Fingerprint and Footwear Forensics Newsletter

October 2008 Publication No.67/08

Home Office
Scientific Development Branch

IN THIS ISSUE

CONTACTS AND AREAS OF RESPONSIBILITY

Valerie Bowman 01727 816209
Programme Manager

Vaughn Sears 01727 816216
Fingerprint Development, Light Sources, Imaging, Lab Design

Helen Bandey 01727 816385
Footwear Development, Powders, Light Sources, Superglue

Stephen Bleay 01727 816252
Digital Imaging, Arson, VMD

Chris Selway 01727 816266
CBRN Forensics

Andrew Gibson 01727 816272
Digital Imaging, Powders, Lab Design

Lesley Fitzgerald 01727 816433
CBRN Forensics

Rory Downham 01727 814019
Powder Suspensions

Tom Ciuksza 01727 816295
Footwear Development

Matthew Bannister 01727 816475
Placement Student

Emma Newton 01727 816290
Placement Student

ADDRESS

HOSDB, Woodcock Hill, Sandridge,
St Albans, Hertfordshire, AL4 9HQ, UK

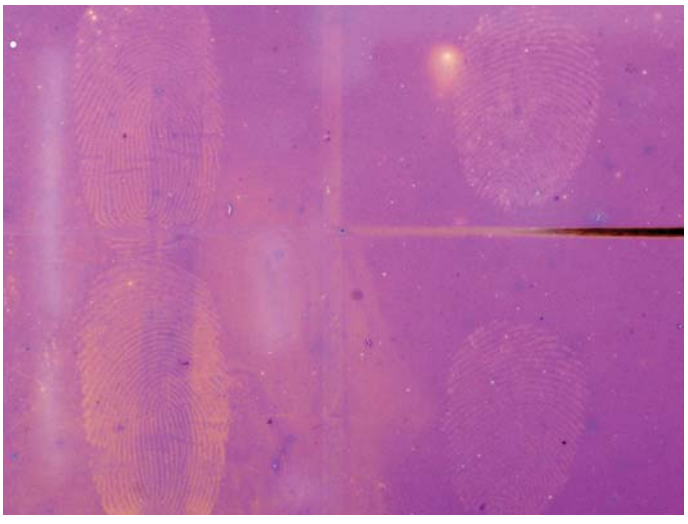
INTRODUCTION

You will notice this edition of the Fingerprint and Footwear Forensics Newsletter is shorter than usual. This is not because there is less to report, but reflects the current direction of projects within the programme. Because the projects have become more diverse, we intend to use this shorter format six monthly newsletter to provide a brief overview of progress and to provide more in-depth updates on specific project work within additional newsletters. These will be issued when projects reach appropriate points of maturity. We intend to issue special newsletters on Digital Imaging, Powder Suspensions and a second Footwear newsletter in the coming year. It is hoped that this arrangement will supply laboratories and scenes of crime units with the information they need, both in terms of timeliness and background information. Any feedback on this change in approach would be most welcome.

PROGRAMME UPDATE

Arson

We have been carrying out work on recovery of fingerprint evidence from arson scenes since late 2003, with initial guidance for soot removal and fingerprint recovery being issued in 2006 in the form of a Special Edition Newsletter (26/06).



Fingerprints developed on a ceramic tile using silver vacuum metal deposition after 20 minutes exposure at 700˚C

Since then, a more focused PhD study looking at the recovery of both fingerprints and DNA has been carried out by Ainsley Dominick at the University of Strathclyde, partly funded by HOSDB. This study has expanded on the range of temperatures and exposure times studied and will enable more detailed advice to be given regarding evidence recovery from arson scenes, with the intention of updating the current guidance in summer 2009. Ainsley has just completed a second 6 month period at HOSDB and has demonstrated that latent fingerprints can withstand short term exposure (up to 20 minutes) to 800°C and still be developed by superglue and vacuum metal deposition. This is higher than the highest survival temperature of 600°C found in previous studies.

Powder suspensions

As reported in previous newsletters, there has been much work over the past couple of years to establish the effectiveness of powder suspensions relative to other techniques on adhesive surfaces and on smooth and rough non-porous surfaces. Draft processing charts have been issued for all these surfaces and feedback is being sought prior to full publication.

The next chart that will be addressed is chart 5, plastic packaging materials. The advice contained within the current chart is based on an extensive trial conducted over 20 years ago. Since that time, there has been a significant change in the composition of plastic bags with an increase in recycled content and the introduction of biodegradable polymer blends. In addition to this, processes introduced since the previous study such as powder suspensions and portable lasers may be more effective than techniques currently recommended. It is already known that the performance of techniques such as vacuum metal deposition is reduced on certain types of plastic bag and as a consequence it is now appropriate to repeat the trial utilising current technology. The trial is scheduled to start in October and it is anticipated that an update will be given in the next newsletter.

Fingerprints on metals

Over the past couple of years there has been some media coverage of techniques for the development of fingerprints on metals, in particular fired cartridge cases. Of recent note are the techniques developed at the University of Swansea, and Northamptonshire Police in conjunction with the University of Leicester, both of which utilise the residual corrosion left on the metal surface by the fingerprint rather than any residue still remaining to develop and/or image the mark.

Fingerprints developed on metal as a result of natural etching by fingerprint constituents

The processing chart for metals in the HOSDB Manual currently only considers chemical development techniques, and so does not include any of the etching or electrochemical processes that have also been proposed for fingerprint development on metal surfaces. Metals also vary significantly in terms of their chemical activity and therefore a technique for one type of metal may not be effective on others. HOSDB intend to contribute to a more extensive comparative study of both the proposed and currently used techniques for metal surfaces, looking at chemical, electrochemical and the more recent electrostatic techniques across a range of representative metal surfaces. The work will be carried out by a PhD student at the University of Swansea, jointly funded by EPSRC and HOSDB. It is hoped that this work will enable the metal processing chart to be revised to incorporate the most effective techniques and sequences.

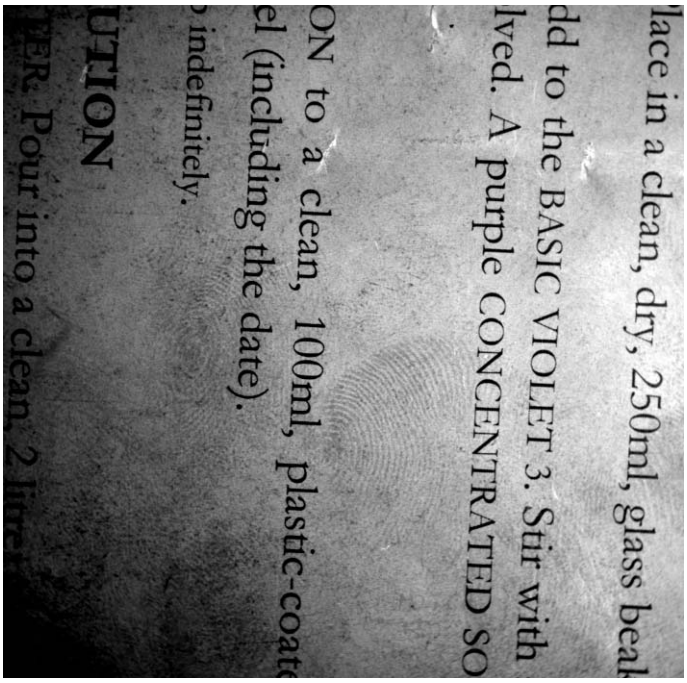
Footwear

The footwear project continues to work to the prioritised list of objectives identified by the National Footwear Board's Research and Development Group. These objectives have included work directed towards serious crime, such as an assessment of Luminol and its variants, and volume crime, which has focused on storage guidance for gel and ESLA lifts. The outcomes of this work will be reported in a dedicated Footwear newsletter in 2009.

EQUIPMENT UPDATE

Ultraviolet imaging

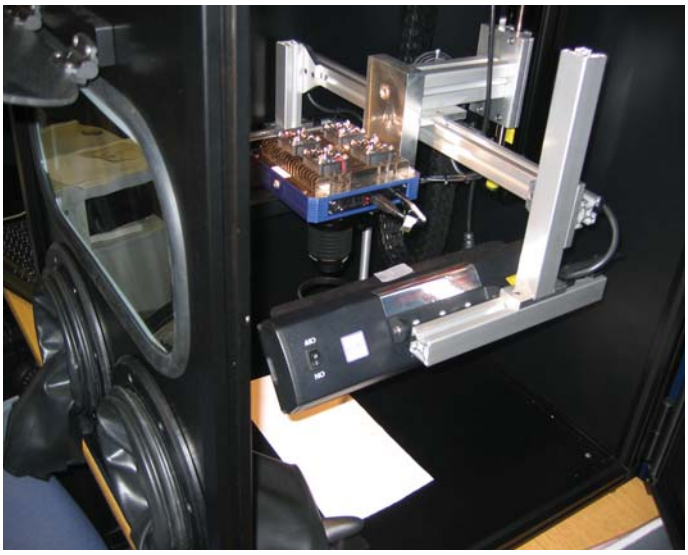
It has been known since the 1970s that a range of ultraviolet imaging techniques can be used to detect latent fingerprints, including the use of reflection, absorption and fluorescence modes. Both short-wave and long-wave ultraviolet light can be used, each being capable of detecting different types of fingerprint.



Absorbing fingerprints detected using short-wave ultraviolet imaging in reflection mode

Ultraviolet imaging can also be used for a variety of other forensic applications, including detection of body fluids, fibres and imaging of injuries. However, the use of ultraviolet light has health and safety issues associated with it, in the case of short-wave ultraviolet light even an exposure of a few seconds is capable of causing burns to skin and eyes if a powerful light source is used in close proximity to a person. HOSDB does not currently issue extensive advice on the use of ultraviolet imaging, partly because of the difficulties in using the techniques due to the health and safety issues mentioned above. However, it is recognised that ultraviolet imaging is capable of detecting fingerprints (and other types of forensic evidence) that are not found by other types of light source examination or by subsequent chemical treatment and it is therefore necessary to re-evaluate the potential benefits of this technique.

HOSDB has started investigating the comparative effectiveness of two methods of ultraviolet imaging, one an ultraviolet sensitive digital camera in an interlocked enclosure for imaging articles in a laboratory, and the other a scene portable RUVIS (Reflected UltraViolet Imaging System) based around an image intensifier with an ultraviolet transmissive lens.



A view of the ultraviolet imaging system developed for use in the laboratory

The way in which the ultraviolet light is converted to a visible image differs between the two systems and enables a comparison of their relative sensitivities to be made. It is intended to investigate both techniques in short-, mid- and long-wave ultraviolet bands and to establish the optimum filters for use with each light source and imaging system combination. This work is being carried out by Matthew Bannister, a placement student from the University of Bath who will be with the group for 11 months.

Another important area that will be investigated is the effect of ultraviolet illumination on DNA. It is known that prolonged exposure to short-wave ultraviolet radiation will destroy DNA and so it is important to establish guidance for the use of ultraviolet imaging in situations where subsequent DNA retrieval may be required. It is hoped that the current project will provide sufficient background information for such guidance to be given.

Ultraviolet imaging systems are becoming more widely available and several forces may be considering the purchase and use of such equipment. As stated above, HOSDB does not currently have any comprehensive published guidance for the use of ultraviolet imaging for fingerprint detection although it is intended to issue some on completion of the project work. HOSDB considers it essential that anyone intending to use ultraviolet imaging in any context attends a training course on the health and safety aspects of ultraviolet radiation and carries out a full risk assessment on any equipment they will use. In the case of scene portable RUVIS systems using short-wave ultraviolet light a safe system of work will involve the operators wearing protective clothing for all regions of potentially exposed skin and

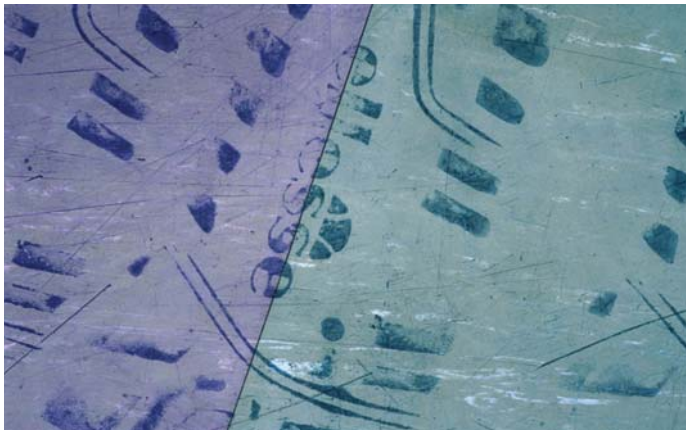
protective goggles for the eyes. Additional measures may be required to safeguard other personnel in the vicinity. For further information on the project or health and safety issues please contact Steve Bleay or Andrew Gibson.

Inter-compatibility of blood dyes

During recent discussions with some laboratories it has emerged that our advice on the use of blood dyes may need some clarification, certainly with respect to the differences between the formulations. This short summary is intended to assist in this.

Prior to the update in August 2004, the only blood dye recommended for use was 'Amido Black', and two formulations were given, a methanol-based formulation for use in the laboratory and a water-based formulation for use at scenes.

In the 2004 update, two new dyes were added, namely Acid Violet 17 and Acid Yellow 7. 'Amido Black' was re-named Acid Black 1 for consistency – there has been no change in the actual dye used. The methanol and water-based formulations were replaced with an ethanol-based formulation capable of being used in a laboratory and at scenes with appropriate precautions. The effectiveness of this formulation is at least equivalent to that of the methanol-based formulation and greater than that of the water-based formulation.



A footwear mark in blood developed with Acid Violet 17 (left hand side) and Acid Black 1 (right hand side)

What has not been made clear is that Acid Black 1, Acid Violet 17 and Acid Yellow 7 are completely interchangeable between all formulations. The ethanol-based formulations all contain the same solvent constituents in the same proportions and the same weight of dye. Methanol- and water-based formulations of Acid Violet 17 and Acid Yellow 7 can be obtained (if required although not recommended) by replacing Acid Black 1 with an equivalent weight of dye in the original 'Amido Black' formulations.

Sequential powdering

The recent project work on powder suspensions has reinforced the fact that powdering is a highly effective process and that the sequence of powders followed by powder suspensions gives good results. The proposed revisions to the charts for smooth and rough non-porous surfaces will promote the use of powdering, both at crime scenes and within laboratories. During recent demonstrations of the HOSDB Powdering Guidelines to laboratory staff, it was noted that it may be possible to apply powders in a sequential manner. In the case observed, a surface where the background became highly clogged with aluminium flake powder was subsequently powdered with black magnetic powder, which cleared the background and successfully developed a mark. At present this is an observation made on one surface only, but sequential powdering does merit further investigation.

COMMUNICATIONS

IAI Conference

Andrew Gibson has recently returned from the Annual IAI International Educational Conference in Louisville, Kentucky, where he presented a paper on the HOSDB approach to evaluation of fingerprint development techniques and some of the recent work on powder suspensions. The USA is a major source of overseas manual sales and attendance at the IAI Conference provides an opportunity for us to present our work to a predominantly US audience and to make contact with fingerprint practitioners at all levels. The conference also has a strong presence from exhibitors, and enables links to be made with companies with little or no UK base. Developments that HOSDB will be following up include the demonstration of a one stage, fluorescent superglue system and software which may enable the automated grading of fingerprints in a less subjective way.

Newsletter publications can be downloaded from:
http://scienceandresearch.homeoffice.gov.uk/publications/fingerprint-publications

For further information contact:
hosdb@homeoffice.gsi.gov.uk

ISBN 978-1-84726-834-1