

HUMAN PERFORMANCE OPTIMIZATION AND ENHANCEMENT

Information Note of the MCDC HPO/HPE Cycle 19/20

MCDC Human Performance Optimization and Enhancement Project in Brief

Project focus: Assess ongoing and planned Human Performance Augmentation programs affecting the interoperability and preparedness of multinational coalition forces and addressing future battlefield challenges regarding resilience, performance and endurance in order to avoid tactical, operational and/or strategic disadvantages.

Results and findings: Lack of awareness, that Human Performance Modification (HPM) methods and technologies are here to stay and will be used by partners as well as by opponents. Lack of Information sharing and cooperation in HPM resulting in limited interoperability among multinational partners. Lack of standardized metrics to compare new HPA methods resulting in poor implementation of HPA programs. Lack of multinational legal, ethical and policy frameworks, specifically of offensive and defensive HPM principles, doctrine, and operational guidance.

Recommendations: Adopting common definitions and terms of references for better multinational understanding. Promoting the development of a Center of Excellence dedicated to Joint Human Performance in the future Battlespace and multi domain environment. Incorporating HPM into strategic, operational, and tactical decision making. Invest in comparative evaluations of existing HPM programs and sharing of best practices.

Project team from:



Introduction

Across many countries, recruiters for service members either in conventional armed forces or specialized elite personnel are facing one dilemma; while the physical and cognitive requirements are steadily growing the fitness and endurance of the candidates are decreasing. This is leading to a serious gap of available active service members fit for duty.

At the same time, we see a rapid technological development altering the performance of human in many fields of societies. The convergence of biosensors, new insights in physiology and metabolism, big data and artificial intelligence, and biotechnology are accelerating the pace of new human augmentation methods and techniques.

The potential of fundamentally augmented human performance gaining an advantage in the battlefield has reached a point that is now being subject of a wider legal, ethical and policy debate. In January 2021, this MCDC working group took part in a workshop hosted by the German Foreign Office on “Rethinking Arms Control”. This event focused in particular on Brain Computer Interfaces. One of the basic findings there: the lines of what is the weapon system and what the human is blurred more than ever, and this is just the beginning of this development. Most of the desirable enhancement technologies imply a significant dual use potential and are by this causing legal ethical challenges. On the other hand, optimizing the human potential by respecting the legal and ethical norms were not sufficiently exploited.

Thus, there is an emerging need to understand the implications of these developments and in particular the risk-benefit-ratio before such HPM-methods and technologies might be used by opponents against our forces and society.

Aim

New interdisciplinary improvements in the field of Human Performance Optimization and Enhancement are increasingly accelerating and require a holistic view on how they are impacting the strategy of future armed forces training and operations. As there are currently no commonly agreed definitions, the main objective of this project was to develop a common understanding within the MCDC partner nations in order to improve multinational military interoperability.

The focus of the project:

- Developing common definitions and mutual understanding of HPE/HPO topics, issues, and complexity.
- Providing an overview of available methods for optimizing and enhancing performance in the military context, now and in the future.
- Promoting a holistic understanding of the potential ethical and moral challenges for society and for the armed forces by these methods and technologies.

The full report is published under APAN and GIDS website. This Information Note seeks to briefly inform a wide audience, both inside and outside of MCDC partner nations across the defense and civil security sector.

Throughout the project the key challenges and implications affecting the interoperability of multinational forces and civil-military interactions have been identified:

Definitions

There are numerous existing definitions of human performance spreading from the bio-hacker community to elite sport athletes, health and wellness industry and lastly from the military/security operator's community. They often

are ambiguous, imprecise, and overlapping. This leads to the necessity to introduce distinct definitions that can be accepted by different stakeholders and consequently contribute to a common interdisciplinary understanding. Common to all terms is that they consider a change in a human's performance in both the positive/increasing and negative/decreasing directions. The MCDC-group provided the following definitions that should fit most of the purposes and support interoperability:

HPM: Human Performance Modification: Active and passive change of an individual's level of performance. While Human Performance Modification usually focuses on optimization and enhancement, we include both Human Performance Degradation and Human Performance Restoration.

HPA: Human Performance Augmentation: HPA is the application of science and technologies to temporarily or permanently improve human performance. This field can be further divided into Human Performance Optimization and Human Performance Enhancement.

HPO: Human Performance Optimization: The process of applying existing and emerging science and technology to individuals allowing them to reach their biological potential.

HPE: Human Performance Enhancement: The process of applying existing and emerging science and technology to individuals allowing them to exceed the biological potential of the individual.

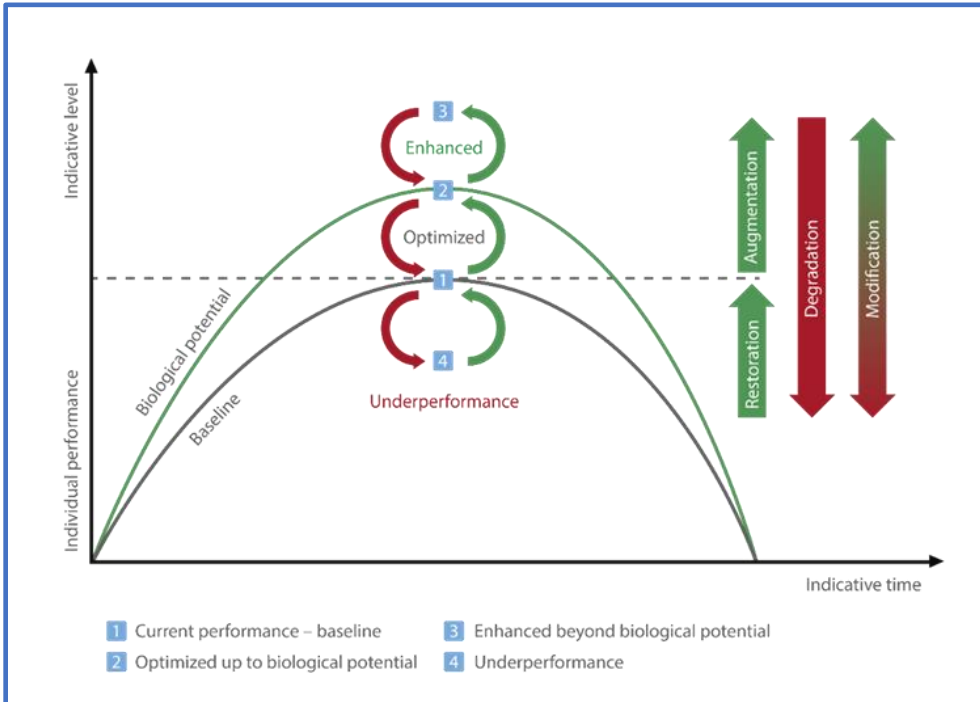
HPR: Human Performance Restoration: Return to baseline¹ when performance has degraded below baseline. The focus here is on restoration from degradation caused by illness, injury, exhaustion, side effects, violence, or coercion.

HPD: Human Performance Degradation: Decrease in performance below previous levels resulting

from four principal sources. It can be explained by factors such as reduced biophysical skills or capacity through [1] fatigue, exhaustion; [2] diseases, injuries; [3] system safety issues, degraded system functionality of prior optimization or enhancement; or [4] actions by

hostile externally based technologies, platforms or systems.

Recommendation: Adopt a commonly recognized definition to support common understanding, comparison, and interoperability.



This diagram shows that a baseline depending on a natural fluctuation during the lifetime is required to further describe the different forms of performance.

The baseline is the individual's current level of performance. It changes over the lifetime of a person as well as over a single day. Therefore, it is better to think of this baseline as a range rather than a clearly defined line.

New methods in optimizing human performance are so far neglected but are low hanging fruits

While physical and cognitive training and drills are at the center of all security and armed forces to achieve an improved level of performance, methods being used so far are mostly based on conservative knowledge and standards. Meanwhile, science has revealed many aspects to improve physical and cognitive performance both of special (elite) and conventional forces by applying biofeedback (biomonitoring), specialized nutrition strategies, personalized training and recovery methods. Within MCDC-nations such programs with focus on wearable biosensors and physiological status monitoring are already part of

many research projects. The analysis of collected biodata is both a data quality problem and a big data problem that requires bespoke systems which aren't already implemented. Further development is necessary to find sensor (monitoring) systems that are sufficient for military requirements in the field with respect to signal transduction, artefacts, built-in quality assessment, and security.

HPA has huge potential to increase mission success, means a lower risk for injuries and increases the survivability of service members. However, there seems to be a reluctance to adopt new methods and tools due to potential disruptive effects on established structures, financial constraints, and unclear advantages of performance programs.

Recommendation: Conducting a meta-analysis of existing HP programs versus conventional training.

- a. Focus on potential (short & long term) performance benefits versus the costs of implementing them. Identify low cost programs with high strategic advantages.
- b. Analyze interoperability needs and determinations among multinational coalition partners with respect to HPM in mission challenges.
- c. Share reviews and evaluations to assess usability and best practices among partner nations of applied HPA programs.
- d. Assess future HPM threat environment addressing offensive and defensive issues for tactical and strategic aspects of future battle domains.

Human Performance is mostly developed in isolated programs – causing interoperability gaps and unexploited advantages for wider unit performance

There is a wide range of programs with major focus on HPO, although some HPE programs are being established. Unfortunately, information on these projects was not available or described enough to draw conclusion about the “must have capabilities”. It is assumed that many programs contain sensible information, which prevent them from being shared in the large MCDC community. However, interoperability relies on common understanding and joint standards, information flow, interaction principles, strategies, system safety and logistics. These aspects are necessary for efficient collaboration. For example, different views and legislations regarding the use of potent drugs caused interoperability issues. It is therefore necessary to use and develop concepts that are inclusive but at the same time as diverse as deemed necessary. According to our survey, there are no multinational initiatives that aim to increase

the interoperability of combined or joint operations. Instead, the focus is on isolated individual/small units.

Nations have diverse human performance programs, however, they usually being conducted in isolation for smaller units, even within one nation. This leads to multiple performance goals and inconsistent standards which impair interoperability among joint and combined forces/units. More importantly, sharing knowledge across partner nations beyond isolated and specialized multinational working groups seldomly occurs due to several reasons such as protecting the intellectual property-IP or the fear of losing the force advantage edge.

Recommendation: Develop joint guidelines and coordination mechanisms to foster sharing of best practices among partner nations and facilitate joint combined research and development projects. Ideally, this would be coordinated and led by the strategic leadership and conducted through operational and tactical organizations such as a special Human Performance dedicated “Center of Excellence”, which incorporates existing national and multinational research initiatives.

HPM will change future warfare

HPM methods and technologies are here to stay and will be used both by allied partners and by opponents. Future conflicts will depend on HPM methods applied both for offensive operations and similarly for the protection and survivability of own forces. New skillsets, tactics, leadership and civil-military interaction will be required to compete with the rapid HPM developments. Understanding the trends in the domain of HPM technologies will help to address emerging new threats and strategic vulnerabilities. Such threats can emanate from lone actors, criminals, terrorist groups or states. Even if MCDC-partners would decide not to develop any capabilities due to legal or ethical

obligations, such nations still need to be aware of the potential capabilities of an opponent with wider use of HPM.

Multinational Force (MNF) commanders must weigh the risks they may encounter by opposing forces on three possible levels. Some opponents may not use HPM-methods and technologies, others may display equivalent systems while, yet others may actually be superior to available MNF HPM technologies. Given these situations flexibility in deploying engineered and tailored countermeasures to nullify or weaken any human performance systems which opposing forces may possess or utilize is vital.

Recommendation: A comprehensive approach towards HPM conflict scenarios should be developed. This includes strong civil-military interaction and requires comprehensive operational doctrine and response strategies and preparing for potential hybrid whole of society scenarios.

Developing multilateral legal and ethical frameworks

Whilst the military application of some human augmentation technologies might be legally unproblematic, other technologies raise a large number of complex legal issues across a wide range of legal aspects. As the growth of modern technology affords greater sophistication in future iterations and combat applications it is expected that several different nations may be in possession of advanced HPA technologies, systems and platforms which convey a distinct strategic advantage. Currently, there seems to be a patchwork of national legal and ethical guidance to different degrees which impairs multinational collaboration. There is also the inherent risk that global research and development work on HPA systems, technologies and platforms will continue covertly and under clandestine circumstances

conveying tactical and strategic military advantages to forces adopting this set of technologies. Therefore, the explicit pursuit and adoption of both offensive and defensive principles, doctrine and operational guidance are needed to assess the conduct of future combat operations in a climate where the presence of HPA is more likely than not.

Additionally, the current legal landscape regarding HPM challenges among MCDC nations offers multiple interpretations what is accepted to be used and what not. Ethically controversial HPA technologies prompt demands for new international law to prohibit or restrict their development and use. Defining a common legal base for the implementation of HPA technologies is essential for the societal acceptance of augmented service personnel. Therefore, nations should invest in the development of legal and ethical frameworks that anticipate the use of future HPA science and technologies.

Recommendation: First, develop specific HPM principles, doctrine and operational guidance for national service members and multinational alliances.

Secondly, a whole of society approach should enable the development of legal and ethical frameworks that provide guidance beyond the military in the use of HPA science and technologies.

Summary

This project collected and analyzed knowledge of currently available technologies and methods for augmenting human performance and provided four potential scenarios how those methods might possibly be applied in the immediate and more distant future. The main focus was to assess ongoing and planned HPA programs affecting the interoperability and preparedness of multinational coalition forces.

1) The group has developed a set of definitions for the most frequently used HPM-methods such as Modification, Augmentation, Optimization, Enhancement, Restoration and Degradation.

2) Currently, the benefits of Human Performance Optimization programs have the biggest potential to be implemented to improve the performance and survivability of the service members. However, further cost-benefit studies should be conducted to facilitate decision-making.

3) Across MCDC member nations, one phenomenon is significantly apparent: all HPA programs are conducted in isolation leading to multinational interoperability gaps and unexploited advantages for wider unit performance even within one nation. The resulting recommendation is: Develop common guidelines and coordination mechanisms to encourage the sharing of best practices and to facilitate joint combined research.

4) HPM will change the future of warfare including the impact on civil-military interaction. This would require a comprehensive and interdisciplinary approach for joint threat assessments and mitigation for potential hybrid whole-of-society scenarios.

5) The need for HPM principles, doctrine and operational guidance is evident. That must be done as a whole-of-society approach by developing the necessary legal and ethical

frameworks. Legal and ethical guidance have difficulty coping with the speed of current developments in HPM technologies. Specifically, the global quest for HPA advantages will continue and in the worst case in clandestine for dual use and offensive purposes.

Ideally, the increasingly relevant area of HPM would be supported and led by the strategic leadership and conducted through operational and tactical organizations such as a specifically dedicated “Center of Excellence”, which incorporates existing national and multinational research initiatives.

Further Readings

- 1) Enhancing Soldiers, A EUROPEAN ETHICAL APPROACH,
<https://www.euroisme.eu/images/Documents/OtherPublications/Le-soldat-augmente-19-06-2020-web-VFinal.pdf>
- 2) Science & Technology Trends 2020-2040, NATO Science & Technology Organization,
<https://www.sto.nato.int/pages/tech-trends.aspx>
- 3) Brain-Computer Interfaces, U.S. Military Applications and Implications, An Initial Assessment,
https://www.rand.org/pubs/research_reports/RR2996.html
- 4) Human Augmentation – The Dawn of a new Paradigm, A strategic implication project, GBR Development, Concept and Doctrine Centre and DEU Bundeswehr Office for Defense Planning (releasing in May 2021)

This Information Note is the condensed version of the full Project Report “HUMAN PERFORMANCE OPTIMIZATION AND ENHANCEMENT” and is a result of contributions from the following co-authors: Alonso Diaz, Sagrario / Eppenberger, Patrick / Franke, Thomas / Grieser, Benjamin / Haggemiller, Christian / Levin, Britta / Mayer, Dominique / Mueller, Matthias / McCreight, Robert / Ojanen, Tommi / Ruehli, Frank / Sandgren, Per / Scheit, Lorenz / Taylor, Jack / Vergin, Annika / Wessels, Frank / Whakahoehoe, Eugene and Whittaker, Annalise.

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