



## Opinion

- 2 Editorial
- 3 A meeting with Alex Jarvis
- 6 The European legal framework protecting the euro against counterfeiting: an overview  
Anti-counterfeiting measures from the legal viewpoint  
Pedro Machado and Francisco Javier Priego. *Banco de Portugal* and *Banco de España*
- 8 The Central Bank Counterfeit Deterrence Group's fight against counterfeiting  
The CBCDG as an example of cooperation on anti-counterfeiting measures  
Antti Heinonen. *Chairman of the Executive Committee of the CBCDG*
- 10 The education strategy for the United States' new 100 dollar banknote  
The global information campaign in the run-up to the launch of a new banknote  
Lorelei Pagano. *United States Federal Reserve System*
- 11 A multilateral approach to the fight against counterfeiting  
The three pillars of the Eurosystem's fight against counterfeiting of the euro  
Allister McCallum. *European Central Bank*
- 14 The importance of forensic work in police investigations  
Technical analysis of counterfeits and its role in helping the police  
Carmen Álamo and Juan Pablo Gamacho. *Banco de España*
- 16 The *Bank of England's* anti-counterfeiting strategy  
The *Bank of England's* weapons to combat the counterfeiting of sterling  
Kevin Wills. *Bank of England*
- 18 The coin packaging system. An element in the fight against coin counterfeiting in Germany  
Standardising coin packaging facilitates counterfeit detection  
Franz-Josef Behringer. *Deutsche Bundesbank*
- 20 Education: a powerful weapon against counterfeiting  
El Salvador's commitment to educating the public about banknotes  
César Roney. *Banco Central de Reserva de El Salvador*
- 20 Anti-counterfeiting measures in the Russian Federation  
Overview of the measures to defend the rouble from counterfeiters
- 21 Banknote authentication devices  
An important tool enabling retailers to verify banknote authenticity  
Francisco Cantero. *Inestrónica, S.A.*

## Banknotes and Coins

- 22 Honduran banknotes  
Geovanny Bulnes. *Banco Central de Honduras*
- 24 The *Banco Central de la República Argentina's* Treasury Management Department  
Luis C. Fiore and Silvia A. Vance. *Banco Central de la República Argentina*

## Cash Activities and Technology

- 26 The *Bank of Japan's* operations centre in Toda  
Automation eliminates human intervention in banknote handling  
Tomoko Kurose. *Bank of Japan*
- 28 The final stage of the cash cycle  
Technology for banknote destruction and waste compaction  
Angelo Kok. *Kusters Engineering B.V.*

## CIGE

- 29 7th International Course on Cash Management – Río de Janeiro

## Miscellaneous

- 29 Publications devoted to cash
- 30 Events
- 31 Central banking news
- 34 Banknote security features

# Editorial

■ J. Darío Negueruela *Banco de España*

Issue number 8 of BILLETARIA is devoted specifically to counterfeiting, with nine contributions from specialists on the subject, all looking at the issue from different angles. Thus, we present here articles on a range of topics: from the different phases of the counterfeiter's activity; the policy for publicising a new banknote, launched months in advance during the run-up to the issue of the actual note; and we also take a look at the various strategies Central Banks deploy in their efforts to combat counterfeiting. We appreciate the effort involved in writing an article in the hectic world in which we all work, and are genuinely grateful for all the contributions received. We are also aware that with a topic this broad, covering the key aspects in the depth they deserve would have needed two or three complete issues of BILLETARIA. We are therefore left with the feeling that the role we are fulfilling today, rather than offering a detailed and in-depth view of the serious problem of currency counterfeiting, is to serve as a reminder and a warning about an activity which remains a threat to which we must continue to pay close attention. International multi-day meetings, such as that run by the *Banco de México* in Mexico DF in early October 2010, are initiatives headed in the right direction and whose usefulness and validity is beyond any doubt.

As a new feature, issue number 8 of BILLETARIA includes a "Special 4 year supplement" which gives an overview of BILLETARIA since 2007, when publication began. The Supplement enables rapid and easy identification of the topics on which articles have been published, and lists the interviews, articles, Latin American banknotes, and descriptions of Central Bank treasury departments, etc. We have also included a complete collection of the maps we have been reproducing on the back cover of each issue, all of which are of historical and artistic interest. In the supplement itself we have broken with this tradition of publishing a map on the back cover and instead have reproduced one of the Bank's most frequently requested works, the oil painting, "Escaping Criticism" by Pere Borrell del Caso, 1874. To finish, just a few words to inform readers that we hope to devote

the spring 2011 edition to the diversity of new substrates for printing banknotes that are appearing on the market as an alternative to traditional paper.

And as always, our thanks to our readers, contributors and friends.



Untitled / JDN

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# A meeting with Alex Jarvis

■ J. Darío Nequeruela *Banco de España*

Alex Jarvis spent his 43-year career at the *Bank of England*, including 35 years at the *Printing Works*, which he ran for 14 years, from his appointment in 1987 until his retirement in February 2001.

Alex has represented the *Bank of England* on a number of International Committees, notably the *Four Nations Group on Anti-counterfeiting*, the *Intaglio Research Group*, the *Policy Committee of the Banknote Printers Conference* and the *Central Bank Counterfeit Deterrence Group*. In 1992, he was asked by the *Governors of the European Union's Central Banks* to lead an EU-wide Working Group to develop, design, produce and issue the banknotes for the new single European Currency, the euro. He remained Chairman until the formal establishment of the *European Central Bank* in July 1998, when the chairmanship of the Working Group passed to Antti Heinonen. Alex continued representing the *Bank of England* in the Group until his retirement.

In the 9 years since his retirement, Alex Jarvis has worked as an independent advisor to a number of companies in the banknote industry, and continued to present papers on a wide range of banknote-related subjects at a variety of international conferences.



**Q.** Could you tell us a bit about the initial preparation phase for the euro? Does anything from that experience stand out in your mind in particular? What was the atmosphere like on the team working on the project? Are you pleased with the results?

**A.** This is a multi-faceted question, which I'd like to answer in reverse order. Given the difficulties of blending together the traditions and aspirations of 15 different countries and cultures –and almost as many languages– I am very satisfied with the end product. I think the first series of euro banknotes has stood the test of time and is regarded as a reasonably well designed and well protected banknote. This outcome would not have been possible without a good working relationship between the various members of Banknote Committee of the European System of Central Banks and its related Working Groups. Therein lay one of the keys to success: we sub-divided the various tasks (e.g., design, technical specification, production, post-issue handling and publicity) to small, focused Working Groups who reached consensus and brought recommendations forward to the Banknote Committee for discussion and agreement in an atmosphere very frank and open; and often quite heated. But I like to think we all remained friends; and this, good working atmosphere was enhanced by going out together as a group for a drink or a meal whenever possible.

One of the most challenging, interesting and enjoyable aspects of planning the first euro banknote series was the selection of the final design. The choice was, of course, made by the European Governors, but in preparation we organised a euro-wide design contest –which attracted 49 entries– and conducted a euro-wide series of public opinion polls and Focus Groups to try and gauge public acceptability of the 'Top Ten' designs, which were chosen by an independent panel of international experts.

**Q.** What key factors in improving banknote security would you highlight, drawing on both your own expertise and the latest innovations in banknotes?

**A.** Generally speaking, I think that most banknotes are pretty well protected against counterfeiting and the protection is getting better. But we can't rest on our laurels. Counterfeiters have adopted the mantra of 'continuous improvement' and we must do the same if we're to remain one step ahead.

An old friend, Willie Kranister, the then Note Issue Director of the *Oesterreichische Nationalbank*, once said that the best anti-counterfeiting feature, in his view, was 8 million pairs of Austrian eyes! So I'd put user-friendly public features at the top of my list. By which I mean something that is striking, easy to use and easy to explain on the one hand, yet very difficult to mimic on the other hand. It is amazing how many seemingly clever features are so complex, or difficult to explain, that the public find them confusing rather than helpful.

I personally favour features that *change* as the angle of view changes: whether colour or image or a combination of both. But simplicity is crucial. I also like 'self-authenticating' features and foresee an increase in this area but we also have to recognize that the users of our notes are not only humans but also machines. More and more goods are being obtained from vending machines, and it's far less risky for a counterfeit to try and 'pass' a dud note via one of them than with the cashier in the corner shop! So we also need cheap but effective features for machine verification.

*There can be few people with as much experience in the banknote world as Alex Jarvis. As an authority on the subject, his inclusion on the line up at international meetings continues to be both a selling point and a seal of approval for those of us who consider ourselves relative newcomers to the field.*

*The significance of his role in the creation of the euro banknotes and coins is beyond doubt, as is the professionalism and expertise with which he led the multinational working group set up to launch the euro, where he had to get everyone to sit around the table and work together until the job was done.*

*I have not had the good fortune to work with Alex, but I have had the privilege of participating in the activities of some of the variety of international meetings at which his presence is indispensable. It is a pleasure to include Alex on the BILLETARIA senior team and to have this opportunity to thank him for his generously being willing to work with us on banknote matters with his customary wit, intelligence and good humour. Thank you, Alex.*



Alex Jarvis visits the *Banco de España* in Madrid / BILLETARIA

**Q. Would you recommend any particular system for banknote production and procurement?**

**A.** I don't believe that there is any 'right answer' to this question. Circumstances vary greatly from country to country so what suits one may be totally inappropriate for another. However, I do question the wisdom of some countries with relatively small note circulations persisting with a State-owned Printing Works. Economies of scale are virtually impossible to achieve as printing equipment becomes ever more costly and increasingly efficient. Given the potential annual output from a line of sheet machines or a large web press, it seems to me somewhat inefficient and wasteful to allow such expensive equipment to remain heavily under-utilised. It's a good maxim to *sweat your assets*.

Please don't misunderstand me: my views are not coloured by the fact that I ran the *Bank of England's* Printing Works for 14 years and I am now working in the Private Sector! There are many extremely well run, cost-effective State-owned Printing Works, and I would claim that the *Bank of England's* was one of them. But in these days of increasing pressure on public expenditure, the question needs to be asked: is it more cost-effective- and less of a distraction from concentrating on such core purposes as monetary policy – for a Central Bank to procure its banknotes commercially?

**Q. In the light of your experience: how can a Central Bank identify its core tasks and the limits on its role in the cash cycle?**

**A.** Lord Laing, one of the UK's leading industrialists and a non-executive director of the *Bank of England*, took a great personal interest in the Printing Works. One particular piece of advice he gave me many years ago was to *only do those things that only you can do*. I think that this advice is most apposite in defining what cash cycle management tasks a central bank should do itself and what can be safely outsourced or dele-

gated to others. The acid test is to critically examine each task and ascertain whether it can be done more cost-effectively or efficiently by someone else. Much of what central banks do is traditional but just because something has been done for the last hundred years or so is not of itself sufficient reason to retain the status quo for the next century. In my view, sacred cows should be shot. Of course, the one thing a central bank cannot delegate is its accountability for the integrity and smooth functioning of the banknote issuance. It thus needs to set, and rigorously enforce, its own standards. But with that proviso, I see no over-riding reason why the points we've already discussed in relation to banknote printing should not be applied to all aspects of banknote distribution and processing, including – dare I suggest it – destruction.

### Main differences between a Cash Department or a Central Bank Printing Works today and the situation in the sixties

#### Value for Money

Whilst not for one moment suggesting that Central Banks were ever profligate, the pressure on them to deliver 'value-for-money' in all their operations – especially such overt activities as Note Issuance – is far higher today than when I first joined the *Bank of England*. This is perhaps not surprising, given the current level of Parliamentary, Media and Public interest in – and scrutiny of – all aspects of Public Sector expenditure. This is no bad thing; and the net result has been a significant improvement in the overall efficiency and cost-effectiveness of the whole Note Issue function. One by-product of this has been the increase in outsourced activities that we have already discussed.

#### Note Sorting & Re-issuance

In the late 1950's and early 1960's all used banknotes were returned to the Central Bank for authentication (by hand-examination) and destruction (by incineration). A small proportion of these notes were also hand sorted – a process known for some inexplicable reason as 'garbling' – and any fit notes were re-issued; but the vast bulk of notes returned to a Central Bank were burnt regardless of condition. At the *Bank of England's* Printing Works this was undertaken in a bank of eight custom-built industrial incinerators and the heat generated from the operation was harnessed to heat the building. We could thus lay claim to operating the world's most expensive central heating system: it worked burning cash.

#### Health & Safety

Another change for the better has been the significant increase in awareness of Health & Safety issues; and this has been reflected in a similar increase in legislation. To give one example, when I first went to work at the Printing Works, the 'size' used for our banknote paper contained formaldehyde. All our banknotes were, of course, stored in vaults overnight and when these were first opened in the morning – especially after a weekend – the lads whose job it was to bring the notes out to the printing machines did so with steaming eyes and a handkerchief held over their noses! In fact, on the first working day after a bank holiday weekend it was necessary to open the vaults a good 30 minutes before anyone could venture in. I cannot imagine such a situation being tolerated today.

**Q. On the subject of issuing very high denomination banknotes, what do you see as the pros and cons of high value notes? What advice would you give colleagues at other Central Banks on this issue?**

**A.** It may be an over-simplification to describe the argument as *ethics versus economics* but there's more than a grain of truth in that description. On the ethical side, issuers of very high value notes are sometimes accused of 'helping the black economy'. Against that, it is undoubtedly more cost-effective if a reasonable proportion of one's banknote issuance is in high value notes. Personally, I think the economic case is compelling and the ethical argument is over-egged: I cannot imagine the fact that the transport of a suitcase full of \$100 bills rather than a briefcase stuffed with €500 is a deterrence factor.

Take as an example the UK and the US: in both cases, the highest denomination banknote is of relatively low value by international standards. Both whilst the £50 note represents only some 10% of the UK's note circulation by value, the \$100 bill is far more popular, accounting for 70% by value. The economic case for introducing a higher denomination banknote in each country is thus totally different.

**Q. Estimating the optimal stock of banknotes to meet demand is a topical issue on which many Central Banks are currently working. Based on your vast experience in cash management, what guidance could you offer on how to prepare a reasonable estimate?**

**A.** The answer to this question, of course, will vary according to the cash distribution model of the country concerned. So first we need to answer a more fundamental question: for what purpose are stocks held by the Central Bank? In a centrally controlled cash distribution system where commercial banks draw the bulk of their supplies of new and used banknotes from the Central Bank, stock levels need to be relatively high; certainly higher than when this task is delegated to the market and the Central Bank's stock is held more as a back-up to ease occasional and seasonal shortages. Another variable which affects the size of a Central Bank's stock is the sourcing of new banknotes. Where these are imported, a slightly larger stock would be expedient to offset possible delays in the supply chain.

But there is another reason for holding banknotes in a Central Bank's vaults: as a contingency measure against a major disaster. An earthquake, a tsunami or a Jumbo-jet crash could all put a Cash or Sorting Centre out of commission for many months so the number of banknotes held in store needs to be related to the time taken to recover from the disaster, and to the contingency plans in place to re-establish banknote supplies.

**Q. What do you see as the main challenges facing Central Bank Cash Departments in the immediate future?**

**A.** I think that the major challenge facing all Central Bank Cash Departments is that of maintaining a truly cost-effective operation without compromising traditional Central Bank standards. This is by no means easy, and we've already discussed how it impacts on banknotes' fitness standards. The security and integrity of banknote Issuance is another area of potential concern.

It seems to me that the root problem is one of 'control': basically, a non-profit making organisation like a Central Bank finds it difficult to accept that a commercial company intent on maximising profit for the benefit of its share-holders, is not going to 'cut corners' and compromise standards. Never lose sight of the fact that Central Banks are in the driving seat and can thus dictate the terms under which they are prepared to out-source some of their operations.

**Q. Alex, how do you see the cash scenario from a global point of view? Do you see any trends towards harmonisation that you could tell us about? Do you believe there is an evolution in any clear direc-**



Alex Jarvis (left) and J. Darío Negueruela (right) during a break in the interview / BILLETARIA

**tion? Is there any kind of leadership? Will the number of international meetings about diverse subjects increase or are we moving more towards setting up small groups to deal with specialised topics?**

**A.** A fascinating question! I've attended more international meetings, conferences, seminars and symposia in my lifetime than my grandchildren have had ice creams! And as I'm still in love with banknotes, I still keep going to them. But I am becoming more picky... and I don't think I'm alone.

As you know, there are two major conferences which attempt to cater for the whole spectrum of our very diverse industry: the Currency Conference and the Banknote Conference. Naturally, they are competitors as both are seeking sponsorship from the same industry suppliers and hoping to attract attendees from the same (Central Bank and commercial) customer-base. But at the very least, I think they should try to work together to ensure their conferences are better spaced out. In 2011 they will be only a few months apart; and, as a potential attendee, I regard this as quite absurd.

Personally, I would like to see a trend towards smaller conferences, each with a focus on a particular aspect of the banknote cycle: design & technical specification; origination & production; public information & publicity; post-issue handling, etc. So my hope and belief is that there will probably be a move in this direction.

**Q. What is your impression of BILLETARIA? Do you think it contributes to communication in the central banking community? Would you suggest any changes?**

**A.** I must admit that I've been very impressed with BILLETARIA. It seems to me that you have managed to strike a rather neat balance between a somewhat 'stodgy' and boring Central Bank Bulletin and a lively and chatty banknote "Newsletter". I think the idea of soliciting the views of a range of people who operate in the banknote industry is potentially interesting; and not just because I'm one of the 'chosen few'! Sustaining your Triple A (Andrew, Antti & Alex) rating is clearly going to be a major challenge. However, it is an excellent initiative which deserves to succeed.

# The European legal framework protecting the euro against counterfeiting: an overview

■ Pedro Machado and Francisco Javier Priego *Banco de Portugal and Banco de España*

**The European Central Bank (ECB) and the Central Banks of the Member States that have adopted the euro (Eurosystem NCBs) have the sole authority to issue banknotes in euros. This article outlines the legislation in force defining the responsibility for ensuring the authenticity of the euro banknotes and coins in circulation.**

## Regulation 1338/2001

The authority to issue and put euro banknotes into circulation established by the general provisions of European legislation does not imply any express authority for legislators to protect the euro against counterfeiting. Nevertheless, this lack of an explicit legal basis did not constitute an obstacle to the adoption of directly applicable Europe-wide legislation to tackle counterfeiting of the euro. This took the form of Council Regulation (EC) no. 1338/2001 of 28 June 2001 laying down the measures necessary for the protection of the euro against counterfeiting in the Member States belonging to Monetary Union. It was followed by Council Regulation no. 1339/2001 of 28 June 2001, which expanded these obligations to other Member States. As a result, the rules and obligations are binding on all Member States, whether or not they have adopted the euro.

Regulation 1338/2001 considers “counterfeiting” to mean: a) any fraudulent making or altering of euro notes or euro coins, whatever means are employed; b) the fraudulent uttering of counterfeit euro notes or counterfeit euro coins; c) the import, export, transport, receiving or obtaining of counterfeit euro notes or counterfeit euro coins with a view to uttering the same and with knowledge that they are counterfeit; and d) the fraudulent making, receiving, obtaining or possession of (i) instruments, articles, computer programs and any other means peculiarly adapted for the fraudulent making or altering of euro notes or coins, or (ii) holograms or other components which serve to protect euro notes and coins against fraudulent making or alteration. It is interesting to note that the Regulation distinguishes between “**counterfeits**”, which it defines as “notes and coins denominated in euro or which have the appearance of euro notes or coins and which have been fraudulently made or altered”, and “**unauthor-**

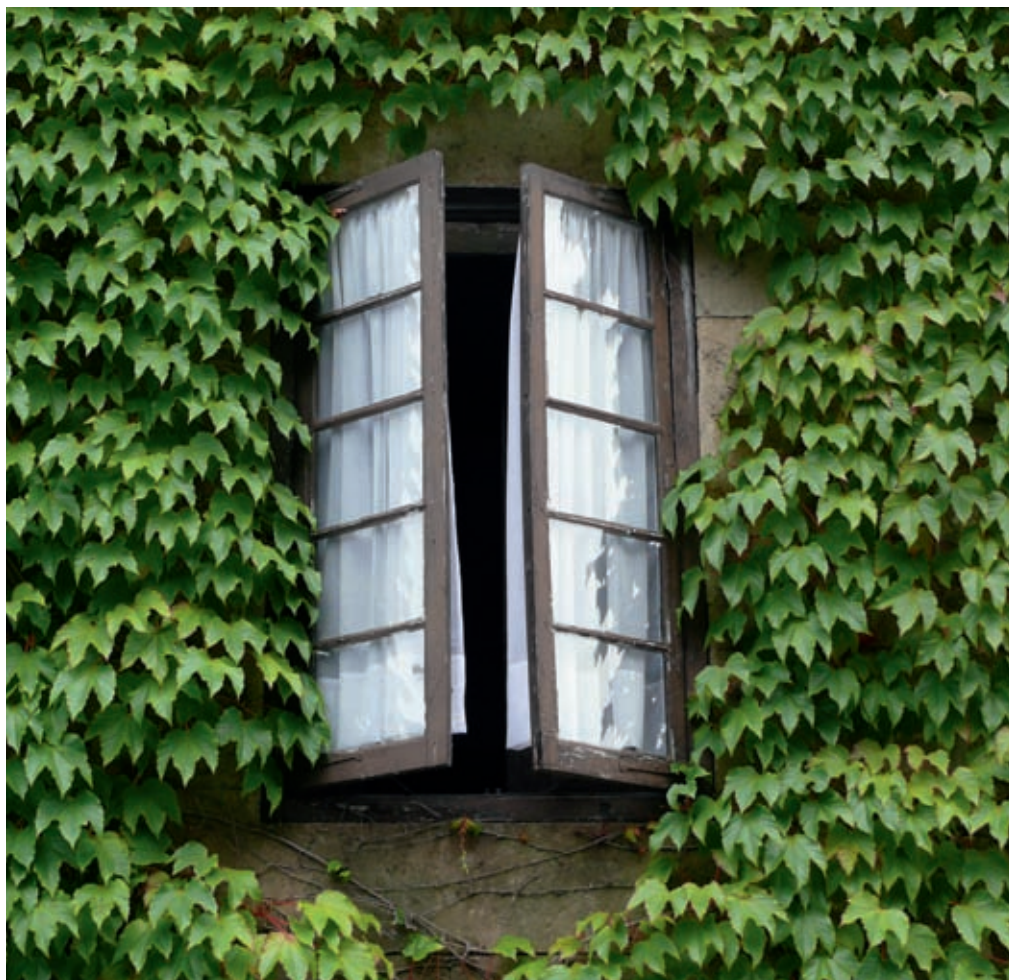
**ised notes**”, which are described as those notes denominated in euro which have been produced with the use of lawful facilities or equipment in violation of the provisions in accordance with which the competent authorities may issue currency, or uttered in violation of the conditions in accordance with which the competent authorities may utter currency and without the consent of those authorities. The most obvious case of this would be banknotes stolen while in transit from the printing works to the vaults of an NCB.

The fight against banknote counterfeiting is divided between the tasks assigned to competent national authorities and those assigned to the ECB. National authorities are responsible for identifying counterfeits, gathering and analysing technical and statistical data through their national central offices, gathering data on counterfeit euro notes and submitting them to analysis by the appointed staff at the national centres. The Member States also have to ensure that all national level information is sent to *Europol*.

The Regulation requires credit institutions, within the scope of their payment activity, and other payment services providers, and any other institution involved in the sorting and distribution to the public of notes and coins, to ensure that euro notes received by them which they intend to



Closing / JDN



Opening / JDN

return to circulation have undergone authenticity checks and that counterfeits have been detected. For euro notes, these checks will be carried out in line with the procedures defined by the ECB, which are defined below.

### Additional legislation

Complementing the above Regulation, European lawmakers have promulgated legislation on freedom, security and justice, within the framework of the Framework Decision of the Council on 29 May 2000 to enhance protection against falsification by means of penal and other sanctions in relation to the introduction of the euro (Framework Decision). This Decision essentially served the double objective of: i) obliging those Member States that had not already done so to sign up to the International Convention for the Suppression of Counterfeiting Currency agreed on 20 April 1929 and its protocol (Geneva Convention); and, ii) complementing the stipulations and facilitate application of the Geneva Convention by the Member States.

Essentially the Framework Decision complements the Geneva Convention in that it requires Member States to adopt the necessary measures to ensure that counterfeiting and circulating unauthorised banknotes are punished with penal sanctions that are effective, proportional and serve as a deterrent, including custodial sentences, and that indictment for such offences may be sufficient grounds for extradition. On this latter point, it is required that any crime or fraudulent act or alteration of the currency, regardless of the means used, be punished with a prison sentence of not less than eight years.

Moreover, the Framework Decision requires that each Member State take the necessary measures to guarantee that legal persons may be held

responsible for crimes of counterfeiting or issuing or distributing unauthorised banknotes, committed on their behalf by any person, acting either individually or as part of an organ of the legal person.

### The ECB's decision on banknote re-issuance

The general regulatory framework is backed up by the measures adopted by the Eurosystem to ensure that the euro banknotes issued into circulation by the various economic agents involved in this process are genuine.

The cornerstone is undoubtedly the recent Decision on the authenticity, and fitness checking and recirculation of euro banknotes adopted by the ECB's Governing Council on 16 September 2010, the direct predecessor to which was the framework on banknote recycling passed by the Eurosystem's governing body in December 2004. The new decision constitutes a formal and binding legal act issued by the ECB under the provisions of article 6 of Regulation 1338/2001, the new text of which lays down that verification of the authenticity of euro banknotes must be performed "in line with procedures to be defined by the ECB."

One feature that stands out in the Decision is the strict link between the obligation to check the authenticity of euro banknotes imposed by Regulation 1338/2001 and the measures to ensure their fitness for circulation, which the ECB considers an essential part of the general

framework protecting the euro against counterfeiting. Thus, euro banknotes may only be recirculated if they have been checked for authenticity and fitness by a type of banknote handling machine successfully tested by an NCB and classified as genuine and fit. Alternatively, this analysis of fitness and authenticity may be performed manually by a trained staff member. Manual fitness checking is only permitted for banknotes recirculated over the counter, with possible exceptions in the case of remote branches of credit institutions. The Eurosystem will establish common test procedures applicable to banknote handling machines, and successfully tested types of machines will be listed on the ECB's website.

The Decision also envisages monitoring and corrective measures to ensure compliance with the obligations on institutions and economic agents bound by these Regulations, under which the Eurosystem NCBs are authorised to carry out on-site inspections in order to confirm cash handlers' machines' capacity to check for authenticity and fitness and trace suspect euro banknotes to their source, and also to verify the handling procedures implemented.

If a non-compliance is detected, the NCB may require the cash-handler concerned to adopt the necessary corrective measures, and if the non-compliance is due to a failure of the type of banknote handling machine, this may lead to its removal from the list on the ECB's website. Independently from these powers, Regulation 1338/2001 obliges Member States to establish an appropriate system of penalties in the case of non-compliance with the authenticity and fitness checking procedures referred to above. For obvious reasons, the power to impose sanctions should lie with the NCBs in the individual Member States, so as to guarantee the most efficient enforcement of the protective measures described here.

# The Central Bank Counterfeit Deterrence Group's fight against counterfeiting

■ Antti Heinonen *Central Bank Counterfeit Deterrence Group*

The work of the Central Bank Counterfeit Deterrence Group (CBCDG) is described here from the point of view of the ongoing war against counterfeiting being waged by issuers of paper money.

## The development of the fight against counterfeiting

A banknote is just a piece of paper; its value therefore depends on the public's confidence in the issuer. To create and maintain this confidence, the first issuers of paper money based their anti-counterfeiting measures on two pillars: security features, and punishments and rewards.

### ■ Security features

Issuing authorities used paper the public could not easily obtain, watermarking being one commonly used technique. Banknotes were also printed with other security features, such as different typefaces, ornamentation, reliefs, embossed seals, and vignettes.

In the early 19th century guilloché was introduced, representing a new printing security feature. At the same time, security printing took a big step forward with the use of steel plate printing. Steel plates performed better, benefitting from an increased durability, and made more sophisticated artistic patterns possible. The new engravings were almost impossible to imitate fully until the invention of photography.

In the second half of the 19th century, photographic techniques caused a paradigm change, as colour printing using special inks began to be used. These were more difficult to imitate and coloured fibres also began to be incorporated in the paper.

### ■ Punishments and rewards

The punishments meted out to counterfeiters were among the most severe under criminal law, and capital punishment was the rule rather than the exception up until the early 19th century. Warnings about the death penalty were normally printed on the banknotes themselves so that the public would be aware of the serious consequences of counterfeiting. Over time, punishments became less severe, however.

As well as punishments, the authorities self-interestedly offered rewards to encourage the public to come forward with information leading to the conviction of counterfeiters, and these rewards were also printed on the banknotes themselves. Although there is little evidence of their success



Breakfast without diamonds / Yolanda Barrera

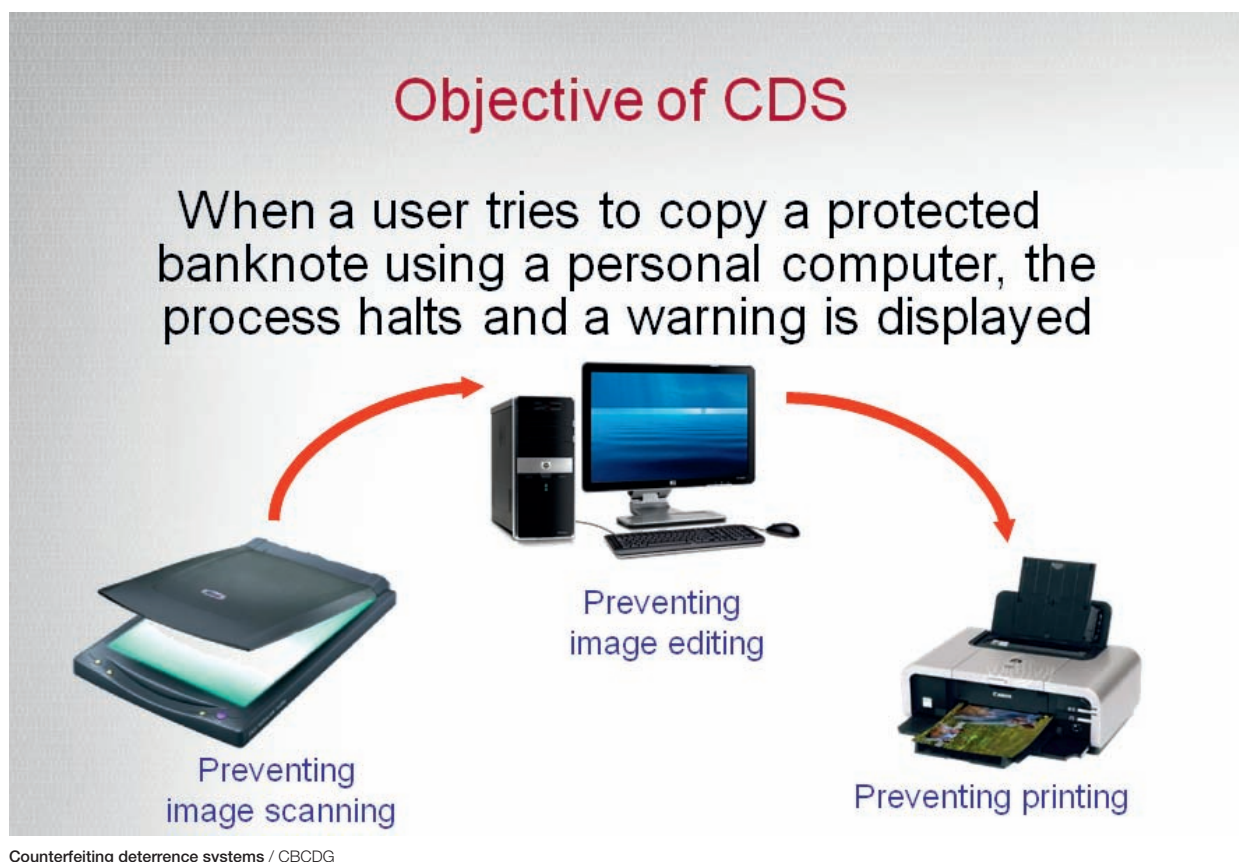
in inciting the public to denounce counterfeiters, issuing authorities today still offer incentives to engage the public in the detection of counterfeits.

### ■ New paradigm shifts in banknote security

The introduction of colour copiers in the nineteen-eighties and innovations in image digitisation and printing technology in the nineties, changed the counterfeiting scene, previously dominated by lithography and plate engraving. The current technology now makes it possible for the layman to produce reasonable quality copies of genuine banknotes.

This made a new banknote security paradigm necessary. These new threats triggered the development of optical security features and innova-





tive substrates, in particular. In parallel, central banks introduced two new pillars in the fight against counterfeiting: public information and training for professional cash handlers on banknote security features, and the promulgation of standards to avoid the recycling of counterfeits in the cash cycle.

### The CBCDG's anti-counterfeiting role

In response to the new threats, the fight against counterfeiting took on a new dimension with the joint response of central banks to deter counterfeiters from using new technologies. With a view to achieving global cooperation between central banks, a special study group was set up under the auspices of the governors of the G10's central banks, which would later be called the Central Bank Counterfeit Deterrence Group.

#### ■ Functions

The governors of the G10 countries' central banks entrusted the CBCDG with the task of identifying threats to banknote security and developing common international responses to them where necessary. The CBCDG works with the competent authorities and industry to evaluate security threats and propose the development and deployment of technologies deterring the use of digital equipment in banknote counterfeiting. To this end, security features which can be incorporated in banknotes at low cost for suppliers have been developed.

The CBCDG currently has 31 member central banks<sup>1</sup>. Additionally, the CBCDG has authorised a number of central banks that do not belong to the Group to use its systems. The members hold an annual plenary meeting and there is an Executive Committee (comprising 7 high-level repre-

sentatives drawn from the central banks) which oversees the year's projects and programmes.

The CBCDG is hosted by the *Bank of Canada* in Ottawa, and its technical support structure, the International Counterfeit Deterrence Centre, is based at the *European Central Bank* in Frankfurt am Main. The CBCDG's most important working party is the Technical Working Group, which together with industry partners, develops new counterfeiting deterrence systems. There is also a Law Enforcement Advisory Group which advises the CBCDG on practices and threats in the counterfeiting field.

#### ■ Counterfeit deterrence systems

As of 1997, taking the work embarked upon by the reprographics industry as a reference, new products coming onto the market began to incorporate a system to prevent colour reprographics counterfeiting. In 2000 a system was introduced to deter the use of personal computers to prepare counterfeits (CDS). CDS prevents PCs and image digitisation systems from being used to capture or reproduce the images of protected banknotes. Recognising the harm that counterfeiting can cause, various leading manufacturers in the hardware and software business voluntarily adopted CDS.

When a PC user attempts to reproduce a protected banknote, the process is halted and a dialogue box is displayed warning the user that the application does not support unauthorised banknote design processing. The application then directs the user to the CBCDG's website.

To conclude, counterfeiters will always exist, so issuing authorities will continue to face the challenge of the new threats and opportunities arising from the continuous development of new reprographic technologies. This biggest threat is that counterfeiting might become easy, but at the same time, this threat is a challenge to the industry as a whole to come up with innovations in the banknote security field. Looking to the future, the CBCDG will continue to be an example of successful cooperation between central banks around the world in the fight against counterfeiting.

1. The 31 members are the *European Central Bank* and the national central banks of the Australia, Austria, Belgium, Bulgaria, Canada, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Switzerland, Turkey, the United Kingdom, and the United States. *The Central Bank of Estonia* will join the CBCDG on 1 January 2011.

# The education strategy for the United States' new 100 dollar banknote

■ Lorelei Pagano *United States Federal Reserve System*

■ The United States government is working to publicise its new \$100 banknote.

The \$100 banknote is in circulation around the world

The 100 US dollar banknote is the highest denomination issued by the Board of Governors of the *Federal Reserve System*. There are currently over 6.5 billion banknotes of this denomination in circulation and it is estimated that approximately two thirds of them are circulating outside of the United States. The Federal Reserve Board last issued a redesigned \$100 note in 1996, at a time when most of the banknotes with this face value held outside of the United States were circulating in a much less diverse environment than today. Given the range of countries on different continents where US currency is used, and the multiplicity of languages spoken by its users, the challenge for the *Federal Reserve* is to determine how to tackle public education on the design changes so as to ensure a smooth transition to the new-design banknote.

## Aims of the public education programme

The successful introduction of a new banknote largely depends on the success of the accompanying public education programme. If the new 100 US dollar note were put into circulation without such a programme, it is possible that large swathes of the population would be unable to recognise legitimate new-design banknotes, with the consequent disruption of commerce. Moreover, it should also be borne in mind that counterfeiters' lives will be made much easier if the public is unable to distinguish a genuine banknote from a counterfeit. The United States government therefore has a responsibility to ensure that citizens around the world who use \$100 notes are prepared for the introduction of the new design and are able to use its security features to check banknotes for authenticity.

The aim of the *Federal Reserve's* public education programme on the \$100 note is to familiarise users with the new design, the security features it incorporates and how to verify them so as to be able to distinguish a genuine banknote from a counterfeit. It will also inform the public that it is not necessary to trade in old-design \$100 banknotes when the new ones come into circulation. The message is particularly important in the international context, as many central banks withdraw old notes from circulation when new designs are issued. Therefore, one of the international public education programme's goals is to spell out that all the banknotes issued by the *Federal Reserve* remain legal tender regardless of when they were issued.

## Strategy

The public education programme on the new banknote issued by the *Federal Reserve* is being implemented in three phases.

### ■ Phase one: Presentation of the new design

The new design is usually presented six months before the date on which the banknote is due for initial release into circulation at a press conference held at a historically significant venue.

The main presentation of the new \$100 banknote design took place in the Cash Room at the *Treasury Department* in Washington D.C. The speak-



Countries in which events were held to present the new design of the \$100 banknote / Federal Reserve System

ers at the press conference included Timothy Geithner, Treasury Secretary, Ben S. Bernanke, Chairman of the Board of Governors of the *Federal Reserve System*, and Keith Pruitt, Deputy Director of the *United States Secret Service*. It was attended by journalists from both the US and abroad. It was translated into 25 languages and distributed to over 52 countries in order to spread the education message around the world. In conjunction with the State Department, a further 13 similar events were arranged at US embassies and consulates worldwide. These were attended by representatives of professional cash handler groups and covered by local media.

### ■ Phase two: Promotion period

During the months between the presentation of the new design and the date on which it first comes into circulation, consumers and firms around the world need to be readied for the launch. This period is also essential to give banknote handling-equipment manufacturers time to adapt their devices. A set of educational materials has been made available to a variety of international sectors for use during this period. These include:

- a website for the redesigned banknote, translated into 24 languages ([www.newmoney.gov](http://www.newmoney.gov));
- educational and training materials available in 25 languages;
- digital tools such as an instructional CD-ROM, translated into 8 languages, and
- training seminars for representatives of financial institutions and competent authorities, run by representatives of the Federal Reserve Board in 12 different countries.

### ■ Phase three: Date of first issue

During 2011, the *Federal Reserve* banks will start distributing 100 United States dollar banknotes with the new design in the United States and abroad. This milestone will be marked by a series of coordinated events in the international media so as to prepare the public around the world for the issue of the new banknote.

Ultimately, the aim is for information about the new \$100 banknote to reach users of US currency wherever they are in the world.

# A multilateral approach to the fight against counterfeiting

■ Allister McCallum *European Central Bank*

The crime of counterfeiting banknotes is as old as banknotes themselves. The aim of counterfeiters is to 'get rich quick'; that is to use fraudulent means to make a large sum of money with minimal effort. The more widely used and trusted a currency is, the greater its attractiveness to counterfeiters. Thus the US dollar has for a long time been an important target for criminals. Currently, as the euro is gaining in worldwide usage it is also coming under attack.



Counterfeit five-pound banknote

Apart from the financial motive there are also well documented historical accounts where governments have counterfeited the currency of an enemy state in an attempt to destabilise its economy. There are rumours that state-sponsored counterfeiting still continues to this day. Furthermore there is evidence that in recent history terrorist organisations have turned to counterfeiting as a means of funding their activities.

Early approaches to counterfeit deterrence relied mainly on hand engraving, watermarked paper and very severe penalties (e.g. death) to those who were found guilty. Nowadays it is generally accepted that penalties for crime have little deterrent value, since most criminals do not believe they will be caught so the penalty is irrelevant to them. It is a fact that many counterfeiters are repeat offenders; in spite of having been caught before, and punished they persist with their activity. Sentences handed down for crimes are the society's means of exacting retribution for the offence: they neither deter potential criminals, nor do they appear to reform past criminals.

In the past, public information and education was less important in the fight against counterfeiting since banknotes were rarely used by the general public. Coin was the principal medium of exchange; one had to be comparatively wealthy to be using banknotes, and only a tiny minority of the population had significant wealth.

The printing of hand and machine engravings onto watermarked paper remained virtually unchanged for over a century as the main means of deterring counterfeiting. Technological developments increased productivity but not security, so it was not until the middle of the 20th century that central banks had to deal with the threat to banknote security from reprographic technology. Since that time, the need to remain at least one step

*A counterfeit five-pound Bank of England note produced under duress by Jewish concentration camp prisoners during the Second World War. Codenamed Operation Bernhard, it was an attempt to destabilise the UK economy by flooding the market with counterfeits that the public could not distinguish from the genuine banknote.*

ahead of the counterfeiters has become a more and more significant activity for a banknote issuer as technology marches on.

## The pre-euro-launch scenario

Following the agreement of the Maastricht treaty in 1992, when it became the aim that several European countries would share a common currency, it was clear that a multilateral currency was going to require a multilateral approach to its protection against counterfeiting. As the launch of euro banknotes and coins approached there were a great many imponderables which, with the benefit of hindsight, now seem to be less challenging. The effective and efficient handling of counterfeits was one such matter. How many counterfeits could we reasonably expect to receive? As a first approximation the Eurosystem assumed that it would be of the order of the sum of all counterfeits of the national banknotes detected in the participating countries, but there was the possibility that it might be a lot more. After all, the foundations were being laid for a global currency that was more akin to the US dollar than to any of the legacy currencies, and it was known that the dollar counterfeiting situation, both domestically and internationally, was signi-

ificant so the Eurosystem had to consider the possibility that the euro would be similarly affected.

An early example of multilateral cooperation in the fight against counterfeiting that pre-dates the euro was the establishment of the *Reproduction Research Centre* in Copenhagen (RRC) in 1990. One of the main reasons for its inception was that at the time high-end reprographic equipment was hugely expensive for a note issuer who wanted to run confidential tests of the resistance of its designs to copying. The economics became more realistic with several note issuers clubbing together to share costs and facilities. Thus the RRC was born with 8 founder members<sup>1</sup> sharing resources. In the 20 years since its inception, the RRC has grown and adapted itself to the new technological challenges that have arisen.

#### Dealing with euro-counterfeiting

The standard strategy for tackling any problem comprises four simple steps: gather as much data as possible; analyse the data in order to gain a good understanding of what is going on; decide what action must be taken to solve it, and implement the decisions taken.

The Eurosystem has adopted a “coordinated decentralised” approach to the problem of counterfeiting in which each country has a National Coordinating Centre (NCC), as well as a National Analysis Centre (NAC) for banknotes, and a Coin National Analysis Centre (CNAC) for coins. Each NCC is established in the Central Bank of the country concerned and acts as an interface between the NAC and the European Central Bank (banknotes) and between the CNAC and the European Technical and Scientific Centre (ETSC) for coins. A fully centralised approach to fighting counterfeiting would have been at the expense of local knowledge, contacts and cooperation.

The European legislation provides for a coordinating function for the NACs, known as the Counterfeit Analysis Centre (CAC) which is under the aegis of the *European Central Bank*. In a similar way the ETSC is responsible for the coordination of the CNACs. Additionally the CAC manages and maintains the Counterfeit Monitoring System (CMS), a web-based database which acts as a central repository for all technical, statistical and geographical data on counterfeiting of the euro. The CMS has very restricted access: read and write access to it is given to all NCCs, NACs and CNACs (and of course the CAC). Additionally, read only access is given to *Europol* and the so-called ‘competent national authorities’ – generally law-enforcement authorities – that need access to the data.

Counterfeits found in circulation by the public, retailers, banks or police should find their way to the NAC of the country concerned, whereupon they are analysed, classified and entered into the CMS. The data entered are straightforward facts such as class, quantity, date, location and circumstances of finding. In this way a global overview on the evolution of counterfeiting is built up. For various reasons the CMS is not equipped to record any personal details relating to those involved in counterfeiting. It is left to the law-enforcement authorities to link CMS data with their own intelligence on criminal activity in order to pursue counterfeiters.

Referring to the problem solving strategy above, the NACs gather the data, the CMS stores the data, the CAC analyses the data, and the CWG (Counterfeit Working Group, a multi-national group of counterfeit experts) makes recommendations for actions to the Banknote Committee of the European System of Central Banks.

As with most crimes, counterfeiting is not spread homogeneously across Europe: certain countries are more susceptible to counterfeiting than others. Even within one country the picture is not uniform: some regions



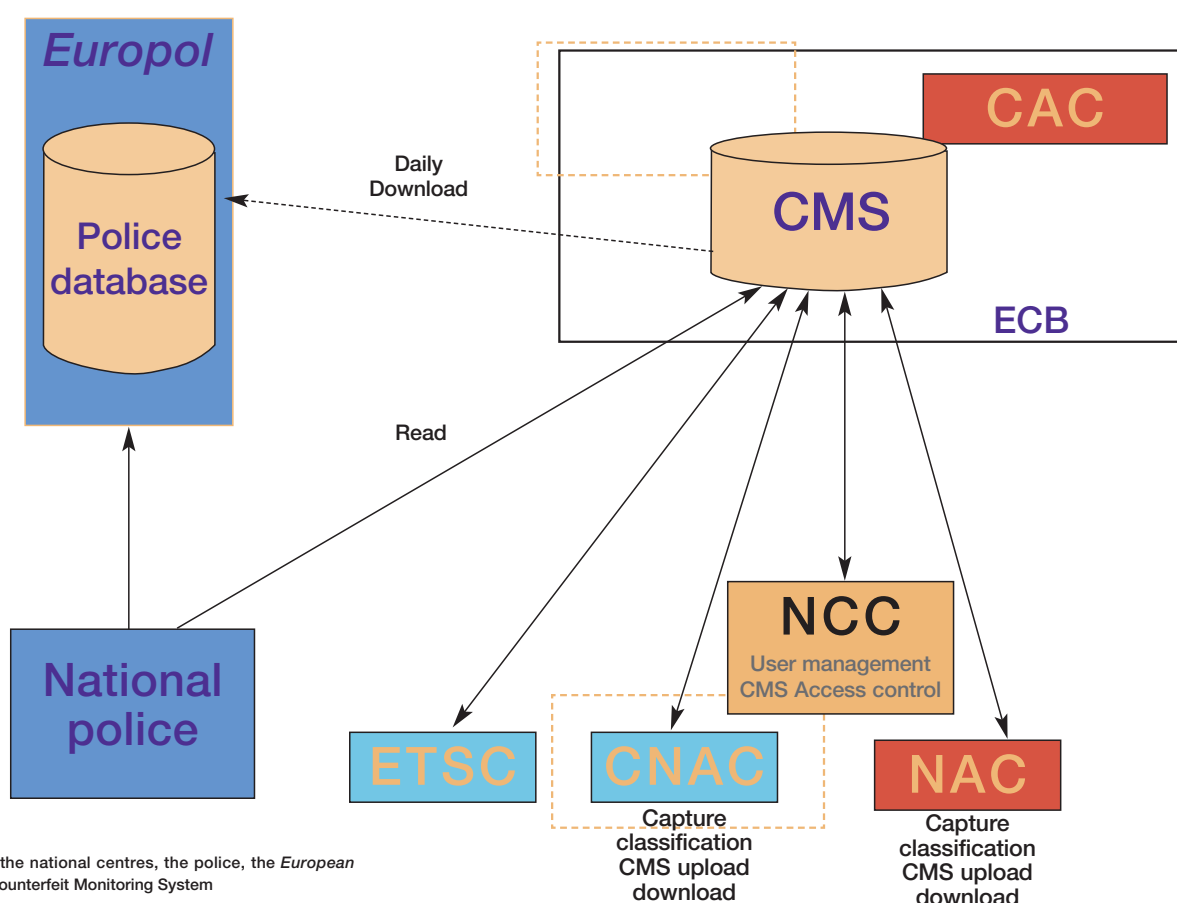
Banknote warning of the punishment for counterfeiting

*An early American currency note that makes it clear to the counterfeiter that the punishment for the crime is death.*

experience more counterfeits than others. The introduction of the euro has naturally brought some benefits, but there have also been some drawbacks: countries that hitherto had not experienced any significant problems with counterfeiting of their former national currencies suddenly found that they were using a currency that suffers more sustained attacks on it. Small countries bordering the south-east Balkans were especially prone to this problem. A further negative effect came in the field of law-enforcement: some police forces seem to be more reluctant these days to devote resources to the fight against euro counterfeiting, since it can be seen as more of a European problem than a national one.

It has been noticed that in the countries where euro counterfeiting is most prevalent there is a very strong correlation between the highest denomination that is routinely dispensed from ATMs and the most commonly occurring denomination of counterfeits. This is not really surprising – counterfeiters will want to maximise their return by targeting the highest denomination that will not receive too much scrutiny, and this will be the highest denomination dispensed from ATMs. Besides, there

1. Austria, Spain, Denmark, Sweden, the United Kingdom, Switzerland, Finland and Norway.



Connections between the national centres, the police, the European Central Bank and the Counterfeit Monitoring System

are few opportunities for the public to receive counterfeit banknotes in a European Monetary Union country because the banknotes are withdrawn mainly from ATMs or over the counter in a bank and, according to the European Regulation, the authenticity of the banknotes will have been previously checked. Therefore the Eurosystem considers that the public is neither the main target, nor the intended victim, of the counterfeiter. Rather, the main targets are those who accept cash as payment for goods and services. So, although the general public should continue to be addressed in publicity and education campaigns, the cash handling community should become much more the focus.

### An efficient protection implies...

In order for a currency to be efficiently protected against counterfeit, three 'pillars' need to be in place to support it, and as with any structure that relies on three pillars for support if you remove just one of them the structure becomes unstable:

- **Banknotes with good design and effective security features** that are as difficult as possible to copy. Most security features do not, in the first instance, actually prevent counterfeiting. The aim for is to render any counterfeits that are made easy to detect. An ideal security feature is one in which the physical properties are intuitively obvious to the users whilst being impossible to copy. One of the guiding principles for the first series of euro banknotes was that all denominations should receive the same level of protection. There are several reasons for this; for example communication and training of the users is easier when there is a consistent message to give, and if one or some denominations are conspicuously less well protected than others, they become a softer target for counterfeiters. The available Eurosystem data reveal that over 95% of all counterfeits are of the three mid-range denominations (EUR 20, 50 and 100) whereas the very low denominations (EUR 5 and 10) and the very high denominations (EUR 200 and 500) are more rarely counterfeited, presumably because they are either insufficiently profitable or they attract too much unwanted scrutiny. This experience could be an economic argu-

ment for removing some of the more expensive security elements at least from the low denominations, which have to be produced in relatively large volumes and which suffer little by way of attack.

- **A well-informed and vigilant user base.** The best security feature imaginable will be useless if banknote users are not aware of it, are unable to verify it or are simply not interested in doing so. Since they are the prime victims, it seems appropriate for training to be offered on a continuous basis to professional cash handlers, both in Europe and beyond, and up-to-date information materials have been created to support the Eurosystem's fight against counterfeiting. The well-established cooperation with *Europol* and the European Commission also serves this goal. The greatest challenge in this area is persuading cash handlers to be interested in accepting training. For them currency counterfeiting is only a minor problem and so comes a long way down their list of priorities.
- **An effective legal and enforcement framework.** For the euro it was necessary to ensure that in every Member state counterfeiting is adequately defined and legislated against in law, and that the police and judicial authorities understand why it is a serious offence and deal adequately with offenders. In the European context this task is looked after by the European Commission and *Europol*. There also needs to be good coordination and cooperation between national police forces, and for the euro this task is fulfilled by *Europol*.

### Conclusion

A multilateral currency requires a multilateral approach to the fight against counterfeiting. The Eurosystem has embraced such an approach and it has proved to be a success. In spite of the progress in potential counterfeiting technology over the eight years or so that the euro has existed in cash form, the number of counterfeits and the financial and societal cost of them has been kept within the bounds of those which existed prior to the introduction of the euro.

# The importance of forensic work in police investigations

■ Carmen Álamo and Juan Pablo Garnacho *Banco de España*

This article aims to explain how the National Analysis Centre (NAC) and the Spanish Central Office are coordinated and how the NAC's forensic work helps the latter in its criminal investigations. This support comes during two clearly differentiated phases: the first, from the appearance of a counterfeit banknote through to the closing down of the illegal printing works it came from and, the second, from the closing of the printing works through to the completion of the police investigation and the holding of the trial.

In Spain, the fight against counterfeiting rests on three basic pillars. The foundations of the legal pillar draw on the Criminal Code, which establishes prison sentences of eight to twelve years and fines of up to ten times the value of the counterfeit currency for criminals who counterfeit or alter currency or import, export, ship or distribute counterfeit currency. The law also typifies as a crime, punishable by up to six months in prison, any attempt to pass counterfeit currency after having become aware that it is counterfeit, even if it is received in good faith.

The police pillar is guided by the Geneva Convention for the Suppression of Counterfeiting Currency of 20 April 1929. This establishes the requirement that each country have a central office which must be in close contact with the currency issuing institutions, the police authorities, and the central offices in other countries. Since 2001, following the Ministerial Order by the Interior Ministry of 10 September 2001, the central office in Spain has been the *Banco de España* Monetary Offences Investigation Brigade ("BIBE" in its Spanish initials). The BIBE was set up in 1934 by a Royal Decree providing for the creation at the *Banco de España* of a banknote counterfeiting investigation and suppression unit, the *Sección de investigación y represión de los delitos de falsificación de billetes*.

The forensic pillar is one of the essential points of support in anti-counterfeiting efforts. In the specific case of the euro, on 28 June 2001 European Council Regulation 1338/2001 was passed, which among other measures, establishes that technical and statistical information on counterfeit banknotes and coins should be gathered, analysed and classified by the competent national authorities and, that the Member States must designate or establish a National Analysis Centre (NAC) and a Coin National Analysis Centre (CNAC) in accordance with their national law and practice. These centres are to collect and catalogue technical and statistical data on banknotes and coins, for them to be subsequently sent to the *European Central Bank*, which is to inform *Europol*. In Spain, Law 24/2001

designated the *Banco de España* as the competent national authority for the identification of counterfeit banknotes and coins, the gathering of technical and statistical data on counterfeit banknotes and has designated it as the NAC and CNAC. The *Banco de España*'s Executive Commission decided to assign these tasks to the Cash and Issue Department, establishing that it would coordinate the exercise of the functions entrusted to it with the BIBE.

From the appearance of the first counterfeit banknote through to closing down the printing works

The NAC's functions include the centralised reception of all euro banknotes suspected of being counterfeits that are discovered in Spain. It



BIBE / Banco de España

analyses and catalogues the technical and statistical details about them, for which there is a shared database, the CMS (Counterfeit Monitoring System), used by all Eurosystem NACs. This enables the data to be made available to the national offices and police authorities. The information stored in this database helps locate the main area of production and distribution routes of counterfeit notes. All this information, held on an application shared by the NAC and the BIBE, allows the latter to focus on the geographical regions in which counterfeits are being produced and/or distributed in order to commence its investigations.

Once the source of the counterfeits has been pinpointed and the national and/or international distribution routes identified, determining the main printing technique used by the counterfeiters to produce the banknote background makes it possible to establish what kind of printing works the police should look for. Counterfeits printed on an offset system suggest a larger printing works, given the space requirements of the presses used whereas inkjet counterfeits might require little more than a laptop and a small mono- or multifunctional printer and a few accessories.

When laser technology is used to print counterfeit banknotes, or laser printing is involved at some stage, it leaves a trace which experts can analyse using a computer program to obtain a unique code precisely identifying the type of device used. Thorough detective work, involving the national office, *Europol* and the JMBIA (Japan Business Machine and Information System Industries Association), can in some cases lead



to the exact location of the printer used to produce a specific counterfeit note.

Forensic work also makes it possible to evaluate the materials and equipment used to create the counterfeits, guiding the investigator towards the source supplying the counterfeiter's inputs. This also enables an understanding of the way in which counterfeit types develop by comparing variations in the counterfeiting process. This allows new routes of investigation to be opened up or existing ones to be confirmed.

Thanks to the analysis conducted by the NAC's experts, it is possible to establish the links between samples found, even if at first sight they may appear to be very different from one another, due to the use of different printing techniques, different denominations, etc. Forensic analysis enables different classes to be grouped together and related, a single counterfeiter to be identified as the source, and even to establish links to banknotes appearing in other countries.

#### From closing the printing works to the trial

Once the printing works has been closed down, the forensic work allows the suspicions about the equipment used to be confirmed. The forensic expert's visit to the printing works serves to confirm whether the equipment found during the police operation was that used by the counterfeiters to produce the banknotes found. The printing process leaves evidence that when subjected to expert analysis can allow the counterfeit notes to be associated with the equipment seized. One example of this is the use of inks that respond to ultraviolet light but which are invisible to the naked eye and which may be found on the printing equipment. What is more, materials found on the premises, such as inks, remains of metal tapes, etc. can be related to the counterfeit notes by forensic work.

Examining the evidence found at the clandestine printing works can help determine if any of the stages in the production of the counterfeit notes were carried out elsewhere than at the printing works, such as transferring the hologram, or printing the serial numbers, etc. This makes it possible to determine whether the whole operation has been shut down with the printing works and with it the family of banknotes produced.

In those cases where the judicial authorities or the Spanish police so require, technical reports may be issued which are subsequently ratified in person, if necessary, by the experts appearing as witnesses in court during the trial. For example, in 2009 the Spanish NAC's experts appeared no less than 61 times as experts to help the court reach its verdict.

*The forensic work before and after the closing down of a clandestine printing works is a crucial task and absolutely essential for the police authorities combating counterfeiting to be able to work effectively. Without it, it would be extremely complicated and costly in time and resources to arrest counterfeiters and their distributors and bring them to trial. The frank, close and continual cooperation between technical experts and the police is one of the main weapons in the armoury of the fight against counterfeiting.*

# The *Bank of England's* anti-counterfeiting strategy

■ Kevin Wills *Bank of England*

One of the *Bank of England's* core objectives is maintaining the integrity of the currency. Ensuring the public can be confident of receiving adequate quantities of good quality banknotes of the required denomination and, above all, that they are genuine, is therefore essential. The Bank takes a multi-pronged approach to achieving this goal: launching new banknotes with enhanced counterfeit-resistant designs; ensuring only good quality banknotes are put into circulation; providing educational materials so users can check banknotes' security features for themselves; working with the police to catch counterfeiters; and, monitoring that banknote sorting machines and machines delivering and receiving banknotes to and from the public are able to detect counterfeits. This article gives an estimate of the scale of counterfeiting of *Bank of England* notes and describes the nature of the counterfeit threat in the overall context of the cash distribution cycle.

The *Bank of England* issues banknotes in four denominations: 5, 10, 20 and 50 pounds sterling. ATMs usually dispense £10 and £20 notes and, in terms of numbers of notes in circulation, the £20 note (of which there were 1.374 billion units in circulation at the end of 2009) accounts for the largest share, at 55% of the total. As this is a relatively high value denomination and widely used in commercial transactions (Figure 1), over the last six years counterfeiters have almost exclusively targeted the £20 note, particularly given that £50 notes are still relatively rare, and so are likely to come under closer scrutiny.

## Counterfeiting of *Bank of England* banknotes

The *Bank of England's* involvement in the cash cycle is limited to the issue of new notes and the destruction of notes that are no longer fit for circulation. All other banknote circulation functions are performed by the members of the Note Circulation Scheme, which sorts banknotes using high-speeding processing machines before returning them to circulation. The public obtains from ATMs 70% of the banknotes it uses in day-to-day transactions. When retailers return banknotes to credit institutions or the members of the Note Circulation Scheme the cash cycle starts again. The £20 note completes this cycle an average of four times a year.

Counterfeiters in the United Kingdom have been trying to counterfeit banknotes almost since the day of the *Bank of England's* first issue over three hundred years ago. Counterfeiting methods have developed as new technologies and raw materials have appeared but over the years few people have tried to counterfeit banknotes denominated in sterling. Counterfeiting levels are volatile, as improved banknote security features are added from time to time, and, as in other countries, designs have been changed more frequently over the last fifteen years. It takes counter-

Figure 1. Counterfeiting by denominations  
The most threatened denomination: £20

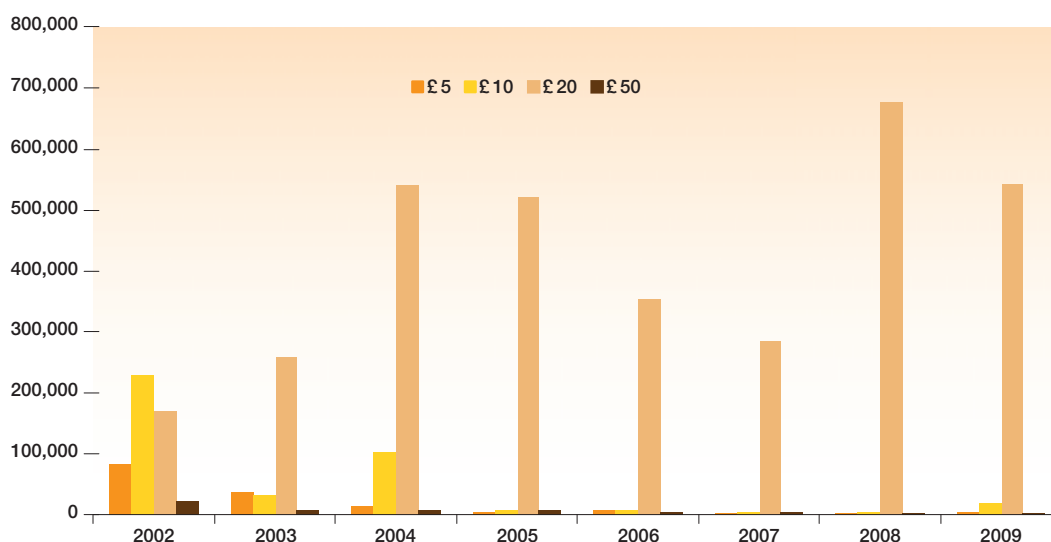
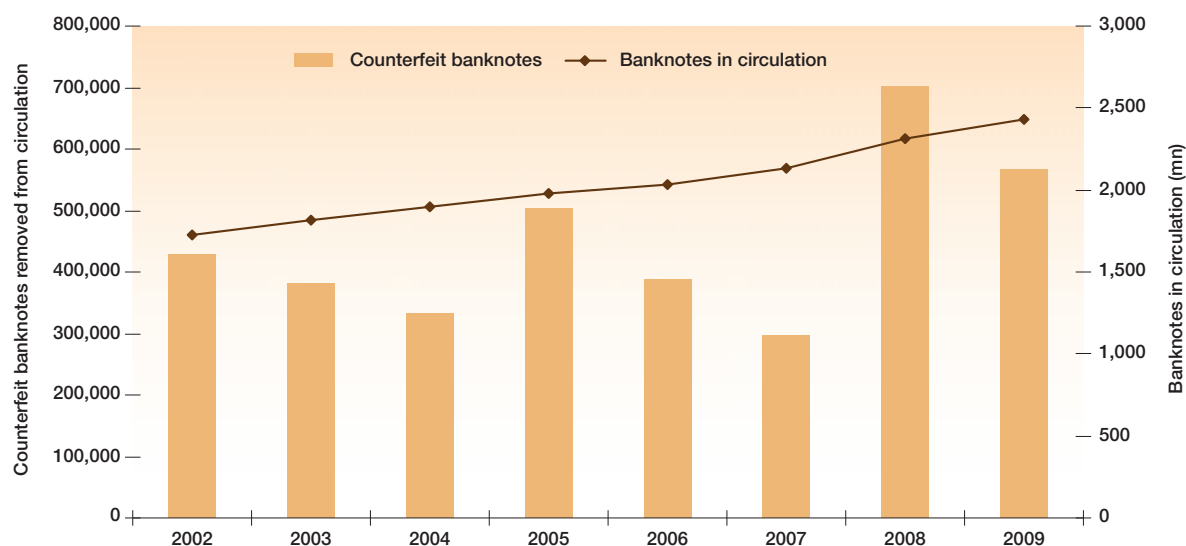




Figure 2. Counterfeit banknotes removed from circulation



feiters time to copy new notes, so the volume of counterfeits drops in the wake of the issue of a new-design banknote. Volumes of counterfeits also drop when the authorities arrest and imprison counterfeiters.

The *Bank of England* analyses and records all the counterfeits found and is able to associate counterfeit types with specific gangs of organised criminals. Between 80% and 95% of counterfeits can be related to five main types of crime. Figure 2 charts how counterfeiting fluctuated over the period 2002-2009. As the ochre bars on the chart show, the number of counterfeits taken out of circulation over this period varied from 300,000 to 700,000 a year. Over the nine-year period shown, the number of notes in circulation, represented by the brown line, rose by 40%, to 2.5 billion notes.

Although the counterfeiting threat comes from a relatively small number of counterfeiters whose distribution networks focus on the £20 note, the *Bank of England's* efforts to combat counterfeiting cover the whole spectrum of denominations.

### Anti-counterfeiting strategy

The *Bank of England's* anti-counterfeiting strategy is based on six main elements:

1. The *Bank of England* seeks to guarantee that ATMs do not issue counterfeits. The Bank therefore regularly provides banknote sorting machine manufacturers with batches of a variety of common counterfeit types for them to sort using their machines so they can confirm that they are able to detect them.
2. The *Bank of England* works closely with manufacturers of automatic banknote handling machines and has established a testing framework enabling manufacturers to demonstrate that their machines are able to detect counterfeits. The machine types that have passed the test are published on the Bank's website.
3. The *Bank of England* seeks to ensure that people who use or work with cash are able to confirm that a banknote is genuine. In recent years, the Bank has substantially expanded its range of educational resources, teaching materials and training. The materials on offer to the public free of charge include leaflets, posters, DVDs and computer-based training.

There is a particular focus on retailers and businesses, as they constitute the front line in the defence against counterfeiting. Information for professional cash handlers is also available on the *Bank of England's* website ([www.bankofengland.co.uk/banknotes/retailers/index.htm](http://www.bankofengland.co.uk/banknotes/retailers/index.htm)). Specific materials and training courses are also available for banks and operators in banknote processing companies.

4. The education and training materials centre on banknote authenticity checks. It is therefore crucial that the banknotes issued be of high quality. This is achieved by the manufacturer's inspecting all the banknotes it produces, backed up with inspections of random samples of finished banknotes by the *Bank of England's* quality control teams.
5. The *Bank of England* issues new-design banknotes in order to create hurdles for would-be counterfeiters. Its team of scientists and engineers monitors developments worldwide on the lookout for new substrates and security features worth assessing for their potential. The criteria on which features are selected include production capacity, counterfeit resistance, ease of use and training, and patent indemnity. Combining security features and design to create a banknote that can be manufactured by print works at high speed with a small volume of waste remains a challenge, however.
6. It is important that counterfeiters be stopped as soon as possible. The *Bank of England* therefore maintains a close working relationship with the national law-enforcement authorities. It also provides statistics on counterfeiting and forensic details of the counterfeiting methods used and expert witness statements for use in court. To raise awareness among the police of the counterfeiting problem, the Bank arranges talks for the police and is currently running train-the-trainer courses.

Ultimately, by implementing this six-pronged strategy, the *Bank of England* seeks to minimise the number of counterfeits and ensure the public is able to detect them easily.

# The coin packaging system. An element in the fight against coin counterfeiting in Germany

■ Franz-Josef Behringer *Deutsche Bundesbank*

In 2003 *Deutsche Bundesbank* laid down standards for coin rolling. The new measure introduced a procedure for detecting counterfeits and facilitated the exchange of coins directly between firms operating coin-accepting machines, credit institutions, and parties requiring coins, without the intervention of the Central Bank.

Prior to the standardisation of coin rolls, there was no common quality standard for coin rolling in Germany, particularly as regards coin authentication. Firms were free to choose the design used for their rolls and often included their own brand name on them, which was an obstacle to supplying these rolls to other firms or customers than the originator. As a result, most of the coins deposited at the *Deutsche Bundesbank* were first sorted and then rolled prior to being put back into circulation. Consequently, it was only rarely possible to deliver coins received by the Central Bank directly.

Against this backdrop, the decision was made to implement a rolling standard that would eliminate the discrepancies and avoid the presence of foreign and counterfeit coins in rolls. Strict rules for authentication were put in place. This succeeded in inspiring confidence in the market and facilitated the exchange of rolls directly between the various players, regardless of the party responsible for sorting and packing the coins.

## Basic legislation on the standardisation of coin rolling

The *Deutsche Bundesbank* laid down the standards for coin rolls through a private contract, following the EU "Commission Recommendation of 27 May 2005 on the authentication of euro coins and handling of euro coins unfit for circulation."

The standards require that rolls be formed by a coin rolling machine equipped with an electronic authenticity detector able to detect counterfeits, suspect coins, unfit coins, other metal objects, foreign coins, medals, tokens, etc. Counterfeits detected during this process must be handed over to the *Deutsche Bundesbank* or the police. Of the 78,500 counterfeit coins detected in Germany in 2009 – equivalent to almost 50% of the total number of counterfeit coins found in Europe – over 80% were detected using this system. Coin rolls complying with this standard are

stamped with an identification code provided by the *Deutsche Bundesbank*. In the event of a discrepancy's arising, this code enables the professional responsible for preparing the roll to be identified.

## Monitoring compliance with coin roll standards

The *Deutsche Bundesbank* performs checks on the rolls of coins it receives to ensure that professional cash handlers are following the rules it has established. A number of rolls are selected for reprocessing at random, particularly larger denomination coins (€1 and €2) as they are more prone to counterfeiting. In 2009, *Deutsche Bundesbank*'s branches sampled and checked 566 million coins, representing an average of 5.4% of the coins deposited with the central bank and 18% and 15% of total deposits of €1 and €2 coins, respectively.

Moreover, the *Deutsche Bundesbank* monitors information from external sources and the complaints received about non-compliant coin rolls. The results of the checks are compiled in the Cash Management System and are reviewed quarterly by the National Analysis Centre.

## Corrective procedures

As part of its review, each quarter the National Analysis Centre draws up a register of the professionals preparing rolls for which the results of the coin sample verification process were outside the *Deutsche Bundesbank*'s thresholds of tolerance. If the coins sorted by these same professionals again exceed these thresholds in the following quarter, the central bank initiates a special corrective procedure. This entails the rolls prepared by the professional in question being subjected to more extensive sampling, and requires that appropriate measures be

taken without undue delay to guarantee improvements in the quality of the rolls prepared. Subsequently, if the *Deutsche Bundesbank* feels that the results continue to be unsatisfactory, it can reject the deposits and revoke the identification code assigned. This situation has not arisen to date, as professional cash handlers have always complied with the *Deutsche Bundesbank*'s requests in order to maintain agile coin movement procedures. Moreover, if the deficiencies are due to the presence of counterfeits, the *Deutsche Bundesbank* can offer professionals the opportunity to perform a free authenticity test with a collection of counterfeit coins, so that the manufacturer of the coin rolling machine can subsequently make any adjustments necessary to the coin authentication devices. If this procedure fails to resolve the problem, the machine that is not functioning properly will need to be replaced.



Standardised coin rolls / Deutsche Bundesbank

In 2009 almost 1,150 professional cash handlers guaranteed to the *Deutsche Bundesbank* in writing that they would observe the coin rolling standards. This year, the coins included in the sample came from 820 different professional cash handlers, of which 32 are currently subject to the correction process described.

Overall, the monitoring and control of the coin rolling standards has led to a considerable improvement in the quality of the coin rolls received by the central bank. It is worth noting that in 2009, 24% of the total discrepancies found by the *Deutsche Bundesbank* were due to the detection of counterfeit coins, compared with 32% in 2007.

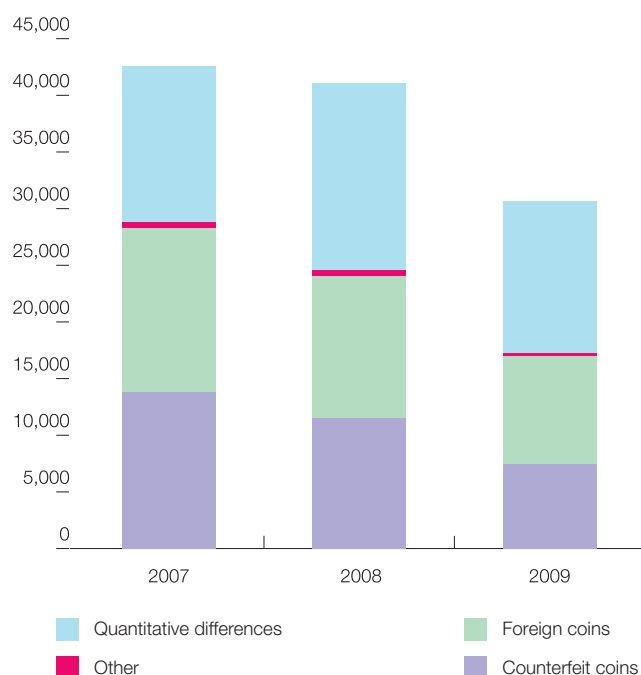
**Outlook**

The approval of the binding European Union Regulation on the authentication of euro coins and handling of euro coins unfit for circulation, due to replace the existing Recommendation in 2012, will lead to more attention's being paid to the quality of the coins in circulation in Europe. Following a similar approach to that applied in the case of banknote recycling, once the Regulation comes into force, a coin may only be returned to circulation once it has been processed by machines that have shown it to be fit for circulation. Moreover, these machines must be of a type included on a list published by the *European Commission*. Manufacturers must submit their machines to annual tests and central banks will perform random checks in situ to verify that they are functioning correctly.

However, at present the *Deutsche Bundesbank* verifies machines' performance by testing samples of coins rather than the machines themselves. This is a process which yields a better understanding of whether the machine is functioning correctly.

Time will tell which is the better procedure of the two. The European Regulation establishes a transitional period, which ends on 1 January 2015, during which the existing procedures, such as those on the standardisation of coin rolls, may continue to be applied. The European Commission will assess the impact of the new Regulation in mid-2014.

**Discrepancies detected in the sampled rolls**



Coin sorting machine / Deutsche Bundesbank

# Education: a powerful weapon against counterfeiting

■ César Roney *Banco Central de Reserva de El Salvador*

The Treasury Department of the *Banco Central de Reserva de El Salvador* runs a banknote education programme aimed at both the financial system and the general public across the country.

This education programme features radio and television commercials, publications in the press, and events to educate groups from various sectors in the country.

This preventive measure aims to combat the circulation of counterfeit banknotes in the economy by informing, raising awareness and thereby protecting the population against the fraud this crime represents. In addition, it is hoped that educating the public on how to look after and make proper use of banknotes will extend their lifetime and so reduce the cost the



Pupils with teaching materials / Banco Central de Reserva de El Salvador

Bank incurs in replacing soiled and damaged notes.

Since 2008 the emphasis has been placed on educating high-school pupils, although other groups have not been ignored. The aim is to spread an understanding among the country's future workforce and to produce a multiplier effect as youngsters pass on their new knowledge to their families and friends. The programme has made it possible to reach even the remotest areas of the country. Since 2008 a total of 10,143 school children in all fourteen of the country's departments have been taught about banknotes.

The teaching is given by technical staff from the Treasury Department. The talks explain the role of the *Banco Central de Reserva de El Salvador* in Salvadoran society, the security features of US dollar denomination banknotes, the appropriate use and handling of banknotes, and the public's rights vis-à-vis the banking system as regards cash transactions. Each pupil attending the talk is given an information pack.

Education about the currency became much more important after the Monetary Integration Act was passed in 2001, making the United States dollar legal tender, and significantly changing the Central Bank's role.

In the future the *Banco Central de Reserva de El Salvador* aims to expand its project to primary schools and run workshops for teachers, thus leveraging teachers' skills in educating primary school children and fostering a more detailed knowledge of the notes and coins used in economic transactions.

## Anti-counterfeiting measures in the Russian Federation

Anti-counterfeiting policy	<ul style="list-style-type: none"> <li>■ Focusing on education, information, training experts and running advertising campaigns.</li> <li>■ Regular contacts with the judiciary, credit institutions, security firms and the public.</li> </ul>
Advertising campaigns	<ul style="list-style-type: none"> <li>■ Coinciding with the launch of new series.</li> <li>■ Periodic.</li> </ul>
Agents involved in counterfeit detection	Central Bank, police and credit institutions.
Counterfeit analysis	<ul style="list-style-type: none"> <li>■ By the police and the Central Bank.</li> <li>■ Recording of counterfeits in a database.</li> <li>■ 450 Central Bank experts are involved in this task.</li> </ul>
Tests on banknote handling equipment	The Central Bank offers a testing service for banknote handling and counterfeit detection equipment.
Counterfeiting figures	27 counterfeit notes per million banknotes in circulation.

# Banknote authentication devices

■ Francisco Cantero *Investrónica, S.A.*

**To combat the activities of counterfeiters and maintain confidence in the cash payments system, a series of devices have been developed, particularly in recent years, that are able to examine security features that humans are unable to detect unaided. These devices back up human visual and tactile recognition and can boost the certainty that a given banknote is authentic. They are increasingly sophisticated, compact, and affordable.**

A banknote authentication device is a piece of equipment designed to help ascertain whether a banknote is genuine or a counterfeit. As the name suggests, the purpose of the device is to allow users wishing to validate the authenticity of a banknote to reject any notes that have signs of being counterfeits.

A banknote authenticator is a small device containing a series of electronic, optical and mechanical components which, with the aid of special-purpose computer algorithms, are designed to confirm the security features of the banknote.

## Types of devices and the technology they use

Authentication devices can be classed according to a variety of criteria<sup>1</sup>, although here we will only look at those which authenticate banknotes independently, that is to say, without requiring the operator to judge whether the banknote is genuine or not.

These devices may be classed as manual or automatic (i.e. those used for large volumes of banknotes) depending on the way in which notes are fed in. It is also possible to distinguish between different models according to the type of technology on which banknote authentication is based. Thus, for example, devices exist which examine the magnetic regions of the banknote or even read magnetic codes, and sensors operating on various wavelengths of infrared and ultraviolet are also used. For cost reasons, authentication devices generally use just a few of these techniques rather than all of them at once.

## Users of authentication devices

Retailers in all lines of business are among the main users of these devices as their establishments habitually receive banknotes as payment for goods and services. Bank branches may also use authentication devices, particularly those in European Monetary Union countries, given their duty to look for counterfeits and their obligation to ensure the authenticity of the euro notes and coins they receive and intend to return to circulation.

## General considerations

To tackle high quality counterfeits top of the range authentication devices are needed, which are able to recognise security features that are totally undetectable by humans. Banknote authentication devices today are an important tool for retailers needing to verify banknote authenticity, as it is no longer advisable to rely solely on checks based on banknote features easily recognisable to humans, such as visual and tactile features. Their price makes authentication devices readily affordable nowadays, particularly bearing in mind the high face value of some banknotes and the added security that an authentication device offers.

The Eurosystem has established common procedures for testing authentication devices' ability to recognise genuine euro banknotes and detect counterfeits. The results of these tests, which are performed by national central banks, are published on the central banks' websites and on the *European Central Bank* website. They serve to inform potential buyers about the reliability of these devices, provided that they do not deviate from their specifications and the necessary updates are made to ensure new counterfeits can be detected. Therefore, in the euro area, when deciding the best technology to opt for when purchasing an authentication device, it is strongly recommended that it be of a type officially approved by the Eurosystem.



Banknote authentication device / Investrónica, S.A.

1. Devices which require human intervention in order to decide the authenticity of a given banknote, such as those using ultraviolet light or infrared cameras are not discussed here.

# Honduran banknotes

■ **Geovanny Bulnes** *Banco Central de Honduras*

The *Banco Central de Honduras* was created in February 1950 by a Legislative Decree and began operation in July of that same year. Its mission is to maintain the internal and external value of the national currency and underwrite the normal functioning of the payments system. It therefore formulates, develops and implements the country's monetary, credit and exchange-rate policy. It performs these tasks in compliance with the provisions of article 342 of the Constitution, which states that "the State shall have the sole authority to issue currency, which it shall exercise through the *Banco Central de Honduras*..."

Honduras's Monetary Act defines the national monetary unit as the lempira, which is subdivided into a hundred centavos. It also states that the *Banco Central de Honduras* is the country's sole issuer of banknotes and coins, and that the currency is legal tender without limitation throughout the Republic of Honduras.

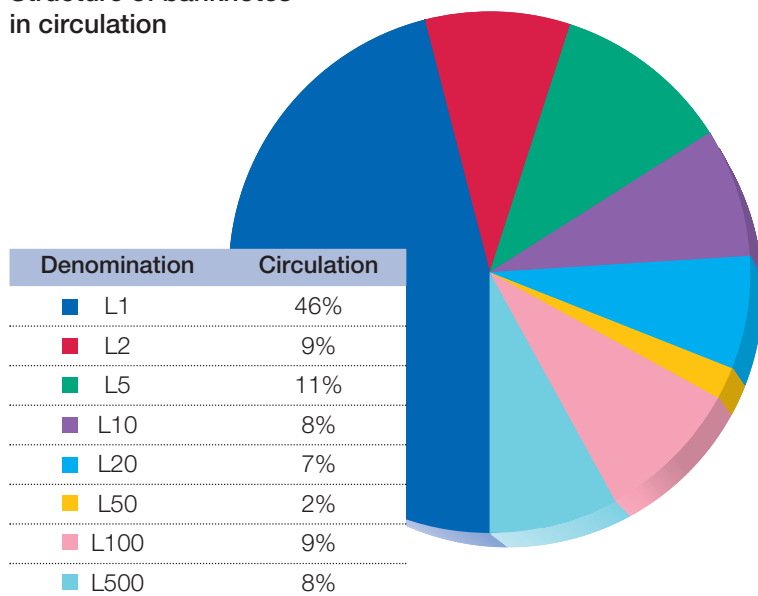
The Bank's Issue and Treasury Department estimates the currency volumes required to meet demand from the economy and supply is primarily channelled through the national banking system. These estimates are obtained from the statistics of the annual monetary programme prepared by the Department of Economic Studies.

The General Services Department (Procurement) manages contracts for the supply of notes and coins with foreign mints and printing works, represented by Honduran companies accredited in the register of suppliers to the *Banco Central de Honduras* and the national office of procurement standards and contractors.

For many years the *Banco Central de Honduras* kept its banknote series (comprising six denominations: 1, 5, 10, 20, 50 and 100 lempiras) unchanged. However, in 1976 it included a 2 lempira denomination and then in 1995 the 500 lempira note was added.

The series of Honduran banknotes currently in circulation have a standard size of 156 x 67mm and are manufactured using a 100% cotton-fibre

## Structure of banknotes in circulation



Data as of end June 2010

paper substrate, with a weight of  $92 \pm 5\%$  g/m<sup>2</sup>, with the exception of a special issue of 20 lempira notes, produced on a polymer substrate, which has been in circulation since 12 January 2010.

All denominations have the portrait of an eminent national figure on the front, and scenes from Honduran history on the back. All the notes bear the facsimile signature of the President and General Manager of the *Banco Central de Honduras* and that of the Secretary of State for Finance.

At the end of the first half of 2010, the number of banknotes in circulation stood at 294 million units with a face value of 15.298 billion lempira. Of the total banknotes issued, 46% were of the one lempira denomination, 11% were 5 lempiras, 9% were 2 and 100 lempiras and the remaining 25% comprised 10, 20, 50 and 500 lempira notes.

## Design features of the 100 lempira banknote

The 100 lempira note is one of the most representative of the banknotes in circulation in Honduras. Its dominant colour is yellow. The obverse bears the portrait of José Cecilio del Valle, a key figure in Central America's independence movement, who was born on 22 November 1777 in the city of Choluteca, in the south of Honduras, and died in Guatemala in 1834. Del Valle was a philosopher, politician, lawyer and journalist, and the author of Central America's Declaration of Independence in 1821. The reverse of the banknote shows the house in which Del Valle, "the Wise" as he is known in Honduras, was born.

## Printing and security features

### Printing techniques

- **Intaglio.** Printed on the obverse and reverse with the greatest possible depth to ensure the motifs give a tactile effect. These comprise the main portrait, vignettes, captions, denomination in figures and writing, names, signatures and positions of the signatories, issuing date and other tactile decoration incorporated on both the obverse and reverse.
- **Offset lithography.** The note includes double (or more) full bleed lithographic printing to produce an iris-effect background on both the back and front. Depending on the denomination, one of the inks is partially fluorescent under ultraviolet light.
- **Letterpress.** The number and series are printed with magnetic ink, which fluoresces under ultraviolet light. One is printed asymmetrically and the other symmetrically, with the same size, distance, shape and colour.

### Security features

The main security features the banknotes incorporate are:

- **Watermark.** When the note is held up to the light and examined from either side, the portrait of José Cecilio del Valle can be seen, with the initials of the *Banco Central de Honduras* (BCH) clearly visible to his left.
- **Security thread.** A plastic strip embedded vertically in the paper,

emerging from the front of the note in silver-coloured windowed sections. The text "BCH 100" can be read when the note is examined against the light. Under ultraviolet light the banknote has bright red hues on both sides.

- **Fluorescent fibres.** The paper contains silk threads randomly scattered across the whole surface. These fibres are visible under ordinary daylight and show up bright blue and orange under ultraviolet light.
- **Anti-photocopying and digital scanning protection.** Both sides of the note include a series of uniform lines in a pyramid or hexagonal shape which are almost imperceptible to the human eye and difficult to reproduce with the same degree of sharpness and precision.
- **Microprinting.** The initials "BCH" are printed in minute letters, making them hard to imitate, around the figure in the top right of the obverse stating the face value of the banknote. A magnifying glass or loupe is needed to read the microprinting.
- **See-through register.** A Mayan figure is printed on both sides of the banknote, and when examined against the light, the two figures coincide to combine correctly.
- **Latent image.** The number 100 is concealed in the top right of the note and can be seen when it is tilted.
- **Intaglio printing.** The portrait and other items are printed on the bank-

note with a thick layer of ink which can be felt with the finger tips or by running a fingernail over the darker areas.

Statistical data as at 30/06/2010	Lempiras	Euros
Value of banknotes in circulation (millions)	15,297.6	628.6
Average value of circulating banknotes	52.1	2.1
Number of banknotes in circulation (millions)	293.9	
Banknotes in circulation per inhabitant	36.3	
Value of banknotes in circulation with respect to GDP	6.5%	

### Plans for the future

The medium-term goal is to review the Honduran banknote and coin series so as to update the monetary structure in a way that facilitates transactions by the public, reduces procurement costs and, ultimately, strengthens security measures by adopting new technologies.

Technical features	
Substrate	100% cotton-fibre paper
Weight of substrate	92 ±5% g/m <sup>2</sup>
Dimensions	156 x 67 mm
Dominant colour	Yellow

### THE 100 LEMPIRA BANKNOTE

Note: The number shown beside each of the security features of the 100 lempira banknote refers to the number given to each feature in the Banknote security features pages in the Miscellaneous section, where a more detailed description of each security feature can be found.

# The Banco Central de la República Argentina's Treasury Management Department

■ Luis C. Fiore and Silvia A. Vance *Banco Central de la República Argentina*

The Banco Central de la República Argentina's Treasury Management Department reports to the Deputy General Manager for Means of Payment and, as is shown in the organisational structure chart below, is divided into three areas: Issuance Operations, Regional Branches and Treasury.

## Organisation and functions

### Issuance Operations Area

This area is responsible for operations relating to currency issues and custody of the paper and blanks used to produce notes and coins. Its responsibilities therefore include supplying these input materials to the public and private sector entrusted with manufacturing banknotes and coins. The area also receives, verifies and stores notes and coins produced by external organisations for subsequent delivery to the Treasury Management Department. The area is also responsible for the destruction of unfit notes and coins. It operates at the Bank's head office and an adjoining treasury, which is used to store the paper for banknotes printing, blanks for coin minting, and coins delivered by suppliers.

### Regional Branches Area

This area controls operations of the twenty-one regional branches located at various points around the country. These branches receive deposits, supply banks in their area with cash, and store the cash deposited by them. Each branch processes and sorts the banknotes deposited by banks, reissuing notes into circulation or sending them to the head office for shredding, depending on their condition. This area is also responsible for ensuring branches have the currency they need to meet financial institutions' demands. The area's staff is located both at the Bank's headquarters and in all the branches.

### Treasury Area

The Treasury Area handles the operations and paperwork associated with the movement and safe-keeping of notes and coins at the head office. This mainly entails the following tasks:

- Verifying, sorting and replacing banknotes and coins lodged by credit institutions.

- Supplying financial institutions with the currency they need for their operations.
- Running the interbank banknote clearing system.
- Secure storage and transport of the cash in its custody.
- Receiving, checking and storing foreign currency – primarily in the form of US dollars – for distribution to financial institutions to meet public debt servicing requirements.
- Preparing statistical data for higher authorities, designing work plans and determining cash supply needs.

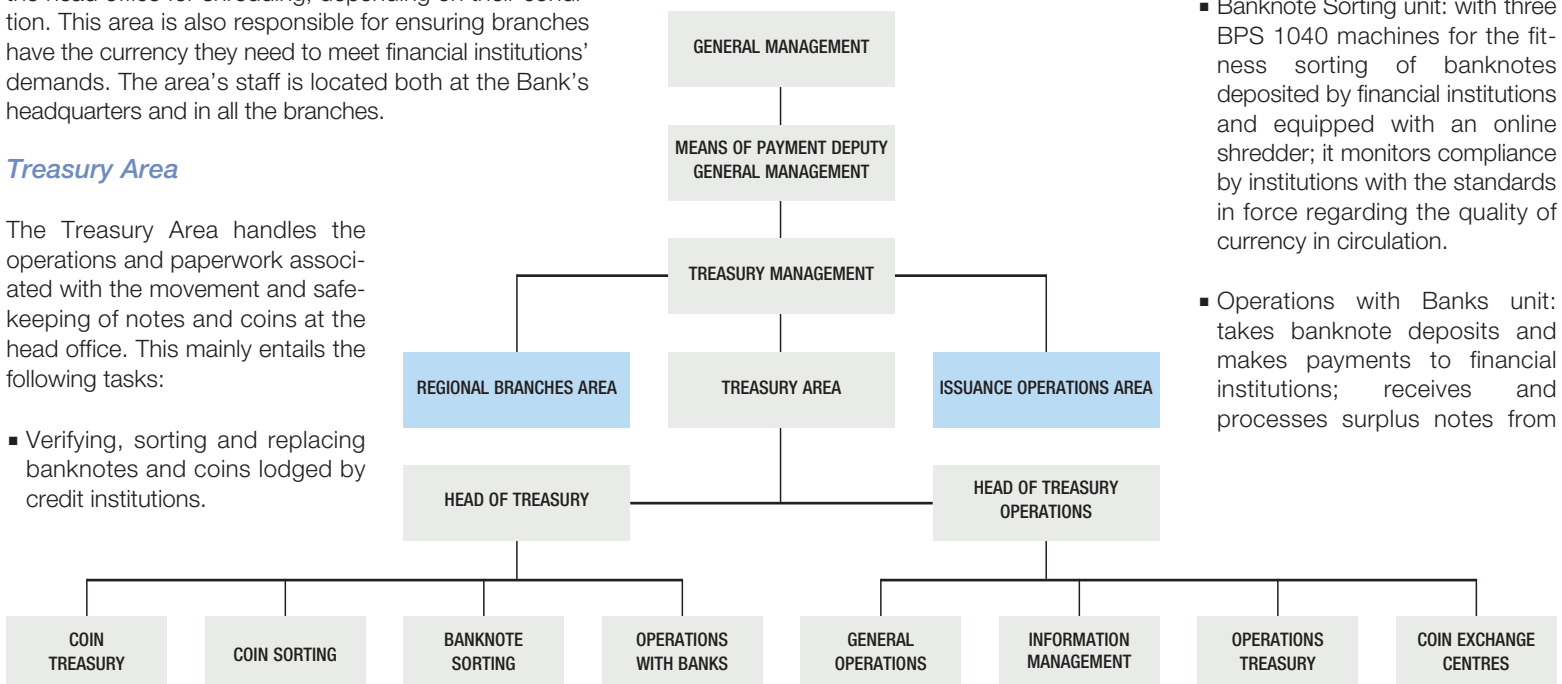
The structure chart shows the eight units into which the area is divided, each of which has a specific function. The department has a total workforce of eighty five, distributed between the head office and an adjoining treasury where both the coin sorting unit and the coin treasury are also located.

The functional units into which the area is subdivided have the following tasks:

- Coin Treasury unit: receives deposits and makes deliveries of coins to financial institutions and provides secure storage for the coins received from the Issuance Operations Area; supplies the Regional Branches Area with cash for distribution to its regional branches.
- Coin Sorting unit: processes, verifies and prepares coins deposited by banks for its return to circulation.

- Banknote Sorting unit: with three BPS 1040 machines for the fitness sorting of banknotes deposited by financial institutions and equipped with an online shredder; it monitors compliance by institutions with the standards in force regarding the quality of currency in circulation.

- Operations with Banks unit: takes banknote deposits and makes payments to financial institutions; receives and processes surplus notes from







The Banco Central de la República Argentina's building in Buenos Aires / BCRA

tion, page. 32), which provide the public with change in coins and 2 Argentine peso notes (the smallest denomination).

## Notes and Coins

Financial institutions are required by the current standards, as laid down in the regulations (CIRMO circular) on the guidelines financial institutions are to apply during processing, to separate unfit banknotes from those considered fit for circulation. This avoids banknotes that might be sorted as unfit from being put back into circulation, and fit notes from being withdrawn. The *Banco Central de la República Argentina* sorting centre applies stricter fitness standards to ensure that only the best quality notes are reissued for circulation.

The *Banco Central de la República Argentina*'s Treasury Management Department performs all its operational tasks in house. Only banknote printing and coin minting are outsourced, being entrusted to the *Casa de Moneda*, the state-owned company that is the official body responsible for these tasks. However, on occasions when there have been peaks in demand for coins at times when its production capacity was fully occupied, it has found it necessary to purchase coins through international calls for tender.

## Planning

The relevant areas of the institution have been asked to draw up plans on which the future construction of a new treasury building may be based. This is in order to centralise all operations relating to banknotes and coins in the City of Buenos Aires in a single building. The aim is to work on a single level on a site outside the city centre so as to facilitate delivery of notes, coins, paper and blanks from suppliers, and the reception and delivery of cash from and to banks.

banks and manages the *Interbank Banknote Clearing System*, whereby institutions provide one another with the cash they need for their operations.

- General Operations unit: runs the counters at the head office where deposits are received for operations in which other areas of the institution are involved. It exchanges mutilated banknotes from the public, gives change in notes and coins to the institution's staff, sells commemorative coins to collectors, makes miscellaneous payments and returns cash deposits that have been posted as collateral, etc.
- Information Management unit: collects and manages information for compilation in the Annual Report by the Treasury Area; replaces capital assets; makes budgetary provisions and buys items and equipment; carries out the monthly reconciliation of the "Monetary Circulation" account, the asset and liability accounts and memorandum accounts, and collects and verifies the information sent by banks on the stock of banknotes.
- Operations Treasury unit: responsible for custody of the legal tender notes and coins in secure storage at the head office in order to supply sectors involved in operations with financial institutions. It receives, verifies and stores US dollars received from the United States Federal Reserve to supply financial institutions with the currency they need to meet public debt servicing requirements.
- Coin Exchange Centres: offices set up on premises loaned by rail transport companies –Constitución, Once and Retiro terminus stations– (see BILLETARIA, Issue 5, Miscellaneous sec-

Statistical data <sup>1</sup>	2007	2008	2009
<b>Notes in circulation</b>			
– Value	73,716.3	82,882.5	96,498.2
– Units	1,396.8	1,577.8	1,820.9
<b>Banknote payments</b>			
Used banknotes			
– Value	17,464.9	20,576.2	20,071.0
– Units	186.7	215.0	203.5
New banknotes			
– Value	10,980.0	10,132.2	13,975.4
– Units	282.3	301.8	361.1
Interbank Note clearing.. <sup>2</sup>			
– Value	5,834.9	7,436.2	1,776.6
– Units	63.6	77.8	17.9
<b>Total value</b>	<b>34,279.8</b>	<b>38,144.6</b>	<b>35,823.0</b>
<b>Total units</b>	<b>532.6</b>	<b>594.6</b>	<b>582.5</b>
<b>Banknote deposits</b>			
– Value	25,832.2	32,376.9	29,624.0
– Units	362.0	420.2	380.7
<b>Banknotes processed</b>			
– Value	7,179.6	5,621.7	8,243.2
– Units	77.7	60.4	83.2

<sup>1</sup> Figures in millions of pesos and millions of units at the end of each year.

<sup>2</sup> Banknote payments made via the Interbank Banknote Clearing system.

# The *Bank of Japan's* operations centre in Toda

■ Tomoko Kurose *Bank of Japan*

The *Bank of Japan's* banknote operations centre came on stream in April 2003. The Centre's end-to-end automated systems practically eliminate the need for human intervention in the sorting process.

## Overview

- **Operations:** The Toda Centre only handles bulk transactions. The minimum bundle size admitted is a thousand units. Smaller volume notes and coins operations are still handled at the *Bank of Japan's* Head Office.
- **Location:** The Centre is located in Toda, a city in the outskirts of Tokyo, approximately 20 kilometres from Tokyo's city centre.
- **Building:** The five-storey building provides 52,000 m<sup>2</sup> of floor space. Designed to withstand a magnitude 7 earthquake, its reinforced steel frame stands on isolated foundations. The Centre has a stringent security system and back-up systems for the main building installations, such as electricity, communications and air-conditioning.
- **Building systems:** These include an ensemble of various automatic facilities and information and security systems.
  - Automated facilities: These include mechanical thousand-unit bundle receivers, a main vault, sorting machines linked by conveyor belts transporting blocks of ten thousand-unit bundles and automatic guided vehicles to transport pallets loaded with forty blocks.
  - Information systems: The automatic facilities are controlled by information systems able to track the location of the banknotes at all times using sensors fitted in the automatic facilities. This information is used to compile the data necessary for the *Bank of Japan's* balance sheet.
  - Security system: controls entries and exits to and from various areas in the Centre.

## Banknote handling activity

Banknote handling activity at the bank's Head Office underwent a thorough review after the new operations Centre came on stream. The main operational changes concerned the standardisation of the processing unit and simplification of operational movements to adapt them to mechanised processing. The banknote deposit and withdrawal operations that take place at

the Toda Centre are described in more detail below.

- **Deposit notification:** Financial institutions enter the deposit information at their own premises and forward it to the *Bank of Japan* over the dedicated communication system. Once the data have been received, the *Bank of Japan* sends the financial institution the number assigned to the transaction. This number has to be entered to initiate the transaction at the terminal in the operations area.

- **Banknote reception:** Once the preceding steps have been completed, the financial institution accesses the deposits and payments security booth. Here the credit institution's employees place the thousand-note bundles on a bulk bundle receiver called the BB-3 which is installed in the deposits booth. The BB-3 groups the thousand-note bundles in blocks of ten and plastic-wraps them. The device then automatically attaches a bar-coded label to each block giving the details of the date and time of the deposit and any other relevant information. The blocks and the information about them are linked and managed using the barcode. Once wrapped and labelled, the blocks are transported automatically to the buffer storage.

- **Storage of unprocessed banknotes:** Banknotes are received and verified in the following way:

- 1) The incoming blocks are held temporarily at the buffer storage;
- 2) 40 blocks are withdrawn from the buffer storage at a time and loaded onto a pallet by a palletiser;
- 3) The pallets are transported to the main vault on automatic guided vehicles. The vault is fitted with shelves on which the pallets are stored until their contents can be verified.

In both the buffer storage and the main vault, the location of blocks and pallets is controlled by means of the barcodes on the labels attached to



the blocks. The system automatically calculates the number of banknotes in both locations. Banknotes are withdrawn from the main vault for processing on a "first-in, first-out" basis.

▪ **Banknote verification:** The pallets stored in the main vault are withdrawn and broken down by a depalletiser to obtain individual blocks, which are transported to the sorting room via the buffer storage. Here the blocks are unwrapped mechanically and the thousand-unit bundles sent to a sorting machine. Rejected banknotes are placed in rejected banknote cassettes and automatically transported to the reconciliation unit for examination.

▪ **Banknote payments:** When a request for banknotes is received via the *Bank of Japan's* communications system, the Toda information system automatically initiates preparations for payment by sending precise instructions to the units involved.

- 1) Complete pallets are assigned to the payment in the main vault;
- 2) Requests for banknote quantities of less than a full pallet are fulfilled using blocks located at the buffer storage which are loaded onto a pallet. The pallet can include a variety of banknote denominations and



Conveyor-belt system in the Toda Centre / Bank of Japan



Automatic guided vehicle / Bank of Japan

During the sorting process, the sorting machines put together thousand-unit bundles of fit banknotes and a further device prepares blocks of ten thousand units, labelled with a barcode including information such as the date and time the banknotes were processed. The blocks are then transported to the buffer storage.

▪ **Storage of banknotes for payments:** At the buffer storage another palletiser prepares pallets for transport back to the main vault where they will remain until the banknotes are due to be used for payments.

qualities (new and fit) to meet the financial institution's request. If the request is for thousand-unit bundles not making up a complete block or pallet, plastic dummy bundles and blocks are used to complete the pallet. These pallets are left temporarily at the main vault.

At the time of payment, once the financial institution has finalised all the procedures in the operations area, the system transfers the loaded pallets from the main vault to the payments booth on automatic guided vehicles. Finally, the pallets are loaded on conveyors for payments and delivery to financial institutions.

# The final stage of the cash cycle

■ Angelo Kok *Kusters Engineering B.V.*

*Kusters Engineering is a Dutch company owned by the Kusters family. It was founded in 1911 and has been a player in the cash industry since 1979. It offers its customers tailored systems for banknote shredding, coin destruction, and the destruction of high-security information. Its products meet high standards of reliability and security, and have been designed with concern for health and the environment in mind. The firm's customers include central banks, printing works and mints around the world.*

### Cash activities

The secure destruction of banknotes and coins is the final stage in the cash cycle. *Kusters Engineering* has developed dust-free banknote shredding and waste-briquetting systems which leave a compact volume of waste at the end of the process. Moreover, the briquettes produced by the destruction process can be used in industry as a fuel. *Kusters Engineering's* systems offer the following advantages:

- Cash centre reliability: the waste briquetting systems dealing with the waste from the destruction process —directly connected to sorting machines— largely determine processing capacity and therefore play a fundamental role in cash centre operations and control.
- Corporate social responsibility: eliminating the environmental harm caused by the smoke from incineration or the water lost producing pulp, ensures better protection of employees and people living in the neighbourhood of the banknote shredding facility.
- Cost-effectiveness: the machinery is long-lasting, with an estimated operating lifetime of 25 years, which is covered by warranties and maintenance service.

### Information processing

The use of software to manage the process allows central banks to periodically collect useful data on banknote shredding. Interpolating and extrapolating from this information enables decisions to be made about the most efficient volumes and quality of future production runs, so as to save time, reduce production costs and avoid shortages or surplus of banknotes.

*Kusters Engineering* has developed management software that includes information management and processing (MAPRIS). This system stores and retrieves data for output in reports of various kinds. Analysis of the details of the shredding process enables optimal decision-making by cash handlers.

### Developments in cash activities and management by central banks

A number of central banks have already implemented or begun to implement a policy of recycling banknotes at regional processing facilities so that only unfit or counterfeit banknotes are sent to the central bank for sorting and shredding. This policy significantly reduces transport and processing costs.

*Kusters Engineering* has developed an intelligent banknote processing (IBP) system for central banks that have adopted this approach. The

system offers an innovative integrated modular configuration for banknote processing with online shredding, so as to facilitate reliable banknote sorting, authentication and destruction.

### Innovations in the cash cycle

A few decades ago, central banks began to replace the traditional methods of banknote destruction, such as incineration and pulping, with newer systems. Since then, the technological development of the systems used for banknote and coin destruction has largely revolved around progress in the mechanical technology used. Banknote printing progressed over the years, but there was no alternative to the cotton-fibre-based paper substrate until the first polymer notes began to appear in the late nineteen eighties.

Polymer opens up new possibilities for banknote destruction. *Kusters Engineering* has adapted its banknote shredding technology to encompass polymer notes. Most central banks that have started to issue polymer notes, mainly in the lower denominations, continue to issue paper banknotes. Therefore, the waste flows from the two banknote types need to be separated at source, and collected separately, as their final fate is very different, and mixing polymer and cotton paper would prevent the potential reuse of the polymer. Thus, whereas cotton paper waste briquettes are an important source of energy in industrial processes such as aluminium smelting and cement manufacture, banknote waste, comprising 70% polypropylene, has a good chance of being reusable and can be turned into granules suitable for use as a raw material in the plastics industry. The reuse of this material reduces the disposal cost of central banks' waste, given the income streams they generate. And, of course, as well as producing income, this enables central banks to fulfil their social and environmental responsibilities. In short, this system enables central banks to destroy end-of-life banknotes in a way that saves money and benefits the environment.



Shredding and briquetting system / *Kusters Engineering*

# 7th International Course on Cash Management Río de Janeiro, 16-21 May 2010

The 2010 International Course on Cash Management was held in Río de Janeiro (Brazil), during the week from 16 to 21 May 2010. It was organised by the *Banco Central do Brasil* and inaugurated by Mr João S. Figueiredo, Head of the *Banco Central do Brasil*'s Currency Department together with Mr Ángel Camarena, Head of Division in the Cash and Issue Department at the *Banco de España*. The event was closed by Mr Anthero de Moraes Meirelles, Deputy Governor of the *Banco Central do Brasil*. The course was well attended, with students coming from 16 countries and a line up of prestigious lecturers of eight different nationalities.

As in previous years the teaching approach involved three days devoted to basic content, given from a triple perspective (theory classes, round tables, debates and site visits). Participants were able to visit the premises of the *Casa da Moeda do Brasil* where Brazil's notes and coins are manufactured, and the Currency Department's premises in Río de Janeiro. During the closing session it was announced that the next edition of the course will be held in Lima, where it will be hosted by the *Banco Central de Reserva del Perú*, in May 2011.



Participants in the 7th edition of CIGE / Banco Central de Brasil

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## Miscellaneous

Publications devoted to cash

## Notas e Moedas

Since 2005 the *Banco de Portugal* has published a quarterly newsletter entitled *Notas e Moedas* on the topic of currency which is aimed primarily at sector professionals. It has specialist information on "the euro, our money", counterfeit coins and notes, coins and notes of the world, and data on counterfeiting of euro banknotes and coins. It also places emphasis on understanding the euro notes and coins and, to this end, includes detailed explanations for professionals in the world of cash.

*Notas e Moedas* is only published in Portuguese and has a print run of 6,000 copies per issue. Although the newsletter is mainly aimed at Portuguese professionals in the world of cash, anyone else interested in the topic may request it by email from [cncontrafaccoes@bportugal.pt](mailto:cncontrafaccoes@bportugal.pt), giving the name, institution, position, address and e-mail address of the person it is to be sent to.



The covers of  
some past issues of  
*Notas e Moedas* /  
Banco de Portugal

# Events

## Meeting of the European Banknote Conference (EBC) in Óbidos

From 21 to 24 June 2010, the EBC held its 27th general meeting, which was organised by the *Banco de Portugal* in Óbidos, approximately 90km from Lisbon. Participants in the EBC include Central Banks and banknote printing works, and it holds its general assembly biennially. The conference deals with a variety of topics concerning banknote production, handling, security and quality. The event was presided over by Antonio Pinto Pereira, the current chairman of the EBC's Policy Committee, and Nunzio Minichiello, chairman of the Policy Committee of the Advisory Group. The participants came from 21 EBC member countries, together with delegates from the *European Central Bank*, the *Pacific Rim Banknote Printer's Conference*, the *Association of the African Banknote and Security Documents Printers*, and *Interpol*.

The EBC's standing technical committees (Materials, Issue and Manufacturing Processes, and Security) reported on the activities taking place over the last two years. Particular areas of interest were issues concerning central bank and banknote printing organisation, manufacture,

issue and handling, the state of play in counterfeiting, etc. Finally, the meeting was rounded off with a monographic session discussing the latest developments in new substrates and trials underway using them.



Attendees at the Óbidos meeting / Banco de Portugal

## Meeting of Anti-Counterfeiting Experts



On 30 September and 1 October 2010, the second meeting of Latin American Central Banks was held in Mexico DF to discuss measures to combat currency counterfeiting. The event brought together 55 participants from 24 countries, including the *Bank of Canada*, *Bank of England*, *United States Federal Reserve*, the *European Central Bank*, the

*Oesterreichische Nationalbank* and the *Center for Latin American Monetary Studies*, the meeting's supporting organisation, working in close collaboration with the *Banco de México*.

A number of interesting talks were given by subject specialists, focusing in particular on issues relating to communication policy and strengthening collaborative ties between the various authorities and institutions with responsibilities in the area, at both national and international levels. Among the topics covered, there was particular interest among attendees in detailed uniform statistical information being available so as to enable the economic scale of the counterfeiting phenomenon to be monitored adequately, with a particular focus on the Latin American area. Care over the methodological aspects to ensure comparability of figures was a widely-shared concern.

## 10th Central Bank Treasurers' Meeting. Mexico DF

The 10th Central Bank Treasurers' Meeting was held from 26 to 29 September in the Mexico DF, under the auspices of CEMLA and the *Banco de México*, which hosted the event. The Deputy Governor of the *Banco de México*, Ing. Guillermo Gúmez García, took part in the meeting's opening session, which was presided over by the Director General for Issuance at the *Banco de México*, Manuel Galán, and in which representatives of 24 Central Banks took part, including those of the majority of Latin American countries, together with the *Bank of Canada*, the *US Federal Reserve*, the *European Central Bank*, the *Banco de España*, the *Banco de Portugal*, the *Oesterreichische Nationalbank* and the *Bangko Sentral ng Pilipinas*, among others. The meeting, which aimed exclusively at representatives of Central Banks, dealt with various aspects of topics such as automated banknote handling, central-bank communication policies, inventory policies, controlling banknotes distributed by ATMs, and a comparison of the features of the various new substrates that have recently appeared on the market. The organising committee presented



Participants in the 10th Central Bank Treasurers' Meeting / Banco de México

the second edition of Latin American cash statistics, an attempt to harmonise basic statistics on the subject in which 18 countries are now taking part, and it is anticipated that the number will increase in future editions.

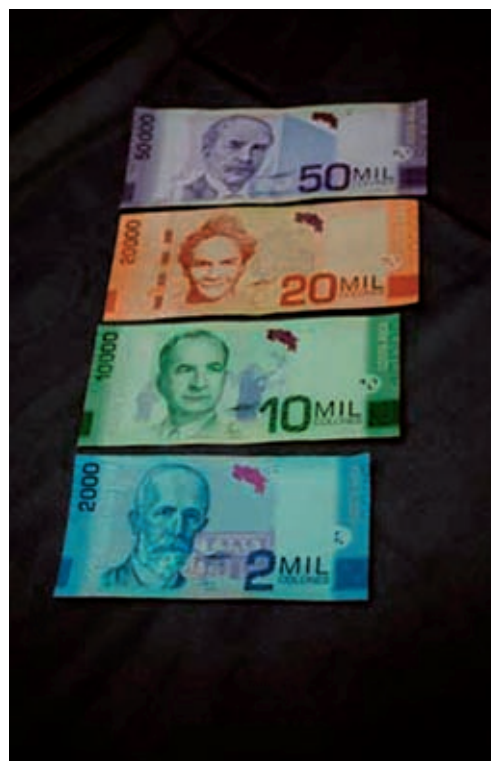
# Central banking news

## New banknote family issued in Costa Rica

On 27 April 2010 the President of the *Banco Central de Costa Rica* (BCCR) presented the Bank's new series of colon-denominated banknotes. The official ceremony took place at the *Instituto Nacional de Biodiversidad de Costa Rica* (INBio), a full audience from a range of the country's economic and cultural circles, along with the media. At the presentation, the Bank's president, Francisco de Paula Gutiérrez, thanked J. Darío Negueruela for the *Banco de España's* help on project implementation and enabling the new banknotes to be launched in record time. He announced that the first of the new banknotes to be issued would be the 20,000 colon note which would be released into circulation in August 2010. The other five denominations will be issued successively starting in the first quarter of 2011.

The banknotes incorporate new overt security features such as a ribbon with moving images (*Motion*), as recently announced for the new 100 US dollar note, and use of optically variable ink (OVI). The printing substrate will be cotton paper for all the denominations except the lowest, which will be printed on a polymer substrate. The new Costa Rican banknote family comprises six denominations: 1,000; 2,000; 5,000; 10,000; 20,000 and 50,000 colons. Each of the notes has allusions to an ecosystem existing in Costa Rica and bears a portrait of an important national figure on the obverse.

All the denominations have of the same width but their lengths differ so as to make it easier for the visually impaired to distinguish them. The *Banco Central de Costa Rica* will be offering training courses on the new banknotes and their security features and will be giving advice on how to look after the banknotes and the steps people should take if they come across a banknote they suspect may be counterfeit. An advertising campaign in various media channels is scheduled to accompany the launch of each denomination.



The new series of Costa Rican banknotes / BCCR



Presentation of the new series of Costa Rican banknotes / BCCR

## An example of technical cooperation in the fight against counterfeiting: *Deutsche Bundesbank* advises the *Bank Indonesia*

In 2006, the *Bank Indonesia* decided to set up a Counterfeit Analysis Centre (NAC) as part of a raft of measures to protect the national currency. The staff responsible for setting up the centre turned to international expertise in the field. Thus, the *Deutsche Bundesbank* collaborated with the *Bank Indonesia* to provide its support in the project within the framework of its Central Bank technical cooperation activities. In early 2006, staff from the *Deutsche Bundesbank's* National Analysis Centre visited Jakarta to get an overview of the situation.

Under Indonesian legislation, the police has primary responsibility for tackling counterfeiting crime. As a result, even counterfeits detected during banknote sorting at the *Bank Indonesia's* branches have to be sent to the local police authorities immediately. However, the police do not undertake a technical analysis of counterfeits to classify them in different categories and identify specific counterfeiting groups, but limits itself to forensic analysis. For this reason, the creation of an NAC was a logical step to ensure that counterfeits found by the Central Bank could be examined in detail before being handed over to the police, and also that counterfeits seized by the police could also be forwarded to the NAC.

The creation of an NAC at the *Bank Indonesia* was a multi-step process. First, using the *Deutsche Bundesbank's* own NAC as their model, staff from the German central bank outlined the working procedures, organisational structure and number of employees, the tasks the analysis centre was to carry out, and the procedures it would use to identify counterfeits. Arrangements were also made for employees at the *Bank Indonesia's* NAC to receive training in printing techniques and on the identification and analysis of counterfeit coins. In parallel, the *Bank Indonesia* developed a database in which to record information on counterfeits.

The future staff of the *Bank Indonesia's* NAC attended two working sessions at the *Deutsche Bundesbank's* NAC in Mainz, where they learned about classifying and analysing counterfeits and about the different printing techniques used. There was also detailed discussion of the logical steps that should be taken to evaluate reports and statistics obtained from counterfeit analysis. Other points of interest and tasks of the NAC, such as sharing information with the police, organising information sessions, preventive measures, issuing alerts, etc. were also covered during the visit to Mainz.

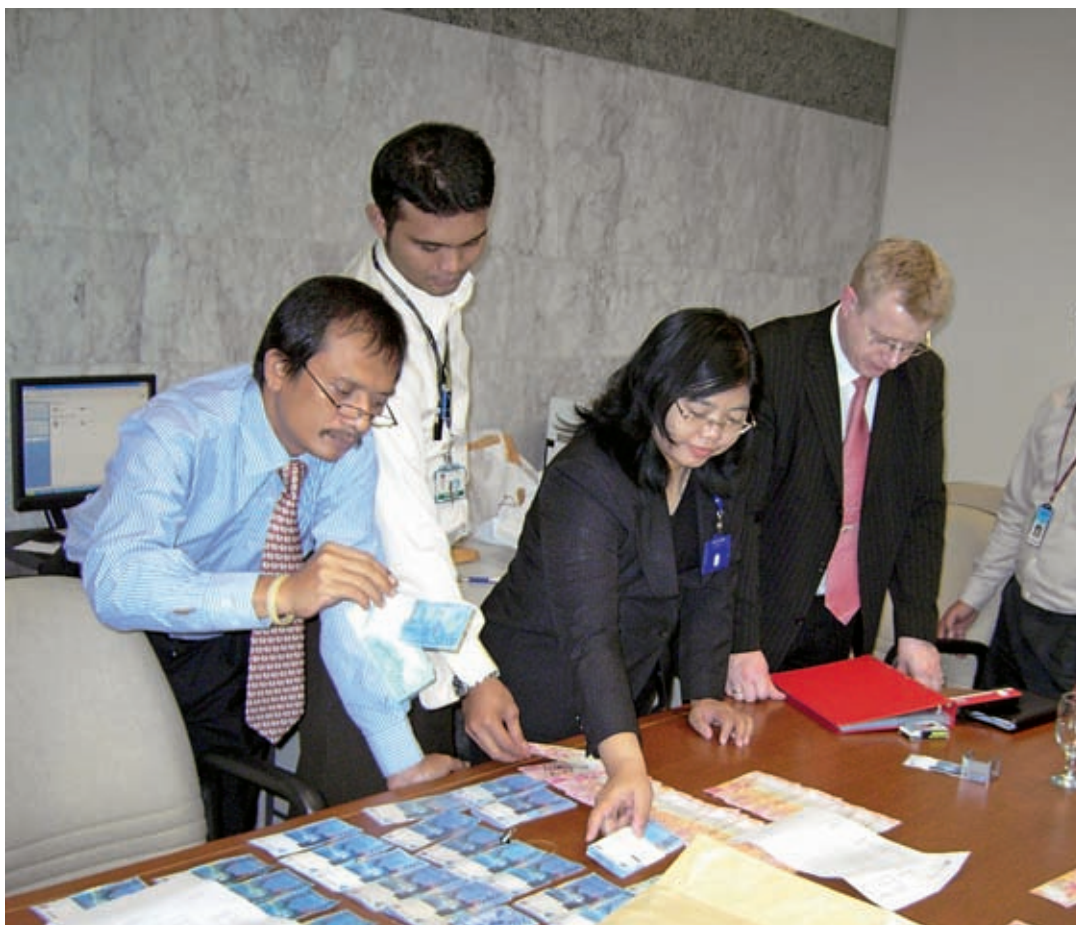
During the visit by two members of *Deutsche Bundesbank* NAC staff to Jakarta, the first categories of counterfeit notes were defined and described. The most complex task was distinguish-

ing between different printing techniques. Books were compiled with samples for the new counterfeit categories, working procedures were discussed, and finally, the relevant forms and documents were written up.

Although at present the *Bank Indonesia's* NAC only works with counterfeits detected at the Jakarta branch, the two employees at the centre are responsible for the whole range of tasks relating to counterfeit analysis, including data collection, classification of counterfeits, adjusting counterfeit note categories, creating books of samples, compiling reports, documentation and statistics.

The *Bank Indonesia* envisages that in late 2010 its 37 branches will start entering information about counterfeits appearing during banknote sorting in the database, which will be accessible online. Counterfeits will subsequently be classified using the serial numbers and descriptions stored in the database, and those contained in the books of samples distributed to the branches. Since the start of the cooperation project the centre's staff have examined and classified several thousand counterfeit notes and created several categories. All in all, the cooperation between the *Bundesbank* and the *Bank Indonesia* can be considered a resounding success.

Start up session of the *Bank Indonesia's* NAC / *Deutsche Bundesbank*





## New update to the 1000 rouble banknote

On 10 August 2010 the *Central Bank of the Russian Federation* issued an updated version of its 1,000 rouble note with enhanced security features including a patch with the coat of arms of the city of Yaroslavl printed using SPARK ink. Other features include intaglio printing, watermarking, a security thread, micro-perforations and optically variable printing on a paper substrate. The new 1,000 rouble note will gradually replace the two previous versions of this denomination, issued in 1997 and 2004 which are still in circulation. The 1,000 rouble note is the most widely counterfeited Russian banknote.



Front and back of the new 1,000 rouble banknote / Central Bank of the Russian Federation

## The Banco de México issues new 500 and 100 peso notes



Front of the new 500 and 100 Mexican peso notes / Banco de México

In August 2010, the *Banco de México* issued two new banknotes in 100 and 500 peso denominations. These new banknotes complete the programme of issuing the new family of banknotes which began in September 2006. The new 100 and 500 peso notes will coexist with the notes of these denominations

currently in circulation. Both banknotes are produced on security paper. In the new series of notes, each denomination is a different length, with each banknote being seven millimetres shorter than the denomination immediately above it.

The dominant colours of the 100

peso note are red and yellow. The obverse has as its main motif a portrait of king Nezahualcóyotl, also known as the “poet king”, who created the triple alliance between Texcoco, Tenochtitlán and Tlacopan around the year 1431. The dominant colour of the 500 peso note is ochre, and the main motif is a self-

portrait by Diego Rivera, painted in 1941 together with a vignette comprising his work “Nude with Calla lilies” three brushes and a palette. On the reverse there is a self-portrait by Frida Kahlo.

The security features of the two new notes include a *Motion* thread in which a pre-Hispanic snail symbol, associated with the Aztec god of the wind (Ehécatl), can be distinguished, together with images in optically variable ink (OVI). In the case of the 100 peso note, the image is a corn cob and on the 500 peso note it is a calla lily.

## Guatemala adds to its banknote series

On 23 August 2010, the *Banco de Guatemala* issued its new 200 quetzal note following a series of studies which suggested the need to issue a higher denomination banknote. Guatemala’s family of banknotes already included 1, 5, 10, 20, 50 and 100 quetzal denominations. Printing of the new notes was outsourced to the German banknote and securities printers *Giesecke & Devrient GmbH*.

Set in its dominant colour, “aqua”, the new banknote has the marimba as its main theme and the obverse shows, from left to right, the busts of three masters of Guatemalan

music: Sebastián Hurtado, who introduced the chromatic scale in 1894, thus creating the double or chromatic marimba; Mariano Valverde, teacher and composer of emblematic musical compositions such as the waltz *Noche de luna entre ruinas*, inspired by the earthquakes that shook Guatemala in

1917 and 1918; and Germán Alcántara, composer of important pieces of music such as the waltz *La flor del café*, which won a prize in Germany in 1910.

The reverse of the banknote includes an allegory of the work of the musicians shown on the obverse, with a

composition including the original score of the waltz *La flor del café*, together with an illustration of the waltz *Noche de luna entre ruinas* and a double or chromatic marimba.



Front and back of the new 200 quetzal banknote / Banco de Guatemala

# Banknote security features

■ Banco de España *Cash and Issue Department*

This section presents a catalogue of the main banknote security features recognisable by the public and currently in use worldwide. The features have been grouped according to their common functional properties for detection by the general public and retailers. The picture of each feature is accompanied by a brief explanatory text. The list will be subject to constant review, adding new security features resulting from technological advances and discarding those that are no longer relevant for the industry.

## WATERMARKS



### 1. Multitone watermark

Image incorporated into the paper which is visible when the banknote is held against the light. It is created during the paper making process by varying the thickness of the paper. The resulting variations in opacity give rise to an image with bright and dark areas.



### 2. Electrotype watermark

A filigree visible when held up against the light. It is created during the paper making process using a filament which takes the form of numbers or different types of characters.

## SECURITY THREADS



### 3. Embedded security thread

A thin band of plastic inserted into the paper. It is usually 1-2mm wide and 30-40 microns thick. It often bears microtext and fluorescence. It can also have electrical or magnetic properties readable by banknote processing machines.



### 4. Window thread

This band is made of a thread, which is slightly wider than the security thread, 3-4mm, weaves in and out of the paper. The uncovered sections are visible and could contain an optically variable element such as an ink that changes colour when the banknote is tilted.



### 5. Thread with floating images

A window thread inserted into the paper using a standard window embedding technique. The floating image effect is produced by embedding microlenses into the thread. When the thread is tilted, the microlenses move producing floating images.

## INTAGLIO FEATURES

### Tactile



### 6. Intaglio printing

The printing with relief is detectable by the sense of touch. It is a printing technique in which the ink is transferred directly from the plate to the substrate under high pressure and temperature conditions. The printing produces a relief effect due to the thick layer of ink deposited and the embossing of the substrate. The main motif of a banknote is usually printed in intaglio.



### 7. Tactile marks for the visually impaired

These tactile marks are detectable by touch. They are printed in intaglio and are usually located near the borders of a banknote to facilitate its recognition by the visually impaired.

### Visual



### 8. Colour gradation in intaglio

Gradual superimposition of colours printed in intaglio, which are very difficult to reproduce by copiers.



### 9. Latent image

A hidden image that becomes visible when the banknote is viewed at a certain angle. It is produced by intaglio printing using a particular structure of lines.



### 10. Blind embossing

An embossed colourless image that becomes visible when the banknote is viewed from an oblique angle. It is created by deforming the substrate by the high pressure of inkless intaglio printing.

## OPTICALLY VARIABLE FEATURES

**11. Iridescent ink**

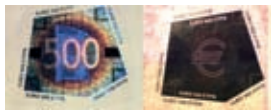
A brilliant ink that changes colour when the banknote is tilted. The ink can be applied in a stripe and displaying an image.

**12. OVI ink**

Printing with optically variable ink (OVI), implies it will change colour when the banknote is tilted. Its effect is increased when the whole surface is covered by a layer of this ink applied in silkscreen printing.

**13. SPARK ink**

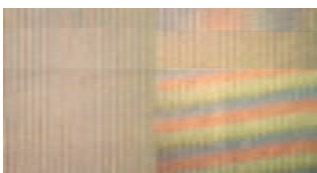
A particular type of OVI ink which changes colour, containing magnetic particles which can be oriented in such way as to produce a dynamic colour effect when the banknote is tilted. The effect is increased when the whole surface is covered by a layer of this ink applied in silkscreen printing.

**14. Optically variable devices (OVDs)**

Images produced onto holographic elements which change form and colour when the banknote is tilted. These are anti-copying devices based on the light diffraction principle, such as kinograms. OVDs can be stamped onto the substrate in the form of a patch or stripe.

**15. Moiré variable colour**

Feature that uses the latent image principle. It produces a rainbow effect which appears when the banknote is tilted. It is performed by means of an offset printing combined with an intaglio printing.



## VISIBLE BY MEANS OF A MAGNIFYING GLASS

**16. Microprinting**

Printing of small characters that are not visible to the naked eye but can be seen through a magnifying glass. When printed onto a banknote, it usually combines characters in positive and negative.

## ULTRAVIOLET AND INFRARED PROPERTIES

**17. Ultraviolet properties (UV)**

These properties are incorporated into the fluorescent pigments of the printing inks which are not visible in daylight but are visible under UV light. Ultraviolet properties in banknote printing are more striking when the substrate used is non-fluorescent under UV light.

**18. Fluorescent fibres**

Fibres made of synthetic material and differently coloured embedded into the paper that are not visible in daylight but are visible under UV light. Their length is usually 3-6mm. There are certain fluorescent fibres in which each fibre has several colours. The fibres are incorporated onto the banknote in a random way while elaborating the paper mass.

**19. IR properties (IR)**

These are incorporated into the pigments of the inks. These are inks with different infrared performance due to different absorptions in that spectrum. The IR characteristics are usually applied combining transparent inks with inks opaque to IR.

## OTHER FEATURES

**20. See-through register**

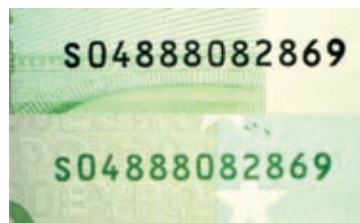
Some elements of an image are printed in offset on the front side of the banknote and the remaining elements of the image are printed on the back. The whole image with perfect coincidence is visible when the banknote is held against the light. This feature is also known as 'perfect register' as it is printed simultaneously on front and back sides in register.

**21. Structure of fine lines (moiré effect)**

Set of fine and narrowly printed lines which produce an optical confusion, named moiré effect, when reproduced by copiers.

**22. Rainbow printing**

Offset printing that creates in the banknote an area with different colours that are gradually mixed together to create a rainbow effect.

**23. Numbering**

The serial number on each banknote, which enables it to be identified. It is usually printed in letterpress, naked eye readable and may also be machine readable if mechanically readable characters are used. The ink usually incorporates magnetic properties.

**24. Transparent window**

Transparent area on a banknote on which optical effects are incorporated by applying various elements, such as a blind-embossed image or an optical device. It is used in polymer banknotes and is beginning to be used in paper banknotes too. In these, the window is placed on a holographic band.

**25. Microperforations**

An image made up of a large number of microholes in the paper, which becomes visible when viewed against the light. The microholes are drilled by means of laser.



De Zee-Atlas off Water-Weerelend. Pieter Goos, 1666.  
Library of the *Banco de España*. Madrid.

# BILLETARIA

YEAR IV

ISSUE 8

OCTOBER 2010

BANCODE **ESPAÑA**

Eurosistema

**BILLETARIA**

October 2010

**Published by**

*Banco de España* / Cash and Issue Department  
[www.bde.es](http://www.bde.es)

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© Banco de España  
Legal deposit: M-45.124-2010  
Printed in Spain, by Artes Gráficas Palermo, S. L.

BILLETARIA