The Use of Non Impact Printing in Security Documents such as Passports

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Introduction

When I first started to write this paper, I thought back on the time I was at a previous NIP conference in Seattle some six or seven years ago. At that time I was puzzled by the fact that no one was making the connection between NIP and document security. I knew that most of the drivers licences in the USA and Canada were using dye sublimation, a non impact process, but where was the link to other security documents?

As it turns out, about 10 years ago there were very few countries using NIP to personalize any type of security document such as a passport. Australia, Germany, Finland and Japan were the only ones.

I guess I was someone who was thinking like Panasonic and I was "slightly ahead of my time". How things have changed in only the seven years since then. To quote statistics from a paper given in April of this year at Interpol by Malcolm Cuthbertson of De La Rue Identity Systems, "--- More than 1/3 of 230 + countries are now using some sort of a digital printing system to personalize their passports and that represents 2/3 of the worlds number of passports---". So the time is now to look at this technology that is leaping forward. In order to see how far we have come it is helpful to look at where we have come from.

The Past

One of the earliest mentions of passports dates back as far as about 450 B.C. when Nehemiah, an official serving the King of Persia asked permission to travel to Judah. The King agreed and gave him a letter addressed to "the governors of the province beyond the river" requesting save passage for the bearer.

Many of todays passports, including those of the USA and Canada, still carry such a letter of request. Inside the front cover, or on one of the inside pages appears some wording that requests safe passage.

These letters of request didn't become popular until the reign of King Louis 14th of France. He granted letters to his personal friends so that they could travel. This letter was dubbed "passe port" literally meaning to pass between two ports, as most international travel was done over the water, by sailing ship.

In the 100 years following Louis 14ths reign, almost every country in Europe had set up a system to issue passports.

With the advent of rail travel in the mid 19th century, the tourism explosion led to the complete breakdown of the passport system. By 1914, every country had abandoned passports. However the first world war brought out renewed concerns for international security and passports and visas were again required "as a temporary measure".

A series of international conferences in 1920, 1926 and 1947 led to the introduction of a passport in the form of a booklet which could receive visas and entry and exit stamps from countries visited. The booklet style passport remains to this day in various forms and in 1980 international standards were developed so that the two lines of text at the bottom of the data page could be read in a mechanical reader, to facilitate travel between nations. Standards continue to be written to allow for other technologies to be incorporated in passport books, both in the form of overt and covert features. The latest standards revolve around biometrics and how they might appear and be read in a passport.

The earliest form of passport was of course a document filled in by hand and carrying some sort of "official seal". One of the criteria for working in passport issuance used to be good writing form, with a clear and readable style. The typewriter and other similar forms of impact printing came into vogue next and photographs started being applied to the passport around the beginning of the second world war. These photos were affixed with staples, rivets or grommets or glue or crimping and around a clear plastic "lamina" was introduced to protect the photo and data page.

Digital imaging by non impact means was introduced by Australia in the late 1980's, using a black & white photo image, and in the early 1990's by the printing of a colour laser image on the backside of a security lamina and then this lamina was fused to a passport page to become the data page.

The Present Non Impact Printing (NIP) Technologies

There are many different technologies used to personalize or fill in the passport that are considered non impact. I will

deal with each one and give an example of a country that is using it.

Colour Laser

Several countries are using this technology and earlier versions suffered from a certain graininess of the bearers image, due to dot size, but later versions are better. Latvia uses a system using a Tektronics laser print engine.

Dye Sublimation

This is a popular choice, as it renders a continuous tone image, although care has to be taken against fading due to UV rays. Japan uses a Toshiba print engine and UAE, Sri Lanka and South Africa use Toppan.

Pigment Sublimation

Somewhat related to dye sublimation is pigment sublimation where the ink ribbon is actually pigmented material, as opposed to dyes. The advantage here is that the pigments are much more stable to UV light. It is still a thermal transfer process where the ink transfers to the backside of a thin film transfer material and then this material is fused to the passport page to form the data page. Examples of countries using this technology are the USA, Canada and New Zealand with Toppan MP 300 printer.

Ink Jet

This process has made significant strides in the last few years and can produce good quality images of the passport bearer. So far its only use has been in several smaller countries such as Azerbaijan and Turkmenistan, and for some overseas printing of Nigerian passports.

Laser Engraving

This process involves the etching, by means of a laser, into a layer of polycarbonate material that has some material that is rendered black. Until recently this process was only capable of black & white printing, but now, in combination with a colour dye sublimation print, one can get "colour laser" printing. Countries using monochrome black printing are Sweden, Finland and the new Netherlands passports.

Photographic

The German passport personalization system is unique in that is uses a custom photographic technique, at first only in black, but now capable of full colour imaging. It is encapsulated within a thick lamina sandwich material, with additional security in this lamina material.

Digital Offset

This is the final category of non impact printing used only by th United Kingdom. It is a digital offset printing process that is variable with each revolution of the press. The data page receives the bearers image and biographical data while the data page is still in sheet form. It is then cut down to the appropriate size and is sewn together with the visa pages and cover to become the passport book.

Factors Affecting the Choice of NIP Process for Personalization

- Do you want to centralize your issuance process, de-centralize it or have a combination ?

- Do you need a colour portrait or will b & w be alright ?

- Does your blank passport book require major re-design to convert it to a digital format ?

- Do you want a controlled unique printer and consumables or is "off the shelf" acceptable ?

- Do you want in book printing or is printing to a label acceptable?

- Do you want the same system for both domestic and overseas production ?

- Do you want a system with a proven track record ?

- Is after sale servicing an issue for you ?

- Is cost a factor ?

How NIP has Affected Passport Document Security

The advent of information now presented in a digital manner has opened up new fields of document security that were previously not attainable.

UV Personalized Printing

It is now possible to print a duplicate image of the passport bearer, in an ink that is only reactive to UV light. The production of this "ghost image" renders the passport much more difficult to change the bearers image as not only the visual image but the UV image need to be changed. Japan, New Zealand and Canada utilize such a feature.

Digital Watermarking

Also known as "scrambled pixels" where the pixels within the bearers facial image are reordered into a specific pattern, not visible to the eye but which can be decoded with a special lens or scanner. Hong Kong and New Zealand are currently using this feature.

Imageperf(TM)

In this process the facial image of the passport holder is duplicated on the data page by a pattern of laser burned holes in the paper, forming a well defined portrait of the holder. This technology is very sophisticated and would be extremely hard to simulate.

The new Netherlands passport is using this feature.

Paper and Substrate Matching

Several of these NIP processes are optimized only when they are matched to the right receiving medium. Ink jet for example requires a substrate that absorbs some of the ink in order to form a bond. Laser toner lays on top of the paper and tends not to migrate into the pores and fibres of the paper or substrate. Therefore both of these processes require some sort of overlay or protection from removal. Traditional thick laminates have been used in the past, however they are being replaced by thin film materials, most often with some sort of custom holographic image embedded within.

Because of the nature of dye sublimation and pigment sublimation printing to the backside of a thin film material, these images are afforded protected once they are in the passport.

The Future

More and more countries will be switching from traditional "stuck in" photos and moving to NIP methods, as they modernize their application and issuance procedures. ICAO, the International Civil Aviation Organization recently have produced a document of recommendations for Minimum Security for Travel Documents, which states, in addition to many other things, that digital printing methods should be chosen over traditional photographs, in order to discourage photo substitution.

Digital printing of 2D bar code allows for the addition of some biometric information to the passport. Latvia currently prints a 2D bar code on the other side of the data page.

Ink jet printing will finally gain favour with more countries due to its increased quality and the relative cost to deploy the technology. Care will need to be taken to render portions of this technology unique for passport issuance, due to the fact that there are so many versions of commercially available ink jet printers on the market.

Biometrics will become common in travel documents, partially due to U.S. laws and regulations coming into play in the fall of 2004, and also due to the need to better link the passport bearer with the document they are carrying.

Biography

Ronald Seguss' current position is Manager of the Secure Document Advisory Group, Security Directorate, Canadian Passport Office (6 years). His professional training is as a Forensic Scientist, formerly with the Royal Canadian Mounted Police (RCMP) Forensic Laboratory, Ottawa, Ontario Canada (26 years, as a counterfeit specialist in currency, credit cards and Travel Documents). He received his Bachelor of Science Degree 1967 as a Chemistry major. He has represented Canada and given papers at Interpol International Meetings, ICAO as a Passport representative on Working committee for Travel Document standards and has presented paper at PISEC of the Americas.