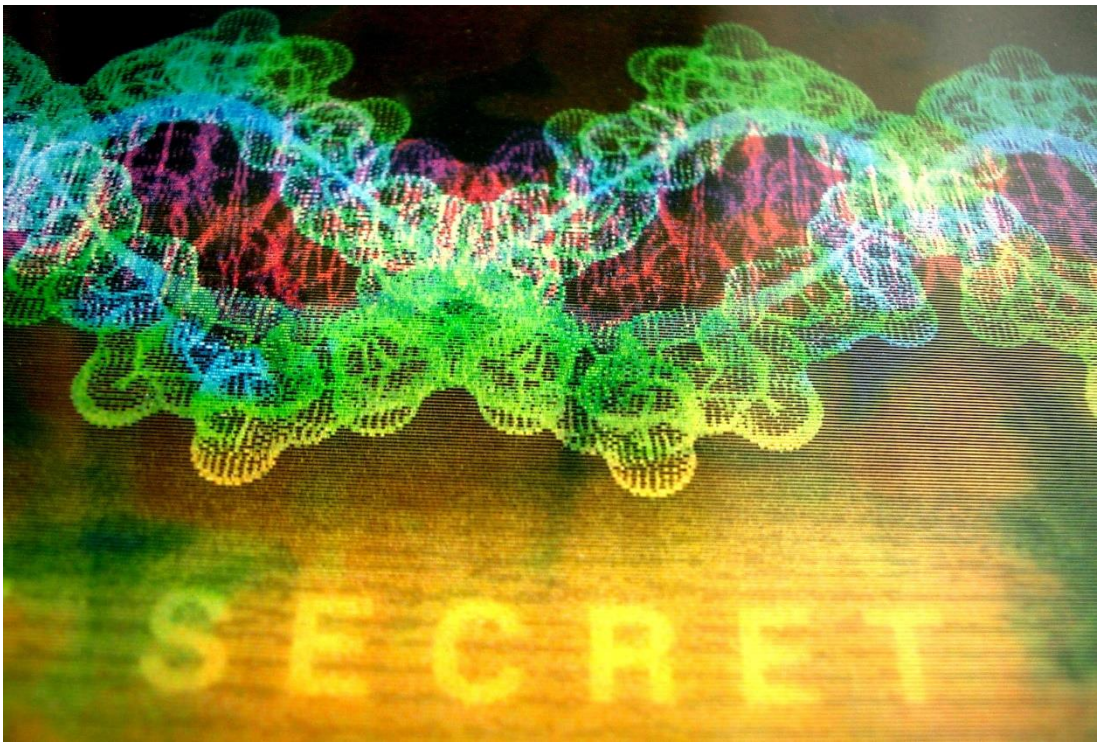
Nanotechnology

Ancient And Modern



By JC Ryan

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Nanotechnology Is Ancient History

Practically every day, distinct forms of knowledge are lost forever — no copies are available. When a natural disaster hits or a war breaks out, libraries, archives, museums, monuments and other artifacts of heritage, valuable buildings, incunabula and unique objects are destroyed or face the threat of destruction. These events usually remove pieces of human knowledge and sometimes entire cultures.

The vast majority of the knowledge humans have assembled over the centuries, has been lost. The world's geniuses either kept their revelations to themselves and then died, or else they put it down on paper which has long since rotted or burned.

Obviously, we'll never know what has been lost to time. Occasionally, however, items from the remote past are discovered, quite well preserved. Here are a few of them:

In the ancient times, nanotechnology was used by the Damascans to create swords which we can’t replicate today. The Romans crafted iridescent glassware (the Lycurgus cup), which left our modern scientists in awe.

In 1991, the discovery of tiny, coil-shaped artifacts which could only be seen under an electron microscope were found near the banks of Russia’s Kozhim, Narada, and Balbanyu rivers. This discovery brought about a debate that has continued to this day. These mysterious and minuscule structures suggest that there may have been a culture capable of developing nanotechnology 300,000 years ago.

So, were our ancient ancestors also nanotechnologists? And what can today's scientists learn from such historic artifacts?

The manipulation of material at the atomic and molecular scale to create new functions and properties sounds like it should be a profoundly modern concept. By modern-day standards, they were working in a branch of nanotechnology called nanocomposites. These are bulk materials in which nanoscale particles are mixed to improve the properties of the overall or composite material.

There are a number of relatively famous examples of ancient artifacts which were created using nanocomposites.

Damascus Steel

Damascus steel was an impossibly strong type of metal that was widely used in the Middle East from 1100-1700 AD. It is most famously associated with swords and knives. Blades forged with Damascus steel were known for their amazing strength and cutting ability, and were said to be able to slice rocks and other metals—including the blades of weaker swords—cleanly in half. The blades are believed to have been created using wootz steel, which was most likely imported from India and Sri Lanka and molded and blended to create a patterned blade. The special quality of the swords is thought to have derived from this process, which weaved together tough cementite and soft iron to form a metal that was as strong as it was flexible.

The particular process for forging Damascus steel appears to have disappeared sometime around 1750 AD. The exact cause for the loss of the technique is unknown, but there are several theories.

The most popular is that the supply of ores needed for the special recipe for Damascus steel started running low, and sword makers were forced to develop other techniques.

Another is that the whole recipe for Damascus steel—specifically the presence of carbon nanotubes—was only discovered by accident, and that sword smiths didn't actually know the technique by heart. Instead, they would simply forge the swords en masse, and test them to determine which met the standards of Damascus steel.

Whatever the technique, Damascus steel is one technology that modern experimenters have been unable to fully reproduce.

There are pattern welded knives that are marketed as being made from “Damascened steel”, but while usually well made, they are only approximations of the lost technique for real Damascus steel.

The Lycurgus Cup

The stunning Lycurgus cup reveals a brilliant red when light passes through its sections of glass containing gold-silver alloyed nanoparticles.
Photograph: British Museum Images

The glass chalice, known as the Lycurgus Cup because it bears a scene involving King Lycurgus of Thrace, appears jade green when lit from the front but blood-red when lit from behind—a property that puzzled scientists for decades after the museum acquired the cup in the 1950s.

The mystery wasn’t solved until 1990, when researchers in England scrutinized broken fragments under a microscope and discovered that the Roman artisans were nanotechnology pioneers: They’d impregnated the glass with particles of silver and gold, ground down until they were as small as 50 nanometers in diameter, less than one-thousandth the size of a grain of table salt. The exact mixture of the precious metals suggests the Romans knew what they were doing, “an amazing feat,” says one of the researchers, archaeologist Ian Freestone of University College London.

The ancient nanotech works something like this: When hit with light, electrons belonging to the metal flecks vibrate in ways that alter the color depending on the

observer's position. Gang Logan Liu, an engineer at the University of Illinois at Urbana-Champaign, who has long focused on using nanotechnology to diagnose disease, and his colleagues realized that this effect offered untapped potential. "The Romans knew how to make and use nanoparticles for beautiful art," Liu says. "We wanted to see if this could have scientific applications."

The colorful secret of a 1,600-year-old Roman chalice at the British Museum is the key to a supersensitive new technology that might help diagnose human disease or pinpoint biohazards at security checkpoints.

Note: The information above was extracted from an article by Zeeya Merali published in the Smithsonian Magazine in September 2013. The article is titled: This 1,600-Year-Old Goblet Shows that the Romans Were Nanotechnology Pioneers. You can read the full article here.

http://www.smithsonianmag.com/history/this-1600-year-old-goblet-shows-that-the-romans-were-nanotechnology-pioneers-787224/

300,000-Year-Old Nanotechnology

The discovery of extremely tiny, coil-shaped artifacts, made from copper, tungsten and molybdenum, found near the banks of Russia's Kozhim, Narada, and Balbanyu rivers in 1991, brought about a debate that has continued to this day.

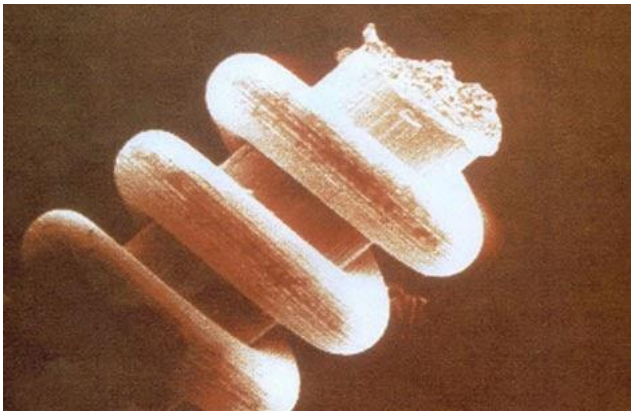
These mysterious and minuscule structures suggest that there may have been a culture capable of developing nanotechnology 300,000 years ago.

In case you weren't aware, today tungsten is used for hardening special steels and for the filaments of light bulbs; molybdenum is used for hardening steel and giving anti-corrosion properties to tools.

The size of these artifacts range from 1.2 inches (3cm) down to an incredible 0.003 millimeters. Exact measurements (using electronic microscopes) show that these tiny artifacts are constructed according to the “phi proportion” (also known as the “golden section”). You’re probably familiar with the “phi proportion”. In ancient times this fraction was the iron rule in geometry and architecture.

There is no doubt that these microscopically tiny artifacts are the product of some inexplicable and highly advanced technology from the past and bear some remarkable resemblances to control elements used in micro-miniature devices in our latest technology “nanomachines”.

These artifacts were found from 10 to 40 feet (3 to 12 meters) underground and have been dated at 20,000 to 300,000 years old.



A magnified image of one of the nano coils found in the Ural Mountains. Photo credit: Mysteries of the World, Herbert Genzmer and Ulrich Hellenbrand.

Examination and analysis of these artifacts has been undertaken at four institutions: the Russian Academy of Science in Moscow, in Syktyvkar, and in St. Petersburg, as well as the Helsinki Institute (Finland).

The investigative report, from the Central Scientific Research Department of Geology and Exploitation of Precious Metals (in Moscow), dated November 11, 1996, was written by Dr. E.W. Matvejeva, who concludes that the objects are of “technological origin”.

The question that must be asked is, Who, thousands of years ago, was able to manufacture such micro-filigree objects – something our technology is only now beginning to achieve?

And A few More

Writing on metal plates

Gold tablets dating back to the time of King Darius of Persia, 521- 486 BC, provide evidence that men wrote on metal plates in ancient times.

Laminated (6-ply) wood

The earliest object in Egypt made of laminated wood (plywood) was in "a coffin whose sides were made of six thin superimposed layers of wood with the grain alternating as in modern plywood." (Jean-Philippe Lauer, *Saqqara*, p.99)

Ancient chemistry science

Artifacts in Louvre Museum have revealed that the ancient Egyptians had discovered sophisticated chemistry techniques 4,000 years ago. And they used their scientific skills (developed centuries ahead of their time) to create better eye make-up.

Until now, scientists believed that Egyptians were able only to produce compounds through grinding and heating ingredients. But analysis of face powders stored in their original containers, dating back to 2000 BC, reveal compounds that could be produced only through "wet" chemistry, which involves chemical reactions caused by mixing compounds.

The clue to the Egyptian secret was two lead-based compounds – laurionite and phosgenite – found in cosmetic jars.

What Is Nanotechnology?

Nanotechnology (sometimes shortened to "nanotech") is the manipulation of matter on an atomic, molecular, and supramolecular scale. The earliest, widespread description of nanotechnology referred to the particular technological goal of precisely manipulating atoms and molecules for fabrication of macroscale products, also now referred to as molecular nanotechnology.

A more generalized description of nanotechnology was subsequently established by the National Nanotechnology Initiative, which defines nanotechnology as the manipulation of matter with at least one dimension sized from 1 to 100 nanometers. This definition reflects the fact that quantum mechanical effects are important at this quantum-realm scale, and so the definition shifted from a particular technological goal to a research category inclusive of all types of research and technologies that deal with the special properties of matter that occur below the given size threshold.

It is therefore common to see the plural form "nanotechnologies" as well as "nanoscale technologies" to refer to the broad range of research and applications whose common trait is size. Because of the variety of potential applications (including industrial and military), governments have invested billions of dollars in nanotechnology research.

Through its National Nanotechnology Initiative, the USA has invested 3.7 billion dollars. The European Union has invested 1.2 billion and Japan 750 million dollars.

Scientists currently debate the future implications of nanotechnology. Nanotechnology may be able to create many new materials and devices with a vast range of applications, such as in medicine, electronics, biomaterials and energy production. On the other hand, nanotechnology raises many of the same issues as any new technology, including concerns about the toxicity and environmental impact of nanomaterials, and their potential effects on global economics, as well as speculation about various doomsday scenarios.

These concerns have led to a debate among advocacy groups and governments on whether special regulation of nanotechnology is warranted.

http://en.wikipedia.org/wiki/Nanotechnology

How it Started

The ideas and concepts behind nanoscience and nanotechnology started with a talk entitled “There’s Plenty of Room at the Bottom” by physicist Richard Feynman at an American Physical Society meeting at the California Institute of Technology (CalTech) on December 29, 1959, long before the term nanotechnology was used. In his talk, Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules. Over a decade later, in his explorations of ultraprecision machining, Professor Norio Taniguchi coined the term nanotechnology. It wasn't until 1981, with the development of the scanning tunneling microscope that could "see" individual atoms, that modern nanotechnology began.

It’s hard to imagine just how small nanotechnology is. One nanometer is a billionth of a meter, or $10^{9}$of a meter. Here are a few illustrative examples: There are 25,400,000 nanometers in an inch. A sheet of newspaper is about 100,000 nanometers thick. On a comparative scale, if a marble were a nanometer, then one meter would be the size of the Earth

Nanoscience and nanotechnology involve the ability to see and to control individual atoms and molecules. Everything on Earth is made up of atoms—the food we eat, the clothes we wear, the buildings and houses we live in, and our own bodies.

But something as small as an atom is impossible to see with the naked eye. In fact, it’s impossible to see with the microscopes typically used in a high school science classes. The microscopes needed to see things at the nanoscale were invented relatively recently—about 30 years ago.

Once scientists had the right tools, such as the scanning tunneling microscope (STM) and the atomic force microscope (AFM), the age of nanotechnology was born.

Nanotechnology Applications: A Variety of Uses

http://www.understandingnano.com/nanotech-applications.html

Nanotechnology applications are found in:

Medicine

Researchers are developing customized nanoparticles the size of molecules that can deliver drugs directly to diseased cells in your body. When it's perfected, this method should greatly reduce the damage treatment such as chemotherapy does to a patient's healthy cells.

Electronics

Nanotechnology holds some answers for how we might increase the capabilities of electronics devices while we reduce their weight and power consumption.

Food

Nanotechnology is having an impact on several aspects of food science, from how food is grown to how it is packaged. Companies are developing nanomaterials that will make a difference not only in the taste of food, but also in food safety, and the health benefits that food delivers.

Fuel Cells

Nanotechnology is being used to reduce the cost of catalysts used in fuel cells to produce hydrogen ions from fuel such as methanol and to improve the efficiency of membranes used in fuel cells to separate hydrogen ions from other gases such as oxygen.

Solar Cells

Companies have developed nanotech solar cells that can be manufactured at significantly lower cost than conventional solar cells.

Batteries

Companies are currently developing batteries using nanomaterials. One such battery will be a good as new after sitting on the shelf for decades. Another battery can be recharged significantly faster than conventional batteries.

Space

Nanotechnology may hold the key to making space-flight more practical. Advancements in nanomaterials make lightweight spacecraft and a cable for the

space elevator possible. By significantly reducing the amount of rocket fuel required, these advances could lower the cost of reaching orbit and traveling in space.

Fuels

Nanotechnology can address the shortage of fossil fuels such as diesel and gasoline by making the production of fuels from low grade raw materials economical, increasing the mileage of engines, and making the production of fuels from normal raw materials more efficient.

Better Air Quality

Nanotechnology can improve the performance of catalysts used to transform vapors escaping from cars or industrial plants into harmless gasses. That's because catalysts made from nanoparticles have a greater surface area to interact with the reacting chemicals than catalysts made from larger particles. The larger surface area allows more chemicals to interact with the catalyst simultaneously, which makes the catalyst more effective.

Cleaner Water

Nanotechnology is being used to develop solutions to three very different problems in water quality. One challenge is the removal of industrial wastes, such as a cleaning solvent called TCE, from groundwater. Nanoparticles can be used to convert the contaminating chemical through a chemical reaction to make it harmless. Studies have shown that this method can be used successfully to reach contaminates dispersed in underground ponds and at much lower cost than methods which require pumping the water out of the ground for treatment.

Chemical Sensors

Nanotechnology can enable sensors to detect very small amounts of chemical vapors. Various types of detecting elements, such as carbon nanotubes, zinc oxide nanowires or palladium nanoparticles can be used in nanotechnology-based sensors. Because of the small size of nanotubes, nanowires, or nanoparticles, a few gas molecules are sufficient to change the electrical properties of the sensing elements. This allows the detection of a very low concentration of chemical vapors.

Sporting Goods

If you're a tennis or golf fan, you'll be glad to hear that even sporting goods have wandered into the nano realm. Current nanotechnology applications in the sports arena include increasing the strength of tennis racquets, filling any imperfections in club shaft materials and reducing the rate at which air leaks from tennis balls.

Fabric

Making composite fabric with nano-sized particles or fibers allows improvement of fabric properties without a significant increase in weight, thickness, or stiffness as might have been the case with previously-used techniques.

Nanotechnology In Warfare

Bionic Hornet And Nanoparticle Armor

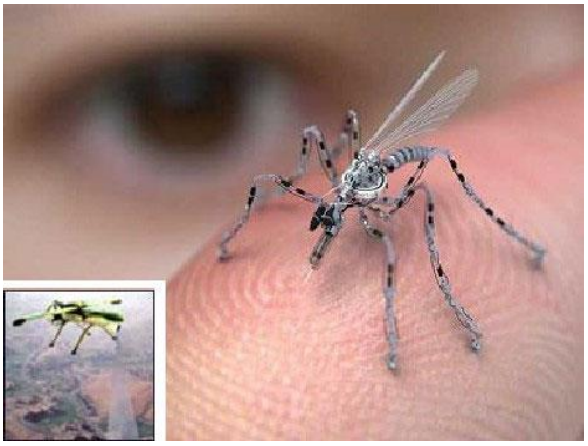
http://weburbanist.com/2008/08/17/15-astonishing-real-life-applications-of-nanotechnology/

Bionic Hornet

Sticking with military matters, the Israeli Defense Forces are drawing on the latest breakthroughs in nanotechnology to update their weapons. One notable application is known colloquially as the Bionic Hornet.

No bigger than an average wasp, the flying device is designed to seek out, follow, photograph and even kill selected opponents.

According to Israel's Deputy Prime Minister Shimon Peres, *"It's illogical to send a plane worth $100 million against a suicidal terrorist. So we are building futuristic weapons."* Are they ever!



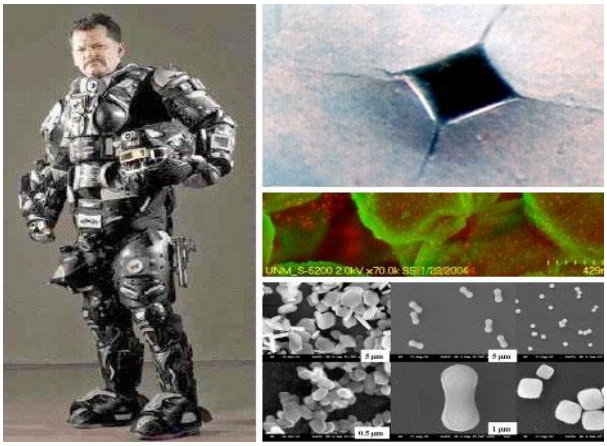
(image via: Sydney Morning Herald)

Nanoparticle Armor

With so many soldiers killed or injured by roadside bombs and IEDs over the past half-decade, intensive research has been devoted to improving the body armor worn by troops sent into harm's way.

The project even has official sanction and a neat acronym: NNI, the National Nanotechnology Initiative. A $15 million contract awarded to the University of Dayton Research Institute by the U.S. Army's Research Laboratory's Survivability Branch is funding the development of nanoparticle armor to protect not only soldiers, but the vehicles they ride in.

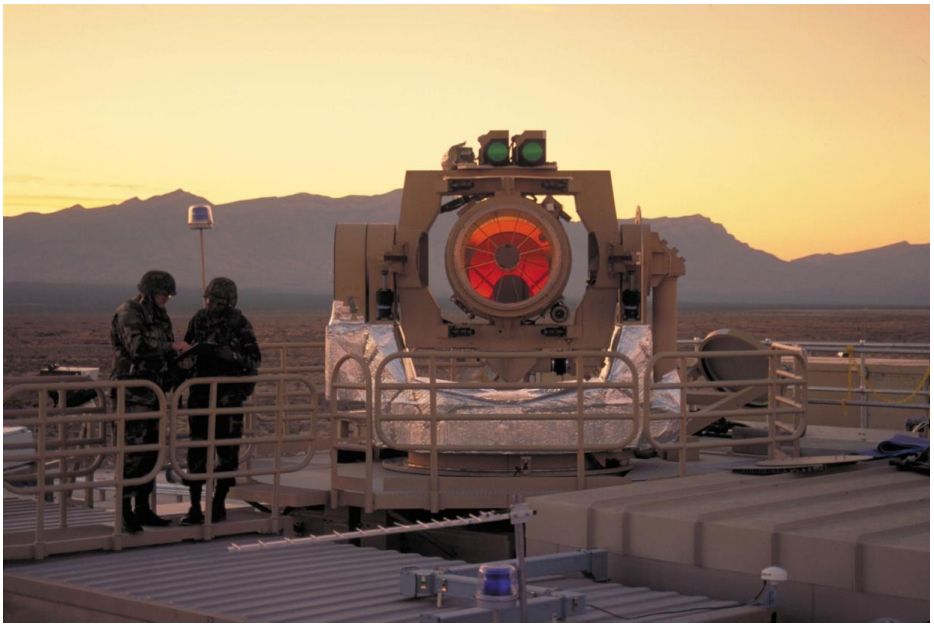
By infusing nanoparticles into ceramic materials used in military armor, both porosity and structural strength are increased. It is hoped that the improved armor is perfected and introduced as soon as possible.



(image via: **CCMC Research**)

A Laser Weapon

The Future of Nanotechnology in Warfare by Hitoshi Nasu - Global Minds July 4, 2013 http://www.theglobaljournal.net/article/view/1132/



In April 2013, the US Navy announced the deployment of a laser weapon on the USS Ponce. The YouTube image they posted at the same time demonstrates how effective it is to damage an unmanned aerial vehicle. The image might have excited some sci-fi movie fans around the world, envisioning the arrival of futuristic weapons, like 'phasers' familiar to 'Trekkies'. It is expected that these

laser weapons will be more widely deployed with the aim to strengthen defense capabilities against missiles, artillery and mortars.

The revelation of a laser weapon was not unexpected. Indeed, the history of the pursuit of laser weapons is as old as the nuclear arms race during the Cold War. The idea of laser weapons was already hinted as a potential counter-strike onto a nuclear ballistic missile. Although the technical details of the laser weapon announced for deployment is kept secret, there is little doubt that the rapid development of nanotechnologies over the last decade has enabled significant improvement of different components of the solid-state laser system that makes it deployable as a weapon.

A greater excitement may be forthcoming with the prospect of further fine-tuning of the laser technology to provide a wider range of tactical options - like a weapon that can be set for 'stun' up to 'kill'. Even the existing laser weapon the US Navy announced for deployment has the ability of limiting the damage to the targeted aircraft, rather than destroying it like with a missile. Ethicists may envision the arrival of a more humane warfare in the near future where a less lethal force will always be used prior to lethal means.

5 Ways Nanotechnology Will Change Warfare

http://www.listosaur.com/science-a-technology/5-ways-nanotechnology-will-change-warfare/

1. New Materials Will Lead to Better Protective Vests and Uniforms

A soldier wears a nanotech-based tactical vest while on patrol in Iraq; USAF photo

Protecting soldiers in combat while maintaining their mobility is a big concern for military leaders and nanotechnology has already produced lighter, stronger body

armor. The newest generation of Improved Outer Tactical Vest (IOTV) can stop rifle rounds and shrapnel more effectively, yet is 3 pounds lighter than vests manufactured just a decade ago. Nanocomp Technologies Inc. is manufacturing an ultra-thin material from carbon nanotubes. Nanocomp says that 100 sheets of this material, which resembles carbon paper, has the thickness of a few business cards, but can stop a 9mm bullet. Future vests will likely do much more than stop projectiles. The U.S. military has partnered with MIT, through the Institute for Soldier Nanotechnologies, to develop vests that may be as light as spandex, but can also monitor a soldier's health, help compress wounds and administer first-aid drugs, and immediately sense and react to chemical and biological threats.

2. Miniature Drones Will Increase Surveillance Options

The Nano Hummingbird weighs less than a Double A battery; DARPA

During the last decade unmanned aerial vehicles, or drones, have become an almost ubiquitous part of U.S. military operations. The demands of the War on Terror are pushing the technology in different ways, including miniaturization. UAV manufacturer AeroVironment has developed a new generation of Nano Air Vehicles that resemble large hummingbirds. These drones weigh less than a Double A battery and are able to conduct surveillance even indoors. Other researchers have demonstrated insect-sized drones the size of a quarter.

3. Nanotechnology Will Create a New Class of Ships and Vehicles

Nanotechnology may help make possible Transformer-type ground-to-air vehicles; DARPA

Half a century ago, a little-known U.S. defense agency known as the Defense Advanced Research Projects Agency (DARPA), developed the earliest versions of the Internet and the Global Positioning System. Today, borrowing a page from popular culture, DARPA operates something known as the Transformer (TX) Program, which is striving to build a Transformer-type vehicle that can drive like a truck but rearrange itself into a helicopter. One of the problems is that the hinges and hardware needed to make this transformation are very heavy, which has obvious drawbacks. New nanomaterials that change shape when voltage is applied could make these vehicles possible in the near future. Other future advances in nanotechnology might make it possible to build large ships that could be operated by a crew of a few dozen, rather than thousands of sailors. Finally, you have the Holy Grail in nanotechnology for the military: Cloaking devices made of metamaterials that could hide troops, vehicles or even a ship. The technology is still in its infancy, but every month seems to bring another demonstration of scientists showing off advances in this field.

Current applications of nanotechnology aren't as exciting as a fleet of Transformers, but that makes them no less useful to the military. Ships and submarines are plagued by the unrelenting corrosive power of salt water and it costs the Navy hundreds of millions of dollars every year to maintain and repair the fleet. Nano-enhanced ceramic coatings are being applied to metal hulls and machinery to reduce wear and tear and extend the life of ships. The U.S. Air Force

is looking at ways to use carbon nanotube polymer composites to make aircraft wings that can change shape to improve flight characteristics.

4. Nano Computers Would Have Countless Uses on the Battlefield

Microscopic nanocubes developed in research for nanoprocessors; BASF

According to Moore's law, computer-processing power doubles roughly every two years. Today's microcomputers bear this out, but nanotechnology promises to revolutionize computers. Microprocessors could soon be replaced with nanoprocessors using exotic biochemical and quantum technologies. Nanocomputers could be incorporated into bullets, creating a projectile capable of correcting its path in flight, like a mini cruise missile. Or imagine tiny computers the size of dust particles that could be released into buildings or into the air to monitor enemy activity. These smaller, more powerful nanoprocessors will also result in great leaps in artificial intelligence, leading to more advanced robots.

5. Nanotechnology Could Make War Unthinkable, Leading to Peace

Some scholars believe the perils of future warfare will lead to lasting peace:

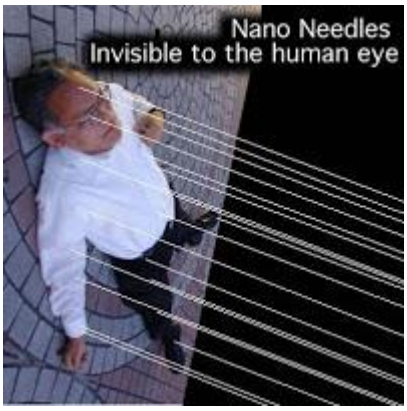
Jonathon Colman

The policy of Mutual Assured Destruction (MAD) during the Cold War era helped prevent nuclear war between the U.S. and the Soviet Union by promising to utterly destroy both sides regardless of who fired the first missile. Some experts believe that the use of nanotechnology in the military could have a similar deterrent effect. Some futurists worry that nanotechnology will create scenarios even more frightening than nuclear war. Imagine a country — or terrorist group — releasing armies of malicious nanobots that can self-replicate at a geometric rate. Nanotechnology pioneer Eric Drexler contends in his book Engines of Creation, "…to destroy all life with [nano] replicators would require only a single speck made of ordinary elements." This kind of awesome power would have to be wielded with the utmost care or the dark science fiction scenarios of machines wiping out mankind could be our future.

Ironically, these very threats posed by nanotechnology advances could make countries more reluctant to engage in war in the future. Of course, we heard this same argument decades ago, about how the destructive power of the atomic bomb would result in lasting peace.

Nano Weapons of the near future

http://alfin2100.blogspot.com.au/2008/05/nano-weapons-of-near-future.html



Nano-weapons are coming soon. No one knows exactly when, but you can be sure that they will see you before you see them!

Here are just some of the possibilities:

Nano-Scouts
Using technologies that effectively "lives on" and controls live insects, the proverbial "fly on the wall" may have literally hundreds or even thousands of parasitic nano-scouts living on its exterior....

Nano-Poisons
Most people instantly think of poison as a tool for killing someone. But nanotechnology, with its ability to trigger specific brain functions, will provide a whole new menu of poison options. As an example, a liar-poison will make it impossible for someone to tell the truth. A kleptomaniac poison will make it impossible for the person to stop stealing things. An alcoholic poison will make a person unable to stop drinking alcohol. The obesity poison will cause a person to eat themselves to death. And my favorite - - we'll call it the "frontal lobotomy poison," - - will make a person incapable of being angry or mean.

Nano Force Fields
Any field powerful enough to keep the bad guys out is also capable of keeping the bad guys in....

Nano Mind Erasers
Neutralizing a person's memory can often be a more powerful defense than killing them. Micro fields flaring up in a succession of unnoticeable tiny brain bursts may wipe sections of a brain clean without anyone ever noticing. Alzheimer's in a can.

Nano Needles
Invisible to the human eye, nano diameter needles will be shot like clusters of bullets from great distances to "pin" people to a wall or freeze their physical movement. Nano needles, because of their tiny diameter, will be the ultimate non-lethal weapon, leaving no visible wounds and causing no permanent damage.

Water Bullets
As a different kind of non-lethal weapon, self-contained water balls, formed around an elevated surface tension containment system, will be used to knock people down, temporarily rendering them harmless.

Desynchronized Energy Fields
Binary power, created by the intersection of two otherwise harmless beams, has the ability to disrupt the energy fields in an individual. A person with desynchronized energy fields will feel extremely fatigued, and pushed to a more extreme level, will drop unconsciously to the ground. A new form of stun-gun.

Nano Heart-Stoppers and Stroke Inducers
... nano-blood flow restrictors that induce excruciating pain and reduce the victim to a fraction of who they once were, over a long period of time, have the side benefit of telling the world "don't mess with me" or you'll end up like this guy.

A future of nano-dust spies, sentinels, assassins, and defensive weapons, is one that most of the world's military specialists are unprepared for — to say nothing of the average world citizen. Yet most of these weapons are far closer and easier to devise and build, than the molecular nano-assembler — the horn of plenty that most people think of when they think of a nanotechnological future.

Nano-weapons combined with bio-weapons, chemical weapons, and genetic weapons, provide the budding world religious or ideological dictator with far more ultimate power than a few nuclear weapons.

Additional Reading

Nanotech weaponry
http://crnano.typepad.com/crnblog/2004/02/nanotech_weapon.html

Molecular manufacturing raises the possibility of horrifically effective weapons. As an example, the smallest insect is about 200 microns; this creates a plausible size estimate for a nanotechnology-built antipersonnel weapon capable of seeking and injecting toxin into unprotected humans. The human lethal dose of botulism toxin is about 100 nanograms, or about 1/100 the volume of the weapon. As many as 50 billion toxin-carrying devices—theoretically enough to kill every human on earth—could be packed into a single suitcase.

Nanotech Sniffer dogs
http://www.ibtimes.co.uk/nanotech-nose-sniffs-out-bombs-five-metres-away-1454770

Nanotech could make nuclear weapons much, much tinier
http://io9.com/5377752/nanotech-could-make-nuclear-weapons-much-much-tinier

The future of war
http://www.thenanoage.com/military.htm

Nanotech news
http://nanotech.einnews.com/news/nanotech-weapons This site has lots of articles about nanotech

Industrial applications of nanotechnology
http://en.m.wikipedia.org/wiki/Industrial_applications_of_nanotechnology

Military uses of nanotechnology
http://www.thenanoage.com/military.htm

Center for Responsible Nanotechnology
http://www.crnano.org/dangers.htm

Nanotechnology promises more destructive weapons than nuclear
http://www.neno-tech-views.com/nanotechnology-promises-more-destructive-weapons-than-nuclear

5 ways nanotechnology could kill us all
http://nakedlaw.avvo.com/environment/5-ways-nanotechnology-could-kill-us-all.html

Future nanotech weapons will disable, not kill
http://www.positivefuturist.com/archive/24.html

More Sites about danger of Nanotech
http://www.juragentium.org/topics/wlgo/en/nuclear.htm

http://militaryanalysis.blogspot.com.au/2009/05/nano-weaponry.html

http://www.crnano.org/dangers.htm

http://nanogloss.com/nanotechnology/nanotechnology-dangers/#axzz36s4gf3P5

http://www.wisegeek.org/what-are-the-possible-dangers-of-nanotechnology.htm#didyouknowout

http://www.rense.com/general79/nano.htm

http://en.m.wikipedia.org/wiki/Nano-thermite

http://www.aleph.se/Nada/InfoWar/nano.html