural transparency of DuraNote material permits inclusion of one-sided or see-through windows that reveal devices or images on inner layers to frustrate copying; windows are fully registered with the printing.
- d.** Multi-tonal images in opacifying layers: by selectively applying gravure coatings to the four opacifying layers, fully registered images of varying opacity can be produced; densities within a single image can vary from translucent (shadow image) to completely opaque.
- e.** Interlayer printing: used in conjunction with multi-tonal images, printing between the opacifying layers results in coloured images or images darker than the surrounding coating.
- f.** Surface printed features and transferred devices: the printer may apply a variety of features such as OVI, foils, optically variable thin films, and kinegrams to the printing surface; the DuraNote surface is flatter than that of paper, thus improving the adhesion of OVDs and foil.
- g.** Printing surface.
- h.** Opacifying layers.
- i.** Clear outer layers.
- j.** Adhesive layer.
- k.** Clear core.

3 The economy of DuraNote currency substrate

Our studies indicate that the DuraNote currency substrate offers significant economic advantages over paper banknotes—so much so that it is more economical to change over to DuraNote banknotes than to continue issuing whatever paper currency is now being used.

A DuraNote banknote has a higher unit cost than one made of paper. However, this is more than offset by the fact that notes printed on the DuraNote substrate should enjoy a longer life and thus a lower life-cycle cost than paper currency. DuraNote substrate is simply much more durable and offers superior tear and abrasion resistance, as well as great print endurance.

Exact figures on DuraNote longevity must await actual circulation trial results. However, experience with other polymer notes in circulation shows that they last at least 4 times longer than traditional paper currency. In addition, no overlacquer is required because DuraNote's coating system is designed to enhance its non-soiling characteristics.

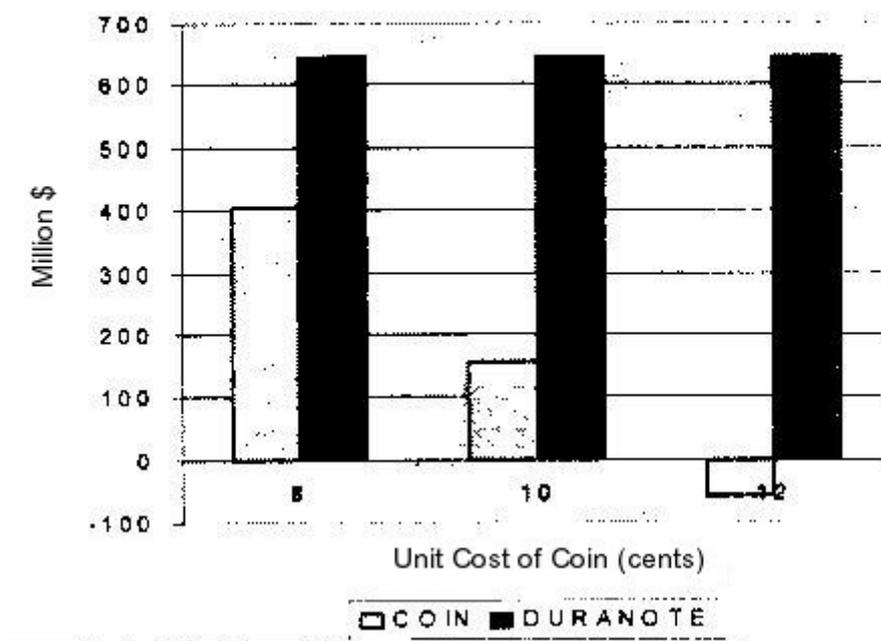
Since coins will, of course, last longer than banknotes, a number of issuers have replaced lower denomination banknotes with coins. This substitution

has taken place despite the fact that coins have a number of drawbacks, including the following:

- coins are relatively easy and inexpensive to counterfeit;
- notes are preferred over coins by the public; this preference is so strong that people often reject coins in favour of the next higher denomination banknote;
- extra coin production is often required because people hoard coins, thus removing them from circulation;
- coins are heavy and difficult for financial institutions to handle compared to banknotes, making them less practical, and also reducing their apparent economic advantage.

We have developed economic models (M. Amon, A cost model of the transition from one type of currency substrate to another, 1995 Currency Automation Conference, Hong Kong; M. Amon, Cost model of transition from banknotes to coins, 1996 Currency Automation Conference, New Orleans) which permit comparisons of paper, coins, and DuraNote currency using different values for nearly 20 parameters such as durability, unit cost, conversion cost, volume in circulation, and number of years from introduction. These models have been used to prepare the following chart, which compares the present value over 10 years of converting a \$1 paper banknote to a coin or to a DuraNote banknote. Data is presented for an average ratio of DuraNote versus paper life of 3:1 and for unit cost of coins from 80 to 120. The cost of a high denomination coin could well be above this range.

Comparison of Net Present Value of Transition from Paper Banknotes to Coin and DuraNote



As the chart reveals, DuraNote is decidedly more economical than paper. Over 10 years, it is also very likely more economical than coins. This is

because the early costs of a paper-to-coin transition are so high that the benefits of coin longevity cannot be realized as rapidly as those of DuraNote. Considering the non-economic negative factors associated with coins, DuraNote is clearly the best choice.

To help you learn exactly how much you can save by converting to DuraNote currency substrate, we will be happy to run an analysis based on your data, selection of variables, and monetary system, or to provide issuers with a copy of the model.

4 The processability of DuraNote currency substrate

The DuraNote substrate has been extensively tested to determine its printability and ease of handling, in collaboration with a number of international banknote producers, issuers, ink suppliers, and producers and users of note handling equipment. These tests show that only minor adjustments are required that are no more extensive than those needed when switching paper stock. A summary of test report comments follows.

DuraNote staff will be happy to answer questions and address specific concerns about the performance of DuraNote under various test conditions.

4.1 Feeding characteristics

Since DuraNote material has a slightly higher base weight than paper, it may be necessary to make slight adjustments to the air, vacuum, and double sheet detectors. Draw wheels may need to be placed at the back of the sheet to help sheets enter the front lay squarely. The anti-static treatment of the substrate eliminates static problems.

4.2 Stacking characteristics

On the stacker, vacuum and blowdown air may need adjustment to ensure that the sheet settles squarely into position. This is necessary because lower sheet absorbency keeps intaglio ink wetter and stickier than on paper; thus the sheet will not readjust itself as easily. Running the press too slowly can actually create poor stacking.

4.3 Lithographic printing characteristics

As DuraNote substrate is less absorbent than paper, it requires less ink. Especially when printing with photopolymer plates, the ink feed must be decreased to prevent plate plugging. Plate-to-blanket or blanket-to-blanket pressure may need to be increased to assist large solid areas. DuraNote allows less oxygen to filter through than does paper. This may increase drying time, although some printers have actually experienced faster drying.

4.4 Intaglio printing characteristics

DuraNote has developed specific intaglio printing recommendations that improve performance. Our experience indicates that pre-wiping of the

intaglio plate improves print quality and handling. As in offset printing, less ink is required. It is important to determine that the balances between various pressures and inks are correct. Because the substrate is dimensionally more stable than paper, it will show a different offset-to-intaglio fit relationship. As with offset, drying time may increase, but this may not always be the case.

4.5 Inks

Some printers have successfully used their current inks on DuraNote substrate, but the experience varies from printer to printer. We are working with a number of ink makers to meet customer requirements and to optimize their use of the DuraNote substrate.

4.6 Aesthetics

Initially, the print on DuraNote material may not look the same as on paper. This can be remedied in part by making changes in the substrate as ordered. Its opacity can be changed by varying the amount of opacifiers in the coatings. Its colour can be changed by tinting the coatings. Portrait appearance will be different than when printed on paper because the lack of absorbency allows no migration of ink and no line bloom. Close examination will reveal the width of the print line to be closer to the width of the engraved line.

4.7 Print handling

Lack of absorbency causes ink to remain wet longer. This must be kept in mind during handling procedures, such as press inspection. Uniform stacks of not more than 1,000 or fewer sheets are recommended. Offset characteristics depend on the inks being used, the overall balance of the intaglio design, and the depths of the engravings.

4.8 Downstream Banknote Processing

We have successfully tested DuraNote banknotes on a broad range of commonly used note handling equipment, ATMs and vending machines.

5 The acceptability of DuraNote currency substrate

In a very real sense a country's currency is as much a national symbol as its flag. Adoption of a new currency substrate must make a positive statement, in both practical and aesthetic terms, to groups ranging from: the issuing authority, to the government printer, to the central banks, to the commercial banks, to the nation's citizenry—as well as the citizens of other countries, for whom the currency helps form their image of the issuing nation.

In the years that we have been developing DuraNote, we have done our best to understand and satisfy the requirements and preferences of those who will influence the acceptance of this new currency substrate. The following are some of the reasons we believe DuraNote will be judged positively.

5.1 Acceptable to the public

A DuraNote banknote looks, feels, "handles" and behaves very much like a new banknote printed on quality security paper. Deadfold closely mimics that of paper, and the tactility is evident and lasting. The note should retain its "like-new" appearance throughout its expected long life. The printing surface accepts both flexographic and gravure inks very well. Because the surface does not absorb and disperse ink as paper does, printed images are sharper, lending the appearance of even higher quality. Print quality has been measured to be approximately 20% better than paper. Although features such as foils, transparent window, and optically variable images are included primarily for their security value, they also give the designer unique, artistic opportunities, as well. The polymer of which the substrate is made is impervious to oil and moisture and exhibits anti-static qualities, so DuraNote currency stays much cleaner than paper. This cleanliness extends beyond mere appearance. Independent toxicology laboratories have found DuraNote substrate to be non-toxic in production and in use. The public will also be pleased to know that DuraNote material is 'greener' than paper. Its longer life means less of a disposal problem overall. And when a DuraNote banknote finally wears out it can be recycled for use in other products rather than burned or added to landfills like destroyed paper currency. This, of course, also contributes to the cost advantage of DuraNote.

5.2 Acceptable to printers

DuraNote substrate actually helps a printer to produce better-looking banknotes. The print cap of the laminated substrate is designed for both lithographic and intaglio ink receptivity. Furthermore, the substrate is much flatter than banknote paper. These characteristics combine to give DuraNote banknotes line definition that has been measured to be 20% better than paper for both intaglio and lithographic processes. And there is no intaglio ink gushing. Minor press adjustments may be necessary to run DuraNote material, but the range of adjustment is similar to that necessary when switching paper stocks. Tests have shown that DuraNote requires significantly less litho and intaglio ink. And DuraNote arrives press-ready. Qualities such as variable opacity can be provided by coating adjustments at the plant. Likewise, the substrate can be furnished with custom tinting to meet customer requirements.

5.3 Acceptable to automated handling equipment

DuraNote has been tested in actual use for compatibility with a variety of handling equipment such as counting and note verification machines. Of course, detectors must be adjusted to accommodate changes in note design and security features, but DuraNote has proven its compatibility.

5.4 Acceptable durability

The materials and structure of the DuraNote substrate have been chosen and engineered to outlast paper by a factor of at least 2:1. Experience of other polymeric banknotes in circulation indicates a durability factor of about

4:1. The tensile strength and tear resistance of the oriented polypropylene used are well known. Interlayer bonding is so strong that any attempt at deliberate delamination will disintegrate the film layers and any associated security features.

5.5 Acceptable identification

The public will be able to differentiate DuraNote banknotes from possible counterfeit notes on polymeric materials by their deadfold characteristics. The public's confidence will be enhanced, in comparison to any other known substrate, by the ability to embed an arsenal of overt anti-counterfeiting features within the laminate ranging from randomly sprinkled denomination identifiers to sophisticated optical variable features. As well, covert features for machine and forensic identification provide truly unique identification characteristics.

5.6 Acceptable security of production facilities and accountability of materials

We have retained the forensic unit of an internationally respected professional services firm to recommend and oversee the installation of physical security and internal control systems appropriate for the manufacturing and storage of materials used in the manufacture of security documents.

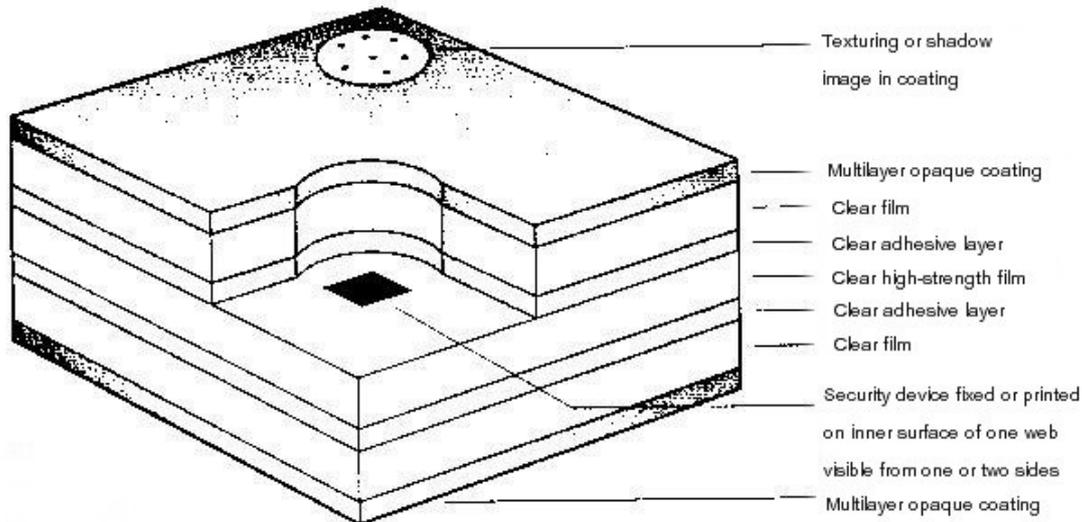
6 Security—innovative options for unprecedented security

Counterfeiting is a burgeoning business. The security of the world's banknotes and other valuable documents is being seriously compromised by the proliferation of new and ever-advancing reprographic technologies. Digital image-manipulation and printing methods, along with advances in desktop publishing, have given counterfeiters effective new ways to circumvent conventional banknote security features.

DuraNote again provides the solution, and does so via its unique structure. Specialty inks, multitone images, and optically variable devices can be printed, embedded, or affixed in multiple locations within the laminated layers. A wide range of security options, both overt and covert, are readily applicable.

Overt security features include: clear windows; shadow images; core-printed images with windows. Covert, machine-readable security options include magnetic inks, fibres, and taggants as well as inks reactive to ultraviolet and infrared light.

This vast array of options provides issuers with a high degree of flexibility in the design of their own currency. Those faced with pressing cost constraints can opt for a limited number of features and still achieve significantly enhanced security... while those beset by more severe counterfeiting problems can employ a wider arsenal of DuraNote's covert and overt features—achieving an impressive new level of security.



The multilayer design of DuraNote banknotes allows incorporation of a vast range of options for leading-edge overt and covert security features.

7 Durability—cost containment through longevity

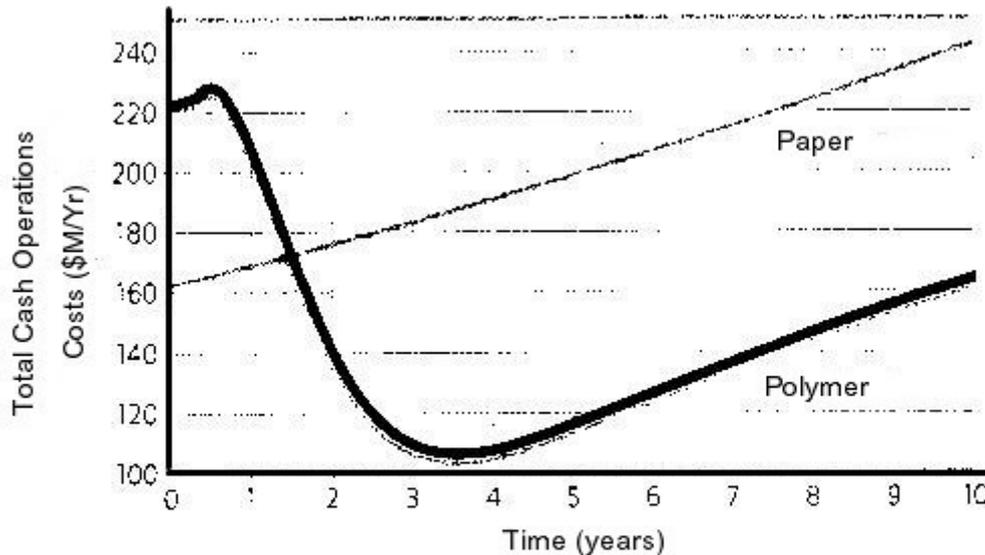
As the old adage goes, "you have to spend money to make money". This holds every bit as true for those who literally make money—that is, for those Central Banks responsible for their country's banknotes. With the use of traditional technologies, overall costs are high and continue to rise.

Certainly, coins are an alternative, but they are easier to counterfeit; and people prefer notes and tend to retain coins, forcing extra production and escalating handling costs.

The bottom line is clear: a more durable, longer-lasting banknote. DuraNote is precisely that—all projections indicate that polymer banknotes last longer than traditional notes!

DuraNote is based on innovative materials that derive their longevity from a unique design of layered polymer films and chemically bonded coatings. At its core, DuraNote features a high-strength, polymeric film that provides an unprecedented level of durability. The additional layers not only enhance the overall longevity, but provide dramatic new security alternatives as well.

The superior DuraNote tensile strength is easily observable in standard repetitive fold, tear, abrasion, and crumple tests. Furthermore, the DuraNote substrate does not absorb oil or moisture as paper does making the resistance to soiling far superior as well.



Paper to polymer conversion for U.S.\$1 bills
(annual savings)

8 Print quality—improved print quality from existing print technology

DuraNote substrates are fully compatible with existing litho and intaglio presses. This is crucial, because it negates the need for major capital investment in new presses or overlacquer equipment. In all testing to date, DuraNote press sheets run through presses as smoothly and efficiently as the traditional sheets currently being used.

There is, however, a major advantage: dramatically improved intaglio print quality. DuraNote substrate does not gush during printing, thus yielding finer line delineation compared to traditional paper banknotes. This allows DuraNote to deliver significantly enhanced quality in the reproduction of the finest lines and graphic details of banknotes.

9 Additional DuraNote benefits

Beyond its durability, security, and quality enhancements, DuraNote offers several other key attributes. For example, although DuraNote is a polymer material, it handles, has deadfold, and "feels" much like traditional currency. These qualities are designed to greatly encourage public acceptance. Also, when DuraNote banknotes do wear out, they can be melted down and recycled; this "green" benefit is a far superior solution—both ecologically and economically—to disposing of paper in landfills.

As we prepare to enter the next millennium, the world around us is spinning in a state of unprecedented change—change driven, predominantly, by the explosive growth in new technologies over the past several decades. This technological revolution has affected the ways in which individuals live their everyday lives, the ways in which corporations do business, and the ways in

which governments around the globe now view a myriad of issues—including issues regarding the banknotes they circulate.



Paper



Polymer

A dramatic increase in intaglio print quality is achieved by conversion from traditional banknote materials to DuraNote substrate.

Examples abound. Many issuers feel intense financial pressure about the cost of frequent replacement of worn banknotes. In addition, they see the urgent need for improved security measures to thwart the growth of ever-more-sophisticated counterfeiting techniques. Meanwhile, ecologically sound disposal of worn banknotes becomes a more important issue with each passing year.

Hence, Central Banks are entering an era of dramatic change. Formidable challenges are arising, and innovative, responsive solutions are needed. One of those solutions is here. Today. And that solution is DuraNote.