

MOBILE FORENSIC ANALYSIS

The compelling story of how handheld X-ray technology impacted the art of human identification

By **Stephen M. Kinney**

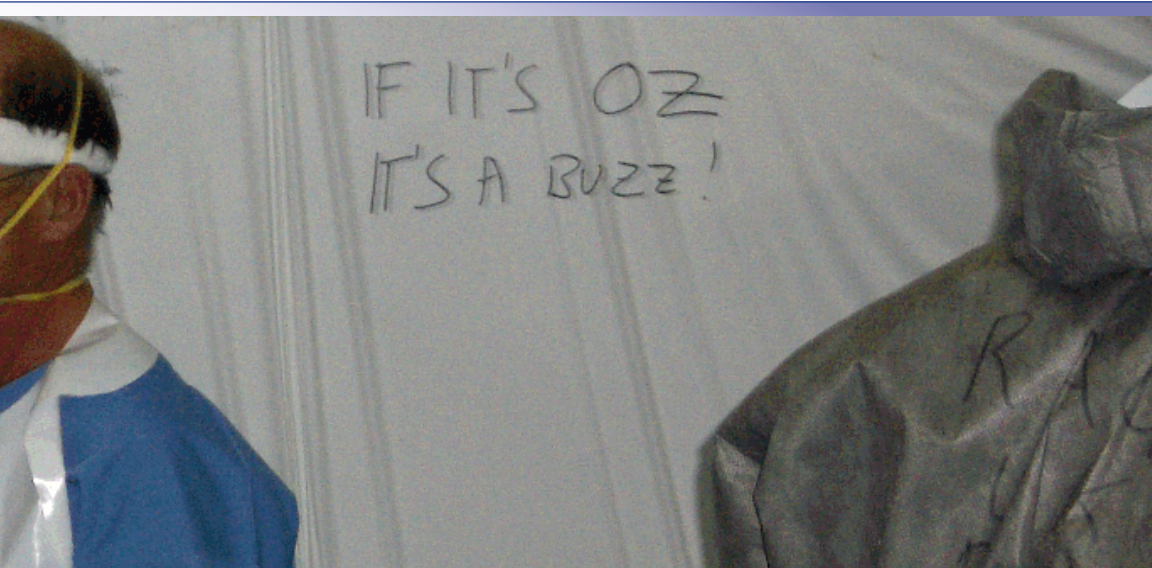


In the summer of 2004, an old friend and business colleague called me at my office in Bangkok to ask if I wanted to join his new project. Don Kloos and I had collaborated on numerous cases and business enterprises that changed the complexion of criminal investigations of the precious metals and jewelry industry. We had taken the well-established science of x-ray fluorescence spectroscopy and adapted it to accurately and non-destructively test gold jewelry – resulting in landmark prosecutions and convictions that spanned the globe.

But this time, Don wanted to talk about a purely commercial breakthrough: A self-contained, battery powered, wireless, handheld dental x-ray generator he called the NOMAD. He was convinced that it would be a huge success in the clinical dental field, but all I could think of was, “This is a forensic dream!” Don immediately chastised me, telling me to stop trying to catch bad-guys all the time – but I persisted.

Having been close to the head of the scientific investigations division of the Honolulu Police Department for decades when I was based in Hawaii, I had learned how critical dental evaluations of bodies were to their ultimate identifications, and how difficult this process was to perform with conventional equipment.

Thailand was embroiled in controversy over recent extrajudicial executions in its war on drugs and constant deadly violence in the South that left a substantial number of bodies to identify, in addition to the normal occurrence of homicide investigations. My personal physician, a retired Royal Thai Police general, immediately understood the implications of totally wireless dental x-ray generator and referred me to Police Colonel, Dr. Sutat Charudilaka, the chief of the dental department at the Police General Hospital in Bangkok. Dr. Sutat performed the lion’s share of the surgical procedures at this learning hospital in addition to his



Dr. Chris Richards of the New Zealand DVI team performs postmortem dental x-rays

responsibilities in forensic dental identification.

Dr. Sutat embraced the concept of this device without hesitation, and asked if he could evaluate it both in the clinic and the mortuary. It took a few months for the inventor, Dr. D. Clark Turner to complete his prototypes, and by early December I was able to provide two units for these separate applications. In a matter of days, the clinical NOMAD had been used in dozens of endodontic procedures that

A French forensic odontologist uses a NOMAD and a Dexis digital sensor to identify a tsunami victim



included root canals and implants, and several dental autopsies had been performed with the forensic unit. Dr. Sutat conducted a root canal workshop the same week expounding the virtues of interoperative imaging, and on the 19th of December, I was wowing the crowds with a NOMAD at the Thai Dental Association conference.

The tsunami effect

As I flew to California for the holidays, the news was reporting that 1,200 people had died from a 9.0 magnitude earthquake-generated tsunami in the Andaman Sea off the coasts of Indonesia and southern Thailand. Soon after the death toll was 15,000, then 30,000. Later still, it became 60,000. The images were limited, but graphic. Using navigation maps I could see exactly where this epicenter was located, and I knew this would be an unprecedented death toll in the hundreds of thousands.

As I was making my airline reservations to return to Bangkok, Don Kloos was phoning the

Department of State to see how we could assist. I was able to reach Dr. Sutat who pleaded for me to bring as many NOMADs as possible for the responders in Phuket where the tsunami had devastated the resorts and killed untold numbers of tourists and local residents.

Upon my return to Bangkok, I was stunned to see how rapidly a thick bureaucracy had descended on this tragedy. The US Embassy referred me to the Joint United States Military Advisory Group in Thailand, who subsequently referred me to the supply officer for the Combined Support Group. They advised me that the Disaster Victim Identification committee, organized by INTERPOL under the command of the Royal Thai Police, was directing forensic identification teams from over 30 countries. The equipment at the three temporary morgue sites and DVI command centre was primarily supplied through Kenyon International.

I found Kenyon's contact information on the web and left a message, resulting in a mobile call from Kenyon's chief science officer, Air Commodore Chris Griffith who sceptically agreed to meet me the next morning at the Kenyon command centre at the Hilton Arcadia Hotel in Phuket.

Chris was extremely impressed with the NOMAD and the safety data I provided, but I was quickly shown the door by Kenyon's operations director because the device had not been granted FDA or CE approval and he could not supply the field operatives without those certificates. I pointed

Dry ice is used to preserve the bodies of tsunami victims



out that the x-ray units would be used on the dead – and therefore not governed by medical device regulations – but the occupational safety officer was adamant. So I put the NOMAD back in my Pelican case and left.

Outside the command centre, I found myself frustrated, but undaunted. Griffith approached me and advised that he was on his way back to Australia immediately, but

The Disaster Mortuary Operational Response Team (DMORT) identifies victims of Hurricane Katrina





A grim roadside sign marks the entrance to a Phuket morgue

wanted to introduce me to someone first. He brought Dr. Russell Lain, team leader of the Australian Federal Police Dental Assessment Team over and told me to show him what I had in the case. When I opened it, Russell looked at me quizzically and asked, “What the hell is that?” I answered: “A handheld, battery powered dental x-ray generator.”

NOMAD in operation

Russell escorted me to a room off the lobby where his entire forensic team was assembling to take the three-hour drive to their assignment in Khao Lak – but there was a problem. The x-ray unit that they were supplied at the site had failed, and the team was facing another idle day waiting for a replacement. Everyone in the room was stunned to see the NOMAD, and desperately wanted to try it. I handed the unit to Russell, and we agreed to meet at 7am the next morning to assess the results.

I spent the rest of that day driving the island north of the airport where

the devastation was breathtaking. Days after the disaster, bodies were still being found under the sand on the beaches, in trees, under the unrecognizable debris of former world-class resorts. I parked my rental car and joined some volunteers who were pulling bodies from a collapsed structure near the beach. The ones who spoke English kept telling me they had never seen the ocean so clear, so blue – so calm. I never had the pleasure of seeing Phuket before the tsunami, so I had no point of reference.

“This thing saved our bacon!” said Russell the next morning. “Without this machine, we couldn’t have done anything. It’s fantastic.” I quickly realised that Russell was keen to hold onto the NOMAD for further work, and then let him keep it.

As soon as I could, I returned to Phuket to hand another NOMAD to an ecstatic Dr. Irena Dawidson, the chief forensic odontologist from Sweden’s National Board of Forensic Medicine. I assisted first

in the mortuaries at site 2, Mai Khao and later at site 1, Khao Lak when the Thai Police opened that location to the INTERPOL teams after some political complications were resolved. I jockeyed back and forth between Bangkok and Phuket for most of 2005, making sure these prototype x-ray units – that were never supposed to leave the testing bench in Orem, Utah – continued to operate as needed. And they did. I worked with odontologists and anthropologists from 38 countries, who all returned home with glowing reports about this new gadget.

Among those who came to know about the NOMAD was Dr. Bryan Chrz, who was just leaving Phuket for his home in Oklahoma when I first came to present my case. Bryan is an active member of DMORT – Disaster Mortuary Operational Response Team – and immediately requested a NOMAD evaluation unit to study and establish exposure levels with the digital x-ray systems manufactured by Dexis. Bryan worked with Dr. Jim McGivney, Dr. David Senn and Dr. Richard Weems in the development of software to bridge the Dexis practice management programs with WinID, a dental identification software program created by Dr. McGivney that became a standard platform for law enforcement. Bryan was instrumental in gaining legal authorization to use digital imaging for identification in lieu of traditional wet film.

From one disaster to another

After nine straight months of DVI work, I decided to take a short

break at the end of August 2005 and returned to my California home in the Santa Cruz Mountains. At the moment I arrived at SFO, Hurricane Katrina ravaged the Gulf coast. Hurricane Rita added insult to injury. I spent the full two weeks I was in the US coordinating NOMAD units into the DMORT operations through FEMA. DMORT had been training for this contingency, and using the NOMAD /Dexis combination exclusively, conducted the first paperless, filmless – totally digital disaster identification program in history. I went back to Thailand to help wrap up the final stages of the Phuket operations that ended in December 2005 while DMORT was finishing their successful operations in the Gulf.



I attended the American Academy of Forensic Sciences conference in Seattle in February 2006, and had the first opportunity to understand the impact that the NOMAD had made. Forensic experts from all over the world converged to share their experiences of the single most active disaster year in memory. I was besieged by legions of odontologists thanking me for bringing the NOMAD into their world. One of the well-wishers explained that forensics had long been treated like the “redheaded stepchild” of the scientific community, and rarely if ever had the chance to get first crack at cutting-edge technology. I vowed from that point forward to do everything in my power to bring our

future developments to the forensic community first for evaluation and validation.

In the ensuing years, there have been overwhelming tragedies and lost lives where the art of forensic human identification has been called into service. With very few exceptions, the NOMAD has been on the scene as essential apparatus for successful repatriation of the victims. The INTERPOL DVI Standing Committee – an organization of over 180 member nations, has approved the NOMAD for standard response kits.

Among the most recent operations to incorporate the NOMAD are the earthquake in Haiti that took the lives of over 300,000, and the plane crash in West Africa



LEFT: The author, consults with chief odontologist Dr. Stephen Knott of the Australia Dental Assessment Team in 2005

RIGHT: The NOMAD is integrated into the curricula of numerous response training programs



The first NOMAD prototype was brought to the temporary DVI morgue at Krabi in December 2004



A glimpse of the unprecedented task of identifying thousands of tsunami victims in Thailand



Bodies are stored in refrigerated containers at Mai Khao until they are cleared for repatriation

that claimed the entire management board of the Australian mining company, Sundance Resources and mining magnate Ken Talbot.

The NOMAD has been used for mass grave exhumations in war crimes investigations, as well as routine police homicide investigations.

Product assessments

Obviously, the most common first reaction of anyone who has only used conventional fixed-arm or portable x-ray heads is that the NOMAD cannot be safe for the operator to hold the device when it is activated. The NOMAD has been studied exhaustively by third-party researchers in academia and laboratories around the world for several years with nothing but full validation of the safety, efficiency and quality claims of the manufacturer. The strongest evidence Aribex has received came from the May 2009 report presented at the Conference of Radiation Control Program Directors in Columbus, Ohio in which the NOMAD handheld intraoral x-ray system (60 kV, constant potential output) was compared side-by-side to a conventional wall-mounted intraoral x-ray system (70 kVp, self-rectified output) in terms of image quality, and patient and staff radiation doses.

The conclusion was that "...this study indicates that the resolution and contrast for the Nomad are superior to the Gendex x-ray system. In addition, the leakage and scattered radiation are lower for the



Royal Thai Police Colonel, Dr. Sutat Charudilaka prepares to deliberate with the Ante mortem/Post mortem Resolution Committee on the forensic evidence collected from several tsunami victims

Nomad compared to conventional, wall-mounted intraoral dental systems. The HVL meets the FDA requirements, with the Gendex having a slightly higher HVL than the Nomad. Both entrance radiation doses and the dose-area products for the two systems are similar.

Occupational doses are lower with the Nomad than with conventional intraoral x-ray systems. This is probably due to the tube shielding design (the Nomad is designed to be hand held and has more shielding around the x-ray tube than a conventional system), the Nomad integral shield to protect the user from scattered radiation,

and the shielded position indicating device (collimator).

Based on the results of this study, use of the Nomad dental intraoral x-ray system results in significantly lower staff doses compared to wall-mounted systems. Consequently, additional measures, e.g., use of lead aprons or stands, are not warranted.”¹

References

- ¹ Image Quality And Radiation Dose Comparison For Intraoral Radiography: Hand-Held, Battery Powered Versus Conventional X-Ray Systems, Presented at CRCPD Annual Meeting May 2009, Edgar Bailey, M.S.E.H.E., C.H.P., Joel Gray, Ph.D., John Ludlow, D.D.S., May 2009.

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