

**LAW ENFORCEMENTS USE OF NANOTECHNOLOGY –
SCIENCE FACT OR SCIENCE FICTION?**

by

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The Command College Futures Study Project is a FUTURES study of a particular emerging issue of relevance to law enforcement. Its purpose is NOT to predict the future; rather, to project a variety of possible scenarios useful for strategic planning in anticipation of the emerging landscape facing policing organizations.

This journal article was created using the futures forecasting process of Command College and its outcomes. Defining the future differs from analyzing the past, because it has not yet happened. In this article, methodologies have been used to discern useful alternatives to enhance the success of planners and leaders in their response to a range of possible future environments.

Managing the future means influencing it—creating, constraining and adapting to emerging trends and events in a way that optimizes the opportunities and minimizes the threats of relevance to the profession.

The views and conclusions expressed in the Command College Futures Project and journal article are those of the author, and are not necessarily those of the CA Commission on Peace Officer Standards and Training (POST).

LAW ENFORCEMENTS USE OF NANOTECHNOLOGY SCIENCE FACT OR SCIENCE FICTION?

In a mid-sized coastal community in California, a grisly homicide has the community paralyzed by fear and the local law enforcement agency is working to bring the perpetrator to justice. Over the past few years, using federal grant money, the agency obtained investigative tools developed with nanotechnology. The Crime Scene Investigators (CSI) responded to the scene of the homicide. While combing the crime scene for evidence, one of the investigators found ammunition casings near the body of the deceased. The investigator used the DNA nano-test kit to analyze the collected casings. The kit, properly used by the well-trained investigator, produced immediate DNA results indicating the identity of the perpetrator.

Investigators quickly made an arrest, restoring a sense of relief amongst area residents. During the court proceeding, investigators presented their findings, evidence collected by using one of the newest forensic tools in their arsenal. The defendant, at the advice of his attorney, admitted culpability and was convicted of the homicide. The use of nanotechnology to convict a murderer receives national media attention and accolades. During the media blitz, the chief was praised for her acquisition of nano-tools and their use by the Department's investigators. In fact, as we looked back years later, this became the seminal case in the use of investigative tools developed through the use of nanotechnology.

The optimistic future described above may represent where we, as a profession, are headed. The near future will bring with it some amazing new technological devices and systems that will, in many ways, rival the decades old imaginings of Hollywood science fiction. Law enforcement will need to get used to that fact and prepare for it. (Policing 2020, 2007) One of the scenarios of our future may be utilizing nanotechnology-manufactured tools designed for law

enforcement use. Is this science fact or science fiction? What nanotech tools are available now or might be “fact” in the very near future? A snapshot of the past will illustrate the absolute need for nanotechnology to manufacture investigative tools.

The Unsolved Violent Crimes

The past is riddled with failed violent crime investigations that may have had very different results with the assistance of nanotechnology available in the near future. For example, the Santa Cruz Sentinel published a story in 2002 about unsolved homicides, including the murder of a 12-year-old who had been found strangled in a park with her hands taped behind her back and masking tape around her neck. Another case involved the body of a 19-year-old woman who had been fished out of the mouth of a river. A third was a University of Santa Cruz student who had been beaten to death at a local State park. In that article, seasoned investigators addressed their hopes for the future and crime investigation. They hoped recent advances in forensic detective work and possible scientific advances in the coming years would offer new leads in cases and help lay these mysteries to rest. (Santa Cruz Sentinel, 2002) Of course, these are just a few of the thousands of homicides occurring every year. As well as the police do to solve many of those crimes, many are left in the trash bin of history. Those victims and their families deserve more.

Timeliness of investigative effort

According to Federal Bureau of Investigation in a 2004 Uniform Crime Report, every 23.1 seconds a violent crime is committed in the United States. Moreover, the report detailed that in 2004 law enforcement agencies cleared just 46.3 percent of violent crimes. (U.S. DOJ, 2004) These statistics stress the importance of acquiring advancing technology, including nanotechnology, law enforcement tools as they will allow for accurate and immediate evidence

collection, results and probable apprehension of the offenders. Had nanotech tools been used in the preceding cases, the perpetrators may have been found immediately, bringing closure to the families of the victims and restoring peace to the communities for which the crimes occurred.

Law Enforcement's use of Nanotechnology

According to William E. Halal, Professor Emeritus of Science, Technology & Innovation at George Washington University, "research in materials and nanotechnology is making it possible to design almost any type of product, and mass customization can deliver an endless stream of sophisticated goods customized for each individual." (Halal, 2008) Nanotechnology, the manipulation or self-assembly of individual atoms, molecules, or molecular clusters into structures, can be used to create materials and devices with new or vastly different properties. (European Nanotechnology Gateway, 2007) On an even smaller scale, the nano world offers high-performance materials, powerful computers, medical treatments, and other benefits yet to be realized. (Halal, 2008)

Nanotechnology promises smaller and more accurate tools and systems, batteries with longer life and incredibly sensitive sensors. (The Indian Police Journal, 2007) Nanotags will be used to coat surfaces to capture DNA, nanoparticles will develop miniature sensors that will detect various illegal drugs, x-ray systems will be enhanced through the use of carbon nanotubes, infrared nanotechnology will expand the uses of searching for missing people and suspects, dusts (known as Clever Dust, Deputy Dust, Daft Dust, Smart Dust and Flashy Dust) may be used to track movements, and miniscule RFID may offer assistance to those who need them the most. (UH ISRC, 2005) The promise of using nanotechnology to investigate criminal activity is rapidly approaching and the use of these newly developing tools may provide the next generation of peace officers their primary method to solve crimes.

According to Lieutenant Colonel Nate Allen, PhD, U.S. Army, “the pace of change mandates that effective leaders understand the implications and promise that the coming technological tsunami holds.” (Halal, 2008) Daniel Linstedt, an internationally known expert in data warehousing business intelligence, proclaimed “Nanotech is already here, and there are limitless utilizations for it.” (Linstedt, 2010)

Mike Pitlethy, the CEO of ROAR Particles, concurs. In a 2009 Materials Today article, Pilethy notes law enforcement agencies have begun to evaluate and use nanotech tools. For instance, the FBI started using a nanoscale developer and x-ray source to image etched fingerprints on a number high profile cases (Pitlethy 2009). This type of nanotech, developed by researchers at Leicester University in England, assists with the detection of fingerprints left on a bullet casing. It can capture a print after the chemicals from the print corrode the surface of the metal. Another fingerprint breakthrough Pitlethy noted was prints captured with nanoscale powders. Nanoscale powders provide clearer images, thus prints developed using nanoscale powders can provide information about whether or not the donor had been handling explosives, handling illegal drugs or if the donor had been using illegal drugs. Although one might have difficulty imagining how this could be used, a recent incident receiving national attention exemplifies the potential of this breakthrough.

On May 1, 2010 in New York’s Times Square, a suspected terrorist abandoned a suspected Vehicle Borne Improvised Explosive Device (VBIED). Had nanoscale powders been utilized, the investigating law enforcement agency could have ascertained explosive compounds while developing leads from fingerprints. Using explosive detection nanotechnology would have provided the investigators valuable officer safety information and excellent trial evidence. Fortunately, the NYPD made a quick arrest without any harm officers or the community. In the

very near future, though, information obtained through explosive detection nano-tools will better ensure the safety of law enforcement officers. Soon, it may be possible to avert VBIED and similar events altogether if the appropriate surveillance nano-tools are deployed in places like New York and other terrorist targets.

The future promises other powerful tools that will prevent crime, safely lead investigators to perpetrators and instantly locate missing at-risk people. For instance, the U.S. Army is testing a wireless health-status system that monitors a soldier's vital signs, location, need for water and other critical indicators. Smart wireless sensors and Radio-frequency Identification (RFID) tags are growing in use and becoming smaller and more powerful. (Halal, 2008) The use of these systems would flourish in the law enforcement world. To have the ability to track wanderers and people with disabilities, such as autism and Alzheimer's, would save lives and provide valuable assistance to the law enforcement community.

According to Thomas J. Cowper, member of the Police Futurists International's Futures Working Group (and 23-year law enforcement veteran), studies show that information processing power has been increasing at an exponential rate for many years and will continue even faster in the future (Policing 2020, 2007). Given the rapid rate of change in the coming years and the new capabilities and opportunities it will bring to policing it is important to remember that we cannot continue "business as usual". To be successful, law enforcement must constantly adapt to changing circumstances driven by technologies and creatively explore better ways of fulfilling their mission. (Policing 2020, 2007) The profession must also be attentive to the social and ethical implications of using nanotech to fulfill aspects of its mission. As Linstedt (2010) noted, "privacy and ethics are a hot debate in the nanotech industry".

Nanotechnology: Locating the Missing

In April 2010, the community of Santa Cruz had been struck with two unfortunate elderly missing person deaths. Both were senior citizens suffering from Alzheimer's and both had walked away from the homes they were placed in to live safely. In one of the cases, the woman had been placed in a care facility on a Friday evening. Within the first 30 minutes of her stay, she walked out the front door without detection. The facility was located in a county adjacent to the county for which she had resided. She wandered for several days until a resident found her lifeless body in an agricultural field ten miles north of the facility her family had intended her to live. The second elderly missing man suffered from dementia and like the woman, he wandered out of a care facility and was found deceased several days later.

In addition to these two incidents, law enforcement worked tirelessly to locate a missing autistic man in the same month. Erik was a 30-year-old autistic man who walked away from home without a trace. Not long after his disappearance, friends and community volunteers posted fliers throughout the county. Sadly, Erik's body washed ashore on a neighboring beach on the last day of the month. Had the families of the missing (and the police charged with finding them) been able to capitalize on emerging rfid and similar nanotech devices, any of the three might have been found alive.

John P. Kotter, the author of *Leading Change*, said "Vision refers to a picture of the future with some implicit or explicit commentary on why people should strive to create that future." (Kotter, 1996) Nanotech is the epitome of envisioning a future state, and then acting on it. Nanotechnology promises smaller and faster computers, smaller and more accurate Global Positioning Systems (GPS), batteries with long life and sensors that are incredibly sensitive and affordable. (Indian Police Journal, 2007) Enhancing the current RFID technology with faster,

more powerful, more sensitive and longer lasting nanotechnology may have future uses that will benefit law enforcement's ability to locate missing people in the quickest manner possible.

Social Implications and Ethical Considerations

To assess the social and ethical implications of utilizing nanotech for law enforcement investigations, a group of subject matter experts convened in September 2009. This group identified several concerns regarding the government's use of this incredibly invasive technology. The most concerning trends identified were:

- Ethical usage; law enforcements use of advancing technology must be ethical and transparent. The panel expressed concerns while relating a nanotechnology scenario that could resemble the L.A.P.D. Rampart scandal if there is no transparency about tools and usage
- Civil rights protections; nanotechnology promises higher quality surveillance systems and concerned was expressed that the technology may be used to obtain information that law enforcement might not otherwise have access to. Privacy rights guaranteed by the Fourth Amendment of the Constitution must be considered and protected
- Information security; concerned was expressed about the information obtained through the use of nanotechnology and that it may be subject to sabotage and theft. Moreover the panel was concerned that information obtained with nanotech could be sold or used inappropriately by private enterprise and corporations
- Reliability of the information; will evidence and information obtained with nanotechnology be reliable and who will have the task of qualifying the information, and,
- Regulatory concerns; what governmental agency will be tasked with regulating the usage of nanotechnology and will that agency have knowledge base and savvy to do so

These experts also discussed events that could affect law enforcement's use of nanotech. Chief amongst their concerns were incidents indicating nanotech was unreliable in practice; that the adverse impact on privacy rights might prompt legislation & court decisions to limit it, and that exposure to nanotech technologies was determined to be harmful to human and environmental health. The panel did identify means by which policing and the nanotech industry might mitigate concerns on the near horizon.

The recommendations included the development of a law enforcement nanotech research team. Advocating for the creation of a law based team of nanotechnology experts that will identify the most appropriate tools for acquisition and that these tools best meet law enforcement's immediate needs. As law enforcement agencies obtain new technology, initial and recurring training must be emphasized. Law enforcement agencies will need to account for the maintenance of nanotechnology tools and create a team of technology experts to assist them with this task. Assessing and writing protocols will assist law enforcement leaders with standards and expectations for the use of nano-tools. Newly enacted laws that regulate governmental use, as well as the creation of a regulatory agency, will provide the public with the transparent use of nanotechnology by governmental entities. Finally, providing secure information storage systems to ensure the information obtained through the use of nanotechnology is used in an ethical and legal fashion and that only those who have legal access to it, can. By planning for future law enforcement technological tools and taking the appropriate steps to ensure ethical and reliable usage, the public sense of security should increase and acceptance should follow.

According to Cowper (Policing 2020), despite our reluctance, things will continue to change. Tomorrow's policing world will be fundamentally different than the one we know today. Technology has always generated profound changes in the way people live, culture,

social norms, business processes, organizational structures and government policies. Policing will become more difficult in the next decade and a half, not less, and in order to understand how we will need to operate with the tools available in the future, we must try to envision how technology will have changed the world from the way it is today. (Policing 2020, 2007)

Cowper points out the necessity of embracing technological changes in the future and the importance of preparing for it. Although there are many promises nanotechnology may offer law enforcement, most importantly law enforcement leaders must take action today to prepare for these powerful crime fighting tools.

The Future

The future holds many promises for law enforcement and the communities they serve. There will be nanotechnology tools available for the detection of crime, investigating crimes, surveillance and tracking tools for those citizens with disabilities that require the assistance of others to track their whereabouts.

Preparing for our future today is the responsibility of our law enforcement leaders. They must know what technology will be available to protect their communities and know how they will acquire it. Our future promises a safer community through the use of nanotechnology. Our duty is to be trained, have set standards and protocols for the ethical usage of this emerging technology, and continually improving our tactics to solve crime and protect the public. Is law enforcements use of nanotechnology science fact or science fiction? It is, in fact, science reality and law enforcement must be prepared.

REFERENCES

- European Nanotechnology Gateway. (2007). *Nanotechnology and Civil Security*. Tenth Nanoforum Report, 4.
- Halal, W. E. (2008). *Technology's Promise*. New York, NY: Palgrave Macmillan.
- Kotter, John P. (1996), *Leading Change*, Harvard Business School Press.
- Linstedt, Daniel (2010), RFID Tracking and Nanotechnology for BI (Business Intelligence). Retrieved on April 23, 2010 from: <http://www.b-eye-network.com>
- Pitlethy, Mike (2009). Nanotechnology and Forensics, *Materials Today*, Volume 12, Number 6. Retrieved on April 23, 2010 from:
<http://www.sciencedirect.com/sciencematerialstoday.com>
- Policing 2020: Exploring the Future of Crime, Communities, and Policing. (2007) *Information Age Technology and Network Centric Policing*. Retrieved August 7, 2009, from <http://www.policefuturist.org/pdf/policing2020.pdf>
- Santa Cruz Sentinel. (2002). Retrieved August 7, 2009, from <http://67.15.208.115/story.php?sid=18298&storysection=local&fromsearch=true&searchterm=s=slaying>
- Sonoma Sheriff's Department Press Release. (2006). *Jenner Homicide Investigation Update*. Retrieved August 21, 2009, from <http://www.wzzm13.com/pdf/050206-pressrelease.pdf>
- The Indian Police Journal. (2007). *Nanotechnology in Law Enforcement and Crime Investigation*. Retrieved August 21, 2009, from <http://www.bprd.gov.in/final-BPRD-Jan-Mar20076309674775.pdf>
- UH ISRC Technology Briefing. (2005). *Smart Dust*. Retrieved August 7, 2009, from <http://www.uhisrc.com/ftb/Smart%20Dust/Smart%Dust.pdf>

United States Department of Justice. (2004). *Crime in the United States 2004, Uniform Crime Reports*. Retrieved May 26, 2010, from

http://www.fbi.gov/ucr/cius_04/documents/cius2004.pdf

University of Surrey. (2008). *Science Physics Tech Nano News*. Retrieved August 7,

2009, from <http://www.physorg.com/news136808322.html>