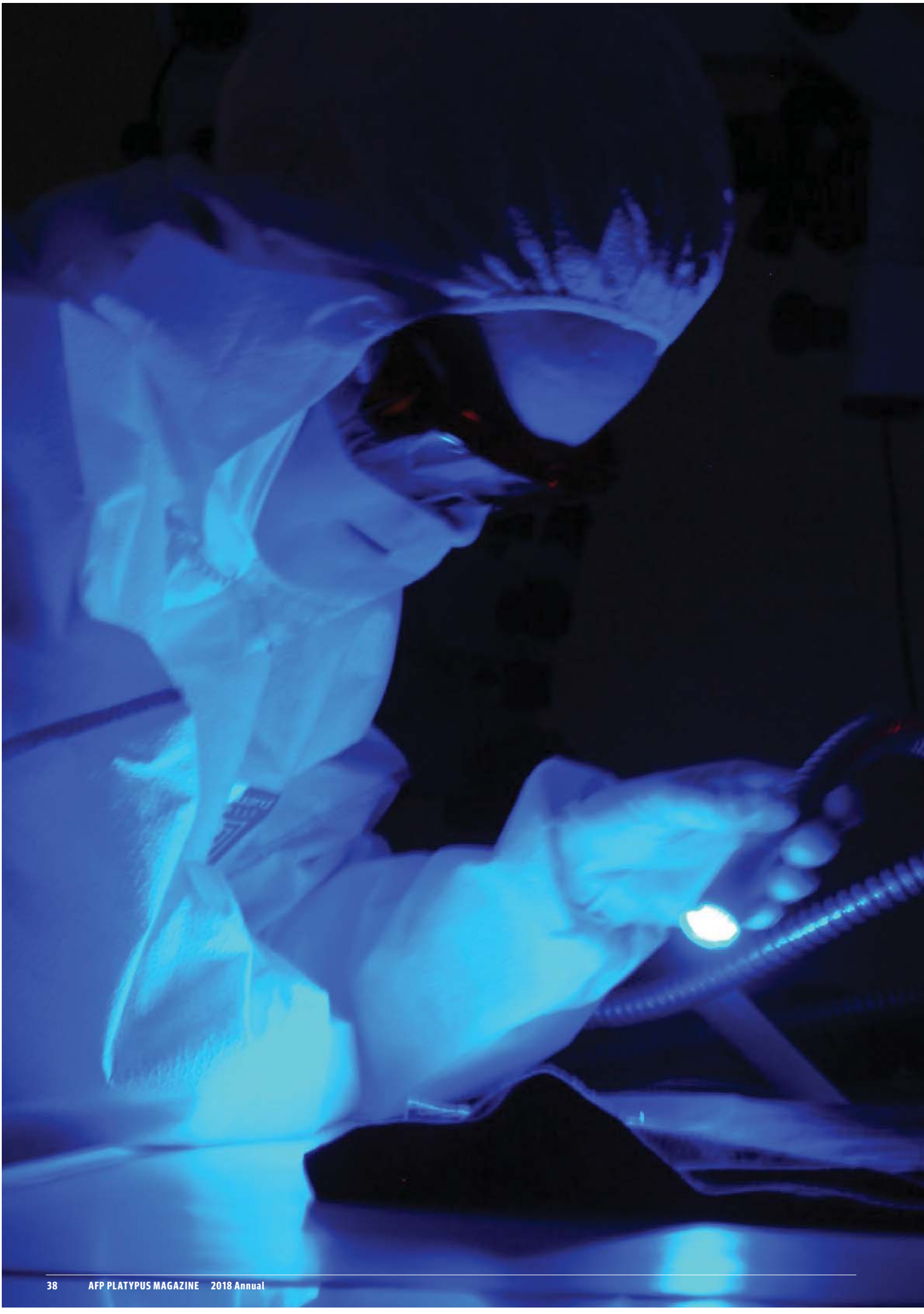
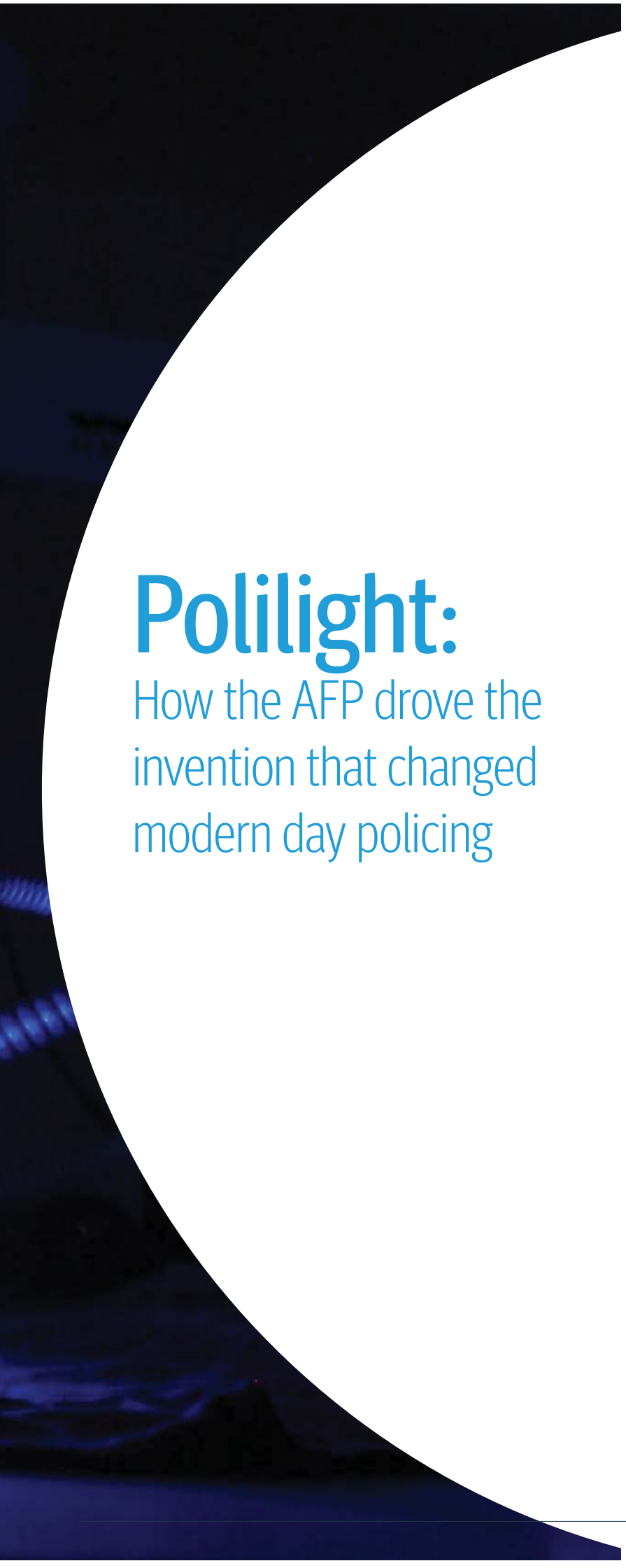




Polilight:

How the AFP drove the invention that changed modern day policing

There is hardly a television crime show or movie that doesn't feature the Polilight – a crime-fighting invention created nearly three decades ago that has helped put tens of thousands of criminals before the courts.

In its nearly 40 year history, the Australian Federal Police can lay claim to many breakthroughs in its fight against crime. But it was the invention of the Polilight in the 1980s that stands alone as a ground breaking technology which has made the most significant impact in modern day policing.

Today, the Polilight, or a variation of it, is used in 98 per cent of crime scene investigations and it has been the subject of many accolades. It is regularly listed as one of Australia's top 100 inventions and nearly three decades later, it is still used by law enforcement agencies around the world.

As well as revealing otherwise invisible fingerprints, bodily fluids, blood stains and revealing document forgeries, it can even be used to detect counterfeit artworks from the real thing to help resolve cases of disputed ownership.

The AFP's Chief Forensic Scientist, Dr Sarah Benson, said the invention of Polilight was 'revolutionary' and took forensic capability forward 'in leaps and bounds'.

"In its day it was certainly cutting edge technology...it brought a whole new dimension for how we approached crime scenes and our ability to collect fingerprints in the field.

"It certainly gave us the ability to make significantly more identifications where otherwise people wouldn't have been identified, and previously would

‘It serves as an important tool in crime scene investigations throughout the world.’ – Dr Malcolm Hall, former Director, Scientific Research Directorate (1979-1985).

have got away with the crimes they committed,” Dr Benson said.

In Australia’s national capital, where most street names recognise people who have made a significant contribution to the nation, the Polilight was selected as a street name in the suburb of Dunlop, amongst a cluster of roads recognising great Australian inventions and inventors.

Sydney’s Powerhouse Museum named Polilight as one of the top Australian inventions of the 20th century and in 2005 the Australian Export Awards acknowledged its global impact with a special award presented by then Deputy Prime Minister and Minister for Trade, Mark Vaile.

The challenge

At a typical crime scene, it is often what the investigators can’t at first see with the naked eye that provides the clue to solving a crime.

When crime scene examiners find fingerprints at a crime scene, they dust the area to make the prints stand out clearly and then photograph them so they can run comparisons to see if the prints match any known offenders.

But before the invention of Polilight, some prints were so hard to detect on surfaces like paper, or where dark-coloured stains had soaked into the material, that the traditional techniques didn’t work. These hidden clues were impossible to see, let alone photograph.

Where it began

In the 1970s researchers began the search for a new technology, an alternative to the traditional method of fingerprint detection which was in use at the time.

Dr Malcolm Hall, Director of the AFP’s Scientific Research Directorate (1979-1985) became aware of the potential use of lasers to illuminate fingerprints during his travels to forensic science laboratories in the UK, USA and Germany.

“The need for improved fingerprint practices and outcomes, along with emerging technologies, encouraged me to initiate a scientifically-based research project on fingerprint enhancement,” Dr Hall said.

In early 1980, Dr Hall approached Professor Ron Warrener, Head of the Australian National University (ANU) Department of Chemistry to see if he would be interested in setting up a Fingerprint Research Unit with funding from the newly-created AFP.

Two new migrants who came to Australia in 1980 were quickly recruited to the team. Physicist Milutin Stoilovic, from the former Yugoslavia was joined by Dr Hilton Kobus, a specialist in spectrographic applications in forensic chemistry, who had been the Director of the Zimbabwe Police Forensic Science Laboratory for three years.

Mr Stoilovic, who had some experience working with light sources in Belgrade, recalls Dr Hall’s vision to develop a new, portable light source to assist police in their investigations.

“No-one knew what this new light source would look like. It really was a blank canvas,” he said.

The research work begins

Dr Hall recalls the team of Kobus and Stoilovic beginning their important work.

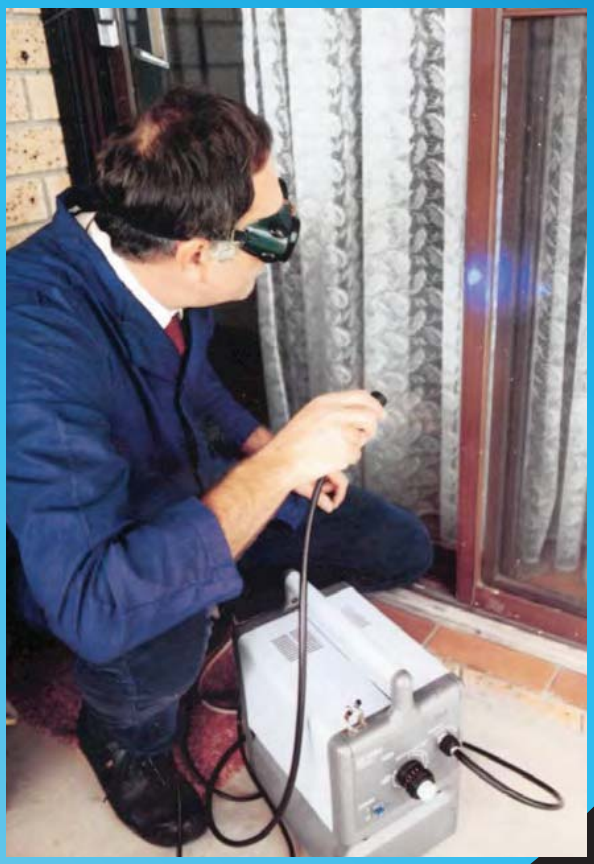
“This involved comparing several high energy light sources, including a Xenon arc lamp and an argon ion laser, to see whether the laser provided better sensitivity. At the time, the laser was the technology being chosen elsewhere for fingerprint enhancement research,” Dr Hall said.

“It soon became apparent that the laser had several practical limitations, including the fact that it was large and its light source was so strong that if a fingerprint was present on a surface, the background fluorescence often swamped any light coming from the fingerprint, making it difficult to see.

“Further, the laser light was restricted to a few spectral wavelengths, whereas it was possible with the lamp, as a white-light source, along with a series of filters, to produce a wide range of spectra.”

While the lamp technology was a significant step forward, the light source was still very much a laboratory-based system, mounted on an optical bench with a lens, filter

One of the inventors of the Polilight, former AFP forensics member Milutin Stoilovic, with a protoype, which is still in good working order.



A demonstration of a version of the Polilight.

Left: The 'Unilight' – one of two prototypes of the Polilight.

Right: Over the years, Rofin Australia has continued to evolve and enhance the Polilight, developing new models using emerging technology to respond to requests from crime scene investigators.

and mirror to reflect the light onto the fingerprint. It was realised a system like this would not be easily adapted to a non-scientific environment, particularly for use by forensic police in the field at crime scenes.

"The concept of a portable light source unit evolved and it became apparent that there were particular challenges in using a Xenon arc lamp as the light source which generated considerable heat during its operation due to infra-red radiation," Dr Hall said.

"Mr Stoilovic spent considerable time investigating how to manage this issue and came up with a clever solution by devising a specific mirror/prism system which managed the infra-red heat problem."

In time, a third team member was appointed to the Unit – Mr Chris Lennard, a PhD student in chemistry. His task was to carry out research on ninhydrin and its analogues. Ninhydrin is a chemical which was widely used at that time, with very variable results for the development and visualisation of fingerprints on surfaces such as paper.

The chemistry of fingerprints

Meanwhile, Dr Kobus and Mr Lennard were focusing on the chemistry of fingerprints themselves, resulting in the development of a range of novel techniques for making fingerprints visible, such as the application of a fluorescent dye to latent fingerprints treated with superglue. The lamp could then be used to illuminate these prints. This innovative technique is now used routinely in fingerprint bureaus throughout the world.

"Different techniques are required to make the fingerprints visible, depending on the nature of the surface and the content of the fingerprint," Dr Hall said.

"Fingerprints contain amino acids which are secreted from pores in the fingerprint ridges. In addition, fingerprints can result from other materials transferred to a surface from an individual's finger. As a result, fingerprints can result from a wide variety of materials and are deposited on a wide range of different surfaces."

In a discovery that was also a world first, Dr Kobus and Mr Lennard were able to clarify the actual chemistry involved in the ninhydrin reaction with amino acids.

"Through understanding fingerprint chemistry it was then possible to apply the lamp (by this stage christened 'The Unilight') to fingerprints which had first been treated with ninhydrin and then with a metal heavy compound," Dr Hall said.

"If the surface of the document was then cooled in a bath of liquid nitrogen whilst being illuminated with the lamp, the level of fluorescence was increased 1,000 fold.

"The resulting fluorescence could then be either photographed or captured by a video camera. Through this method, many faint ninhydrin prints which were regarded as containing insufficient 'points of identity' could then be used as evidence in court cases.

Going commercial

Using his knowledge of optics, Mr Stoilovic continued to work on improving the Unilight as a portable device.

"Once this reached a prototype level of sophistication, the opportunity arose to explore the possibility of commercialisation," Dr Hall said.

Recognising the potential for Unilight internationally, the ANU's commercial arm sold the concept to Rofin Australia Pty Ltd which eventually developed it into the Polilight and promoted its use internationally.

As well as being easier to use, Polilight was smaller and more portable than the original Unilight.

Over the years, Rofin has continued to evolve and enhance the Polilight, developing new models using emerging technology to respond

The Polilight is recognised as one of Australia's greatest ever inventions and it even has a street named after it in Canberra's northern suburbs.

Special Agent Adam Deem, of Air Force Office of Special Investigation Detachment 219, shines light on a glass to reveal fingerprints at Barksdale Air Force Base, La. Deem dusted the glass with an orange powder that helps agents detect finger prints with ultraviolet light. (Photo by Airman 1st Class Micaiah Anthony via Wikimedia Commons)

to requests from crime scene investigators for additional light output, and an optional infra-red output suitable for examining documents.

Global reach

It is now in use in nearly 100 countries and while it has its competitors, Polilight is seen as an essential tool for investigative and intelligence units world-wide, including the AFP, the Federal Bureau of Investigation, the Criminal Intelligence Agency, Japan National Police, Bundeskriminalamt and Scotland Yard.

Managing Director of Rofin Australia, Dr Hadrian Fraval, said "it is astounding to think the Polilight has been recognised amongst the best of thousands of incredible Australian inventions of the 20th century and is ranked alongside world-changing discoveries such as WiFi, the bionic ear and the surf lifesaving reel."

"Of course much credit must go to the scientists at the ANU who first created the concept for the instrument. But over the years we have continually refined and developed it both in terms of its science and its marketability," Dr Fraval said.

Decades later, the versatility of the invention and its broad application is still breathtaking.

Dr Benson said the AFP's role in facilitating the development of the Unilight and Polilight remained a proud achievement for the organisation to this day.

"The engagement of Stoilovic and Lennard in the late 1980s and 1990s meant the AFP was recognised as world leaders in the field of fingerprint development technique research at that time," Dr Benson said.

"At the time, with Stoilovic and Lennard, the AFP provided training and support for research across Australia and internationally."

The final word, to the scientist who is credited with having the bold vision to champion the research project, secure the funding needed, and who recruited a team able to deliver this world-first technology.

"In my opinion, the resulting benefits have been outstanding and reflect positively on the AFP in its preparedness to financially support scientific research," Dr Hall said.

"Without the establishment of the Fingerprint Research Unit at the ANU, when combined with the research outcomes from the Unit as a whole, the concept of a portable light source would not have been realised.

"Today, it serves as an important tool in crime scene investigations throughout the world."

Footnote: Milutin Stoilovic left the ANU in 1989 to join the AFP. In 2013, he was selected as a finalist for the Senior Australian of the Year Awards for his ground breaking work and international reputation in forensics. He has travelled internationally extensively to promote the use of Polilight and recently returned to his former home land where he has donated two Polilights to assist the Serbian Police Force.