

Human Performance Optimization Technology

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Abstract

Innovation and Performance could give DOD extraordinary power in future military operations when it and its individual segments are advanced. We are continually pushing the envelope of innovation and execution. Be that as it may, the headway in those regions must be enhanced for the human part. Human performance innovation advancement has a tendency to be treated with respect. It is romanticized as the exact, controlled, and consolidated utilization of specific substances and gadgets over the short and long haul to accomplish streamlining in a man or unit's execution in general. These mechanical advances have huge effects in the therapeutic and operational practical ranges. The enhancement of innovation and human performance will involve a range going from intra-human (e.g., biotechnology and pharmacology) to additional human (e.g., equipment and programming) that incorporates preparing, hardware, and surgery. The development of these new mechanical advances has prompted some imaginative disclosures with man-machine interfaces. The primary goal of this research paper is to analyze the pros and cons of the HPO technology and its potential impacts on the Department of Defense.

Introduction

The military consistently endeavours to enhance its warfighter ability. With that in mind, human performance optimization (HPO) activities have turned out to be crucial in the journey of expanding and maintaining mission availability. Assist in the new condition with an accentuation on the military administration working pair as a joint constraint and in light of developing dangers to national security. HPO activities have turned into all the more essential procedures for enhancing and upgrading the human execution abilities of warfighters for the U.S. military to accomplish asymmetric control over its foes[1].

Some portion of the larger objective of DoD for building up a system for human performance improvement incorporates institutionalizing how the term is characterized and measured and considering changes in how HPO activities are executed with a thought for particular administration necessities. In any case, the characterization of HPO has been conflicting since HPO implies several things to various individuals. A panoply of terms utilized synonymously with human execution advancement has developed. These terms incorporate human weapon framework^[2], human execution improvement^[3], individual execution assessment^[4], and human performance alteration^[5].

Outline Of The Paper

The Paper is composed of five sections. The initial section provides a working definition of Human Performance Technology. The next three sections are comprised of the following subject areas: Performance fueling, Nanotechnology and Optimization of mental and cognitive capacity (Brain stimulation). These parts will provide advantages and disadvantages and additional justifications as to why DoD should continue research and development in the area of Human Performance Technology. Section IV is the recommendation based on the analysis provided, and the final chapter is the conclusion.

Human Performance Optimization technology supports advancement in military capability. The optimization of technology coupled with the man-machine interface provides for a more efficient and lethal force. Technology is the key to continued military superiority.

Performance Fueling:

Much the same as a Formula One race auto relies on the correct fuel to push it to the highest speeds; our bodies require the correct fuel to impel them to the best execution. Help yourself out and make a filling arrangement in light of your workouts and rivalries, with the guideline of the “right fuel at the opportune time” as a top priority.

Definition:

Performance Nutrition, by definition, is sustenance’s commitment to the supportable execution of intellectual and physical activities by the human body to the best degree feasible under indicated conditions and goals. The coveted end condition of execution powering is to coordinate the strategic planning of fuel to the work being performed for improved mission execution and recuperation. A few occupations are more psychological than physical and consequently require distinctive execution-filling techniques. What functions admirably for an Army Ranger or a Navy Seal doesn’t work so well for a Soldier or Sailor with an occupation that binds them to a work area throughout the day?

Powering For Performance:

How does the appropriate planning of dinners influence both games, as well as scholarly and war contender execution? Nutrition is basic for both scholastic and game execution. An eating regimen that is satisfactory in starch, protein, solid fat, vitamins, minerals, and liquid is the establishment of everyday food for general well-being. As critical as what to eat, however, is the point at which an understudy competitor eats. The correct fuel at the ideal time impacts how well they feel, learn, perform and recuperate.

Trooper Fueling is what the Army calls this activity. Alternate administrations will have their particular names for the joint program. However, the reason will be the same: to give Service individuals healthful rules given the occupations that they do.

Nutrition:

A key portion of execution sustenance is the strategic planning of fuel (supplements and liquids) as indicated by the work being performed and the assignments requested. The ideal time for refuelling after a strenuous mission is 30-45 minutes after the movement. Starches and protein are key jolts amid this anabolic (building) recuperation, organising and permitting the Soldier to quickly re-connect with more vitality. Warriors running on “purge tanks” are less successful than the individuals who have set aside the opportunity to fuel. This sort of refuelling, alluded to as quick refuelling, is a vital apparatus for soldiers who have restricted time between engagements. Preferably, the Soldier would have the capacity to get three suppers and snacks to meet his aggregate supplement needs for the duration of the day; however, adversary activity may meddle, making it necessary to refuel at key interims to maintain execution quickly.

The fancied end condition of execution powering is to coordinate the strategic planning of fuel to the work being performed for improved mission implementation and recuperation. A few employments are more subjective than physical and along these lines require various execution filling strategies (“Performance Fueling: A New Human Performance Optimization Initiative”)^[6]

Effect Of The Fueling On The Performance

1. A) Supplement timing provides strong support to the HPO. The planning of supplement admission will influence the individual’s physical, behavioural, and intellectual prosperity. Supplement schedule, in this manner, is essential to keep up sufficient vitality sometime recently while performing and even after missions to enhance execution, rest, and diminish recuperation time. Sustenance benefit foundations ought to consider the preparation timetable and missions of the populaces they administer to empower supplement timing.
2. B) Starch electrolyte drinks or sugar-containing nibble nourishment can maintain Warfighter execution while delaying strenuous work in difficult situations under conditions. One approach is to substitute the utilization of sugar electrolyte drinks and water amid training sessions or physical activities.
3. C) Diminished calorie menus bolster HPO.

(1) In support of HPO, each battalion military eating office will offer decreased calorie menus (1,500 to 1,600 calories a day). Add up to fat ought not to surpass 30 per cent of the vitality esteem. Every feast ought to contain around 500 calories. Usage techniques, as well as individual cases of a strategy for diminished calorie menus, will be endorsed by every military service.

(2) In support of HPO, army military eating offices serving populaces with high vitality uses, for example, introductory passage students, will offer a lessened calorie menu containing 600 to 700 calories for every supper (1,800 to 2,100 calories a day). Physically influential people who are in vitality shortage due to mission requirements or for the reasons for weight reduction will profit (bulk maintenance) from expanding protein to roughly 1.6 g/kg-day through suppers and snacks.

Recuperation Fueling:

The objective of recuperation sustenance is to supplant liquid, electrolytes, and glycogen that were lost amid the action, make new muscle protein, red platelets, and other cell segments, and give satisfactory sugar, amino acids and minerals to advance legally invulnerable capacity. Both starch and insulin are expected to upgrade glycogen stores, devouring sugar and providing sufficient sustenance or liquids to give glucose, which invigorates the arrival of insulin from the pancreas. The 45 minutes after practice is viewed as the “window of chance” for recuperation sustenance because of various elements, for example, expanded bloodstream and insulin affectability, encouraging an expansion in glucose take-up and glycogen rebuilding. To amplify the rate at which muscle glycogen is supplanted, competitors ought to devour a starch-rich nibble inside this window. Opponents ought to mean to devour 1 to 1.2 g/kg/hour for the initial four hours after glycogen exhausting activity (“Performance Fueling: A New Human Performance Optimization Initiative”).

Pre-Exercise Nutrition:

Expanding a CHO(carbohydrate) luxurious dinner in the hours before continuance exercise seems to profit execution. Execution may likewise be enhanced, or if nothing else does appear to be disabled, by ingesting CHO within 60 min of exercise. The impact of adjusted starches, for example, Vitargo® (fast processing) and UCAN® (moderate processing), is based essentially on the way in which the starch is altered. Starches developed with the end goal of fast edibility can start quick glycogen re-synthesis, in this manner yielding potential execution benefits in rehashed exercise. Conversely, starch alteration with the ultimate goal of moderate absorbability has appeared to expand fat oxidation amid activity contrasted with high-GI CHO, therefore protecting muscle glycogen; nonetheless, critical execution benefits have not appeared to date. High-fat dinners may improve fat oxidation amid resulting exercise, in spite of the fact that the execution impacts are hazy, with most reviews revealing no advantage or decrement versus a CHO supper. There are not very many reviews examining the execution effects of pre-exercise CHO-PRO dinners, despite the fact that there is some proof recommending potentially upgraded glycogen stockpiling amid the exercise digestion system. At last, caffeine and beetroot juice (dietary nitrates) seem to improve execution despite the fact that these impacts might be balanced by hereditary components as well as preparation status. More research is justified to explain the impacts of pre-exercise PRO, fat and altered starch utilization, and also the effects of various pre-exercise and amid-exercise healthful mixes^[7].

Sleep

Another important issue relates to sleep. If a Soldier isn't getting the sleep he/she needs, he/she is often tired before beginning an operation. Fatigue can lead to a lack of motivation and a bad attitude. Professional Athletes value sleep for performance enhancement. "Sleep is half my training," USA triathlon athlete Jarrod Shoemaker once said.

Lack of sleep can be as debilitating as alcohol-induced intoxication. Being awake for 24 hours is comparable to having a blood alcohol level of 0.10 %. Sleeping for 3-4 hours will extend physical and mental activity for an extra 4-10 hours a day, and taking a 30-40 minute nap can extend physical and mental activity an extra 3-4 hours a day. However, taking a nap during work hours is not a viable solution to overcome sleep deprivation. That's where caffeine dosing can help. Caffeine at small doses can improve cognitive performance: Drinking 1-2 cups of coffee or approximately 200 mg of caffeine when tired has an operational purpose – it can improve performance for 3-4 hours. However, if a Soldier is already consuming more than 300 mg of caffeine a day, then additional caffeine will not be as effective. Caffeine's effect may linger for 8-10 hours and can compromise a Soldier's sleep – so the time of dosing caffeine is important.^[8]

DEHYDRATION: Another factor that can degrade cognitive functions is dehydration. Mild dehydration such as a 2% decrease in body weight (example 150lbs Don to 147lbs) affects cognitive function, mood, and fatigue. A Soldier who is mildly dehydrated reacts more slowly, is less able to perform basic math functions, and has decreased word recognition ability.

Dr. Harris R. Lieberman from USARIEM has found that during intensive aerobic activities (ruck marching 12 miles), the regular consumption of a carbohydrate-containing beverage enhances physical and mental performance during sustained physical activity. Carbohydrates also substantially improve critical mental states, such as confusion and fatigue. According to Lt. Col. Edwards, the carbohydrate-containing beverage did not give enough calories to meet the Soldier's fuel needs during the activity but substantially mitigated fatigue and sustained mental function sufficient to allow many to complete the event.^[9]

Advantages And Disadvantages Of The Performance Fueling

Advantages

- Increase the rate of execution
- Sustained mission execution
- It makes the human being Capable of longer operational terms
- Dietary supplements can be utilized to enhance physical performance amid exercise, help build

muscle, change body creation, and postpone exhaustion. In case employed imprudently, in any event, they can antagonistically influence general well-being.

Disadvantages

- Dosage is one key worry that ought to be considered while taking the supplement.
- Supplements may bring about various responses in a sent domain and even influence troops' general mission availability.
- Service individuals may encounter an alternate response to the dietary supplement because of the atmosphere or stress.
- The environment may bring about a change for troops' resilience for certain dietary supplements." In hot and muggy situations like Iraq, supplements can incredibly build the danger of damage, especially as the greater part of them require the client to expand liquid admission.
- "The dangers of lack of hydration and warmth damage increment drastically in hot, damp conditions.
- To summarise, supplements can regularly accomplish more mischief than great, and administration individuals ought to counsel qualified medicinal services proficiently before taking any supplements.

Optimization Of Mental And Cognitive Capacity

Simulation Of The Electrical Brain Therapies:

Electrical stimulation of the brain can play a part in treating certain mental issues. Mind incitement treatments include actuating or hindering the cerebrum straightforwardly with power. The power can be given straightforwardly by anodes embedded in the mind or noninvasive through terminals set on the scalp. The power can likewise be actuated by utilizing attractive fields connected to the head. While these sorts of treatments are less often used than medicine and psychotherapies, they hold a guarantee for treating certain mental issues that don't react to different medications.

Electrocutation treatment is the best-contemplated cerebrum incitement treatment and has the longest history of utilization. Other incitement treatments talked about here are fresher and sometimes still trial techniques.

A treatment plan may likewise incorporate prescription and psychotherapy. Picking the correct treatment plan ought to be founded on a man's individual needs and medicinal circumstances and under a specialist's care.^[10]

One of the best techniques used for this is Transcranial Direct Current Stimulation

Transcranial Direct Current Stimulation

tDCS stands for Transcranial Direct Current Stimulation and is a type of neuron stimulation (otherwise called neuromodulator) where low levels of constant current are conveyed to explicitly focus on ranges of the mind, frequently creating significant outcomes. It was initially set up to help patients with mind wounds, for example, strokes; however, tests on solid grown-ups exhibited that tDCS can increment intellectual execution on an assortment of errands, contingent upon the region of the cerebrum being invigorated. Logical reviews have demonstrated that tDCS can upgrade dialect and numerical capacity, the ability to focus, critical thinking, memory, and coordination. Furthermore, tDCS has additionally been archived as having the capability to treat dejection, tension, PTSD, and also perpetual torment.

The Human Brain

To actually comprehend tDCS, you should understand the human cerebrum. The mind is the most complex organ in the human body, involving a multifaceted system of billions of nerve cells called neurons. These abnormal cells control and respond to everything that occurs in our bodies. The neurons in your cerebrum convey to each other utilizing little electrical and synthetic driving forces called neurotransmitters. Electrical neurotransmitters, dissimilar to concoction neurotransmitters, lead nerve-driving forces quicker (around ten times speedier), creating imperative data to go from neuron to neuron all the more rapidly. At the end of the day, tDCS permits you to open your mind's actual potential!

To What Extent Do Impacts From Tdcs Last?

The quick impacts, where changes in cortical sensitivity that are specifically quantifiable, generally last from the time of incitement, in addition to some delayed consequences running from 3 to an hour and a half after the finish of treatment. In any case, a review looking into the impacts of Transcranial Direct Current Stimulation on discouragement found that the helpful impacts of tDCS incitement appeared to be clear a whole month after the treatment (interface) ("What Is This - Learn About Neurostimulation" 2017).

Military Effectively Tests Electrical Mind Stimulation To Upgrade Staff Abilities

US military researchers have utilized electrical cerebrum simulators to improve the mental abilities of staff in research that intends to help the execution of air groups, ramble administrators and others in the military's most requested parts.

The fruitful trial of the gadgets prepares servicemen and ladies to be wired up at basic circumstances of obligation so that electrical heartbeats can be shot into their brains to enhance their viability in high-weight circumstances.

The cerebrum incitement packs utilize five terminals to send powerless electric streams through the skull and into particular parts of the cortex. Past reviews have discovered confirmation that by helping neurons flame, these minor mind destroys can support cognitive capacity. ^[11]

The innovation is viewed as a more secure contrasting option to doctor-prescribed medications, for example, Modafinil and Ritalin, both of which have been utilized off-mark as execution upgrading drugs in the military. Neuroscientists clarify in the Guardian's Science Weekly: the requirement for 'compassionate residents' – podcast.

What is the neuroscience behind compassion? At this point, when do youngsters create it? What's more, would it be able to be educated?

However, while electrical mind incitement seems to have no unsafe reactions, a few specialists say its long-haul security is obscure and raises worries about staff being compelled to utilize the gear in case it is endorsed for military operations.

Others are stressed over the more extensive ramifications of the science on the general workforce in light of the progress of an unregulated innovation.

In another report, researchers at Wright-Patterson Air Force Base in Ohio portray how the execution of military faculty can drop not long after they begin work if the requests of the occupation turn out to be excessively extreme. ^[12]

"Inside the aviation-based armed forces, different operations, for example, remotely steered and kept an eye on flying machine operations require a human administrator to screen and react to various occasions all the while over a drawn out stretch of time," they compose. "With the repetitive way of these errands, the administrator's execution may decrease soon after their work move initiates."

In a progression of investigations at the aviation-based armed forces base, the analysts found that electrical mind incitement can enhance individuals' multitasking attitudes and fight off the drop in execution that accompanies data over-burden. Writing in the diary *Frontiers in Human Neuroscience*, they say that the innovation, known as transcranial direct current incitement (tDCS), has a "significant impact."

For the review, the researchers had men and ladies at the base take a test created by NASA to survey multitasking aptitudes. The test obliges individuals to keep a cross hair inside a moving circle on a PC screen while always observing and reacting to three different assignments on the screen.

To explore whether tDCS supported individuals' scores, half of the volunteers had a steady two-millimetre current shot into the mind for the 36-minute-long test. The other half shaped a control

mass and had just 30 seconds of incitement toward the beginning of the test.

As per the report, the mind incitement mass began to perform superior to anything the control gathered four minutes into the test. “The discoveries give new proof that tDCS can enlarge and upgrade multitasking capacity in a human administrator,” the specialists compose. Bigger reviews should now take a gander at whether the change in execution is genuine and, provided that this is true, to what extent it keeps going.^[13]

Working Memory Was Upgraded By The Electric Current

The specialists found that the tDCS strategy improved working memory so that the members could store zones of the screen that had, as of now, been seen amid the test so that the people’s brains could concentrate directly on the rest of the undertakings they expected to finish.

The gathering that had been reliably destroyed by the electric current amid the test was better at finishing assignments identifying with correspondence and taking after an objective, yet the strategy did not big impact their scores on the observing and asset administration errands.

“The capacity for a human administrator to multitask productively in a military setting has been an outstanding issue for as far back as quite a few years. Bring down sensors and show that costs have brought about an expansive increment in the data that can be introduced to the human administrator,” the researchers deduced in their paper.^[14]

“The information from the investigation revealed in this gives new confirmation that consideration/watchfulness execution is improved when an account is separated among different assignments. This conceivably has essential ramifications for high workload situations that give data to the administrator using a wide variety of jolts. Extra research ought to be led to assess the power of these watched impacts.^[15]

DARPA needs to build up the people to come, deep brain simulators (call them DBS+) that don’t require client input and that can:

1. a) Read and screen the mind’s exercises continuously utilizing neural recording and
2. b) Mediate these activities on a programmed path through electrical incitement.

Advantages And Disadvantages

Advantages

- It does not require ruinous injuries in the cerebrum.
- Reversible and does not block the utilization of conceivable future treatments.
- Does not harm sound cerebrum tissue by annihilating nerve cells.
- It can be performed respectively with relative security.
- Stimulation parameters can be balanced postoperative.
- Treats cardinal side effects (i.e. tremor, unbending nature, bradykinesia and postural insecurity) of PD.
- Can diminish “Off” time and “On/Off” periods
- Allows solution decrease or stopping
- Improves patient’s personal satisfaction for 5 to 10 years.

Hindrances/Disadvantages

Side impacts to the DBS system are exceptionally phenomenal. The most widely recognized reaction is the chance of diseases occurring. There is a 2%-3% shot of creating genuine and changeless difficulties, including seeping inside the cerebrum, seizures, and the occurrence of death of a person. These antagonistic impacts rely on the experience of the neurosurgeon and the measure of the DBS methodology he or she has performed. A few patients encounter transient shivering sensations in their mouths, arms, and feet upon incitement.

- The advancement of DBS+ will bring up well-known, however imperative, issues that relate to the improvement of all new biotechnologies, including security and dangers. Additionally, DBS+ is probably going to raise a portion of the same moral issues that present DBS countenances, for example, those of validness and estrangement. For example, after utilizing DBS, a few patients have said things like, “During those times of ailment, I was sleeping. Now, will end my life back.” Others have said things such as, “I don’t perceive myself any longer.”^[16]

Nanotechnology And Human Performance

Definition:

- Nanotechnology is the comprehension and control of matter at measurements between around 1 and 100 Nanometers, or Nano-scale.
- Unusual physical, synthetic, and natural properties can develop in materials at the nanoscale. These properties may contrast in important routes from the properties of mass materials, as well as single atoms or particles.
- Encompassing nanoscale science, building, and innovation, nanotechnology includes imaging, measuring, displaying, and controlling matter at this length scale.

It is anticipated that nanotechnology (NT) will bring progressive changes in numerous zones, with the potential for both great advantages and extraordinary dangers. Improvements in the military could involve particular risks, regulation of which will require uncommon investigation and exertion. Innovative military work in NT is being extended quickly.

Potential future applications traverse all zones of fighting. Uncommon risks to arms control and strength may emerge from new organic weapons and micro-robots. For people and society, non-therapeutic body inserts, potentially made more adequate by the military, raise various issues concerning human instinct. Advanced research is expected to locate an ideal approach to stay away from conceivable threats. For the close and medium term, a few rules for points of confinement and limitations are proposed. As an initial step, straightforwardness and universal participation ought to be made stride.^[17]

These advances are starting to have repercussions over all zones of innovation, and numerous items containing nanoparticles are, as of now, available. Ventures and governments all over the world are investing vigorously in nanotechnology – in 2003, the administrations of the industrialized nations spent nearly US\$ 3 billion on innovative work in nanotechnology.

Potential Military Applications

Similarly, as with most new advancements, though, military utilization of nanotechnology is probably going to be the first to be figured out. The principle points of military research into nanotechnology are to enhance medicinal and loss tend to officers and to create lightweight, solid and multi-practical materials for use in attire, both for insurance and to give improved network^[18]

The Ministry of Defense in the UK has anticipated that innovations, for example, medicinal Nano-robots and Nano-improved surveillance and specialized gadgets, (for example, smaller scale radar for little vehicles) will start to be utilized from 2030 onwards.^[19]

Nano-Materials

Nanomaterials can be planned at the nuclear level, loaning more control over their properties and improving them to suit their desired reason. Most nanomaterials get their upgraded capacities from the large increment in surface territory that outcomes when the singular molecule estimate diminishes.

The electronic dynamic cover gives the component of stealth. Meta-material-based optical/EM intangibility suits and vehicle shrouds are near reality. Simulated muscles utilizing twisting or contracting particles give natural development in applications such as full-body automated exoskeleton suits. Nanostructured materials can make a lighter covering and, to a significant degree, solid building materials. Nano-fiber-based duds offer improved security against shots.

A great part of the 60 kg heap of a 21st-century warrior originates from the numerous electronic gadgets required for correspondence and so forth. One primary objective of military research into nanomaterials is to diminish this heap to 20 Kg using the advancement of lighter, higher Gravimeter Energy Density (Wh/kg) batteries.^[20] Nanotechnology offers a not insignificant rundown of potential options for proficient, temperate and maintainable power era and capacity. Lithium-air (Li-air) is one cutting-edge rechargeable battery innovation with the possibility to supplant the existing tech guidelines, Lithium-particle (Li-particle), Nickel Metal-Hydride (NiMH) and non-rechargeable Lithium-Manganese Dioxide (LiMnO₂).

Designed Nanomaterials and metamaterials that are more grounded and lighter, have upgraded properties, are warmer, and are more reduced are becoming distinctly conceivable. Carbon nanotube/fullerene-based materials offer a substantially higher quality-to-weight proportion than those currently utilized.^[21]

Nano-Enhanced Sensors

While the potential applications are essentially boundless, some potential military uses of nanotechnology are, as of now, very progressed and will possibly become the most important factor much sooner than others. One case of this is sensors – various sensors have, as of now, been created to exploit the one-of-a-kind properties of nanomaterials to end up distinctly littler and more touchy, contrasted with traditional innovation.^[22] Compact, active sensors will be exceptionally important to military handle agents, for instance:

- Exceptionally touchy infrared warm sensors
- Little, lightweight accelerometers and GPS for movement and position-detecting
- Smaller than standard elite camera frameworks
- Biochemical sensors
- Health status is observing sensors and medication/nourishment conveyance structures.

Micro-Electro-Mechanical Systems

Micro-electro-mechanical frameworks (MEMS) comprise minor components made utilizing lithographic methods to accomplish small-scale measurements. The elements of MEMS are: they contain mechanical components that are based on a small scale and can be acknowledged just with a magnifying lens. MEMS components interface with non-electronic signs and frequently blend flag preparation with detection and activation; they enhance the execution, security, and unwavering quality of weapon frameworks without trading off their shape or weight. The small size of MEMS makes the incorporation of repetitive frameworks attainable, and also the execution of fault-tolerant models that are measured, tough, programmable, expectedly interfaced, and moderately obtuse to stun, vibration and temperature varieties; MEMS could likewise make advanced new capacities in

weapons practical, such as frameworks that comprehend and convey their condition, empowering the early location of initial disappointment and discovery of altering; and, MEMS sensors are utilized as a part of battling airships for identifying stream insecurity, maintaining a strategic distance from slows down and observing auxiliary trustworthiness, and additionally controlling motors and outflows^[23]

Explosives And Propellants

Materials that can store a lot of concoction vitality, which are portrayed by a high rate of vitality discharge, are named “lively materials.” The enthusiastic materials are being utilized as a part of explosives, fuels, and fireworks. Nanotechnology permits analysts to overcome any issues between immaculate compound assessment, microstructural examination, and better comprehension of the marvels that play out the enthusiastic capacities.^[24] The stacking thickness of the explosives in warheads, on the other hand, shells is one of the critical parameters that impact the execution properties of explosives, for example, speed of explosion, the temperature of the blast, C-J weight^[25]

The Nano-sized particles of explosives and fuel fixings improve the stacking thickness, which expands the speed of explosion and other execution properties of explosives and fuels. Improved execution warheads utilizing nanotechnology offer adequate legality into a little bundle so that these little rockets might be successful against generally easy objectives, for example, radar destinations and reinforced vehicles^[26]. The typical readiness of fiery materials includes a physical blending of strong fuel and oxidizer powders. Nano-sized oxidizers and fuel materials offer the potential (high surface zone) for quick vitality release.^[27] An expanded investigate exertion toward the utilization of Nano-aluminum in explosives, what’s more, fuels are one of the runs of the mill cases in this area.^[28]

Advantages And Disadvantages Of Nanotechnology

Favorable circumstances:

- Restoration of sickness and maturing bodies
- Restoration of psychological capacities
- Open entryways in drugs are unthinkable, and they will empower us to expand the length and nature of human life.
- Open the way to “improvements” in the body — better IQ, appearance, and capacities.
- Soldier security
- Improve vehicle performance (lighter weight, speedier, more light-footed, stealth)
- Nanomaterials created lightweight composites as the other option to plain steel.

Disadvantages

- Unnatural improvements to human ability: outrageous insight and memory limit, fundamentally increased feeling of mindfulness, bewildering athletic capacity, and quality and excellence upgrades are only a couple of illustrations. (These sorts of improvements do exist in a few structures today, for example, steroids, Ritalin and other ADD prescriptions, Prozac, and plastic surgery, and they have, as of now, pulled in critical measures of contention.)^[29]
- Nanotech-empowered improvements could intensify current monetary and social variations. Especially if the innovation were costly and constrained, just a particular class of individuals would have the capacity to wind up distinctly upgraded.^[30]
- Possible cost of the item.

Conclusion

Human Performance Optimization innovation underpins progression in a military capacity. The improvement of innovation coupled with the man-machine interface accommodates a more viable and deadly drive. Innovation is the way to proceed with military prevalence. This paper has demonstrated a comprehension of the significance of Human Performance Optimization Technology. The research displays how technology has influenced human performance. Nanotechnology is becoming increasingly popular among the military. They intend to use it in warfare. The medical application of Nanotechnology is being implemented in the Military. After analyzing the pros and cons, one can establish a sense of the effectiveness of the technology. The supremacy it portrays stands for itself. Nanotechnology has proven itself to be an emerging food for humans, especially in the military. The world is using this technology. Most advanced nations have introduced nanotechnology as a resource for their military operations. The technology surpasses any other discovery made so far in terms of weaponry. Small chips can establish a great amount of resourcefulness among individuals. Not only that, this technology possesses the tracking, eliminating, and directing of militants remotely.

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