

Reflective Ultra Violet Imaging System: The SceneScope

The Result of a Fruitful Jobin Yvon - HORIBA Cooperation

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Abstract

Jobin Yvon (JY) introduced its first RUVIS SceneScope Imager in 1997. The instrument is capable of detecting and photographing invisible latent fingerprints on non porous surfaces, without any treatments. It is both a forensic lab unit and a crime scene investigator's tool. The system was redesigned for better performance and look enhancement in 2002 thanks to strong support from the HORIBA R&D team which had excellent experience in 3D design and molding. 2002 was highlighted by the first quantity order for the SceneScope with 30 systems sold to the Italian Carabinieri to equip all their field units.

1 Outline of the RUVIS

RUVIS is an acronym for Reflective Ultra Violet Imaging System. RUVIS instruments are used by crime scene search investigators and laboratory evidence technicians. By enhancing the observation, photography and collection of evidence including latent fingerprints and palm prints, bites, bruises, blood detection with Luminol, shoe impressions, gun shot residues, etc., RUVIS provides more sensitivity than traditional methods of enhancement and without any treatment in many cases, thereby increasing the amount of uncovered evidence and improving the quality of evidence for photography and collection. Fig. 1 shows one of the first identifications in the USA with the SceneScope.

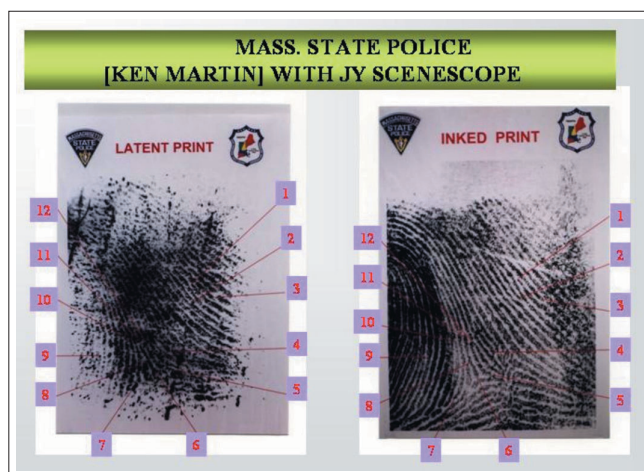


Fig. 1 One of the first Identifications in the USA with the SceneScope

A RUVIS instrument consists of the imaging viewer, a powerful yet portable UV lamp, all necessary UV protection equipment, and the adapter for 35 mm SLR cameras or digital cameras. The RUVIS device uses the viewer and lamp in conjunction with one another to produce a reflection off smooth, non-porous surfaces. As the surface is exposed to the UV light, the materials left behind, for example oily residues or amino-acids in the case of a fingerprint, will scatter the UV light or absorb it. The viewer sees the scatter off the ridges and allows the technician to see the latent print on the surface. By changing the angle of light, the contrast of the print changes and its visibility can be increased, thus allowing the visualization and photography of the latent print without any treatment or contact. Jobin Yvon (JY)'s RUVIS product is the SceneScope (SC).

2 Fruitful Results by Jobin Yvon - HORIBA Cooperation

In 2002, a fast paced, successful cooperation between JY engineers and HORIBA Ltd. in Kyoto engineers allowed the launch of the new SceneScope molded unit. Mr Juichiro Ukon coordinated the teams. The fast introduction of this unit allowed the on-time delivery of the first quantity order, for 30 units, to the Italian Carabinieri law enforcement agency.

At that time, the JY Forensic R&D team was not yet using Pro-E, the HORIBA selected powerful CAD program, and the HORIBA engineers had a strong experience with it for 3D modeling and design of molded parts. The excellent

cooperation of the two teams together, with a strong product management to meet customer expectations, made this unit the most convenient design for processing crime scene searches. The artist's sketches of new model are shown in Fig. 2 and Fig. 3 is a production version.

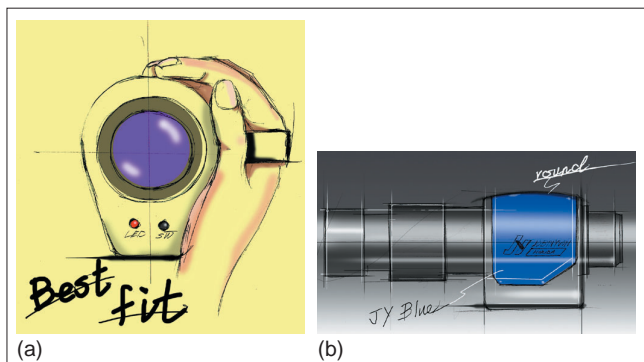


Fig. 2 Artist's Sketches for New Model
(a) Best Fit (b) JY Blue



Fig. 3 SceneScope (Product Version)
(a) SC-VIEWER (b) SC-FM2

High Resolution modified 35 mm SLR Nikon FM2 camera for direct Ultra-Violet photography with simultaneous viewing and focusing capability, 78 mm focal length quartz UV lens and 254 nm UV bandpass filter.

The resulting unit was a lower cost, more competitive instrument which was well accepted by the forensic community during the International Association for Identification in the USA in August 2002.

3 SC-FM2 High Resolution Photography Setup

This patented option is used in conjunction with the SC-VIEWER when high resolution and high dynamic range is needed, which only photographic film can provide. Used in parallel with the SceneScope, the SC-FM2 (Fig. 3(b)) option is the complement for high quality work in the laboratory and at the crime scene.

3.1 Optical Design

A standard Nikon FM2/FM3 camera viewfinder/prism is removed and permanently replaced, with an opto-mechanical assembly on top of the camera. The SceneScope intensifier can be quickly connected to the back of the camera. The user visualizes, in live mode, the Ultra-Violet image to be captured directly on the short-wave UV sensitive film such as two commercial black & white models, TRI-X-400 film or PXP-125, without any intensifier in-between.

3.2 Features

High resolution and high dynamic photography is required beyond the traditional $2\text{ k} \times 1.5\text{ k}$ pixels resolution and 8 bit (256 levels of gray) from digital cameras typically used by Law Enforcement. It allows the visualization of details the SceneScope in viewer configuration may not resolve, such as pores in fingerprint ridges or highly detailed large size palm prints. In this mode, the resolution and dynamic range are limited only by the photographic film, from 5000 dpi up to 8000 dpi as per manufacturer, not by any electro-optical device such as the intensifier which is limited to approximately 2000 dpi.

No electric/electronic device is allowed between the evidence and the photographic film to ensure the integrity of the evidence presented to Court. The intensifier is only used to view the evidence in live mode. The image is "printed" directly on the UV sensitive film through the quartz lens – no other element does enter in the optical path. This is critical for legal reasons in countries such as Japan.

4 Applications

4.1 Latent Fingerprint Detection

The primary application for a RUVIS is the detection of latent prints without treatment on smooth non-porous surfaces. When first using a RUVIS in the collection of prints, the investigator protects the integrity of the evidence by not running the risk of contaminating or destroying a print due to physical contact by over-powdering or smudging. Print collection can be performed on surfaces such as plastic bags, sticky side of tape, glossy magazine surfaces, photographs, vinyl and linoleum tile, varnished furniture, compact disks, credit cards etc., all without treatment of any kind.

Cyanoacrylate treatment (also called “superglue fuming”, a technique pioneered in Japan) will further enhance the results of the RUVIS, increasing the number of different surface types where a latent print can be visualized and collected. Due to the specific wavelength of UV light that the RUVIS utilizes for operation, processing of a vehicle for prints can be accomplished outdoors in daylight since that specific wavelength is not present in the solar spectrum and in the artificial lighting. Police investigators are no longer required to place the vehicle in a tent, garage or wait until nightfall to look for prints.

Fig. 4(a) shows a fingerprint on untreated sticky side of duct tape. And Fig. 4(b) shows Cyanoacrylate fumed fingerprint.

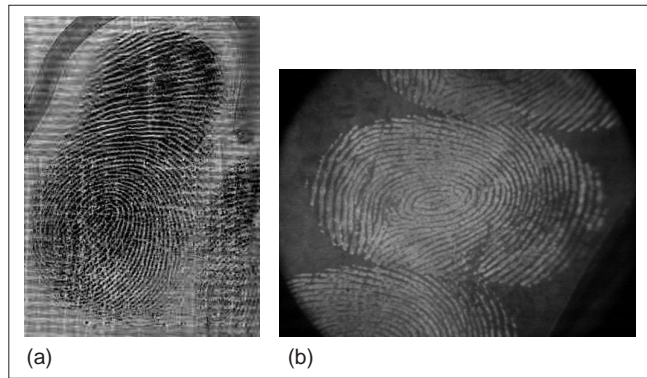


Fig. 4 Latent Fingerprint
 (a) Fingerprint on Untreated Sticky Side of Duct Tape Ridges showing as black.
 (b) Cyanoacrylate Fumed Fingerprint
 The polymer (Superglue reacts with residues to form white lines) reflects the UV, while the white plastic background absorbs UV.

Again the search is best performed on smooth non-porous surfaces of the vehicle, but now the searches can be accomplished in a timely manner at the scene and do yield more latent prints.

4.2 Bites and Bruises and Shoe Impressions

The RUVIS instrument can be used to reveal bruise and patterned wound details that are invisible under normal white light illumination. Details of a bruise pattern in a suspect’s palm can link a suspect to a weapon, and a bite mark can link a suspect to a victim. In one instance, a tool used to hit a victim in the head, was matched with the shape of the wound by using various UV filters 254-312-365 nm which can be added in the kit for such “skin damage examination”. Shoe impressions can be detected and photographed before trying to use lifters, providing a safe copy of the print before any process takes place. The dust for example will scatter the UV light and uncover

details from the shoeprint. Impressions in rugs, varnished tiles can also be enhanced in UV mode.

4.3 Crime Scene Scanning

Upon entering a room at the crime scene, a RUVIS can be utilized to observe large smooth surfaces from a distance to determine if there are prints that would need to be photographed and collected. This scanning saves time by having the latent print detected area processed instead of the entire surface. It tells the investigators which areas to focus on.

SceneScope used on contaminated prints on a vehicle (Fig. 5). Fig. 6(a) shows raw capture in green light and Fig.6(b) shows the result after digital enhancement using FFT mathematical boosting of the ridges.



Fig. 5 Crime Scene Scanning on a Car

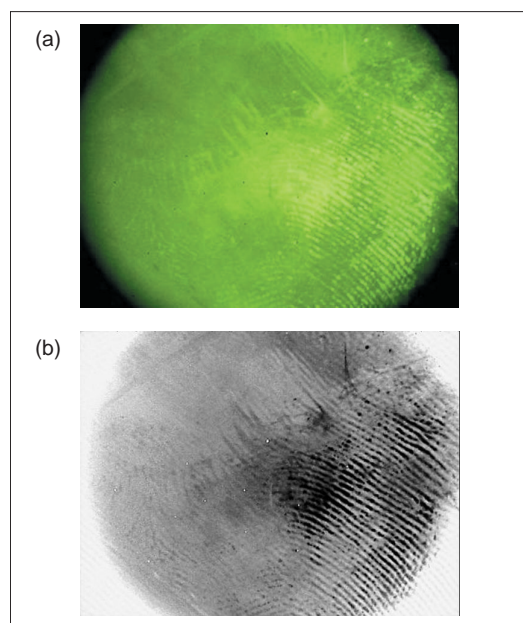


Fig. 6 Contaminated Print
 (a) Raw Capture in Green Light
 (b) After Digital Enhancement using FFT Data Processing

4.4 Luminol and Blood Detection

RUVIS instruments can be used in the detection of blood when used in conjunction with Luminol. The RUVIS intensifies the chemiluminescence of the Luminol and allows for the visualization of the faintest of blood stains using blue band-pass filters. With a RUVIS instrument the technician will have the opportunity to collect more blood samples, without having to over saturate with Luminol to get luminescence. Fig. 7 shows the blue chemiluminescence from Luminol treated blood.

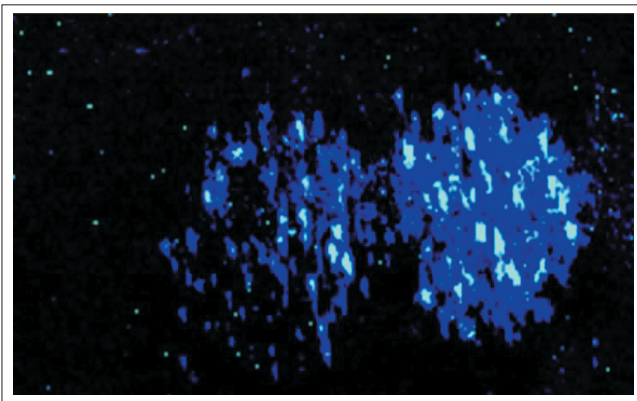


Fig. 7 Blue Chemiluminescence from Luminol Treated Blood

5 Advantage

The SceneScope offers the following advantages:

(1) Less Fatiguing

The newly redesigned SceneScope is more compact and ergonomically designed to fit in the palm of the hand. A strap keeps the unit snug on the hand, even without holding onto the unit. The previous design was larger, bulkier and more awkward to handle. It also did not have the safety strap to keep it on your hand if you let go.

(2) Direct UV Photography

With JY's patented SC-FM2, a High Resolution modified 35 mm SLR Nikon camera, in conjunction with the SceneScope, one can simultaneously view, focus and photograph on UV sensitive film. Using the modified SC-FM2 for photography, allows for a much larger field of view, 24 mm × 36 mm.

(3) Directive UV Lamp

The standard UV light source included with the SceneScope focuses the UV light in a straight beam; this focused light is necessary in creating the best

contrast off a surface. This is accomplished by changing the angle of light, from oblique to perpendicular, as it shines on the surface.

(4) Safety First

The SceneScope comes with a complete set of protection against UV light exposure: full face protection, goggles, and a shield for the SceneScope. When operating the unit, as with working on evidence, users will wear UV blocking gloves and must wear long sleeves for skin protection.

(5) Originators

For more than 6 years the SceneScope has been the cutting edge of latent fingerprint detection technology. First marketed by JY in 1997, the SceneScope has been sold to dozens of U.S. law enforcement agencies at all levels. It has been sold worldwide to most national Police Agencies. The FBI uses both the viewer kit and the full SC-FM2 kits in their photography labs.

2002 saw the introduction of the Second Generation SceneScope developed with HORIBA. Many sub-parts are now manufactured in Japan.

6 For the Further Advancement

JY Forensics keeps introducing MORE Identification instrumentation to meet Today's law enforcement needs. The Division has plans to introduce more products that fit our target market. For the Forensic Identification segment we have an established distribution network and a strong reference base. The on-going addition of the Catalog line with more than 850 products featured in a 140+ page catalog opens up the market of the consumables for the forensic market.



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