



**MINISTÈRE
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DEFENCE ETHICS COMMITTEE

OPINION ON THE AUGMENTED SOLDIER

18 September 2020

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Executive Summary

I. THE ETHICS COMMITTEE'S CHOICES

1. **For a long time, human beings have regularly sought to boost their physical or cognitive abilities to fight or engage in war.** From this historical and anthropological perspective, weapons, as well as protective or vision equipment are "augmentations." This is also true of physical or psychological training with a view to improving a soldier's **resilience** or readiness to fight. Finally, medicine has not only made it possible to treat wounded soldiers, but also in some cases, to replace or repair the injured organs or limbs.

Reflection on the "augmented soldier" is undertaken from a different perspective. The state of science and technology and, even more so, foreseeable, or conceivable developments, in the more or less long-term, promise breakthroughs that would allow ability **increases to be incorporated into soldiers**, in a reversible or irreversible manner, by endowing them with very superior or even new abilities. "Armed and equipped soldiers," "trained or optimised soldiers," and "augmented soldiers" are all concepts and fields that must be distinguished. **Limits and, consequently, thresholds, are therefore crucial questions.**

2. Furthermore, **while the "augmented soldier" issue is, in several respects, closely akin to the more general issue of "augmented human," and raises the same questions with respect to the principles and values of our civilisation,** particularly safeguarding human dignity from any form of degradation, it also has its own specific context, i.e., the military function, the missions of our armed forces and their training programs, and the conduct of operations. **The uniqueness of the "augmented soldier" issue must therefore be emphasised from the outset.**

3. Finally, in terms of positioning and method, the Committee defined a dual constraint. Due to the speed of scientific and technical developments in this area, the timeframe must be limited to **about ten years** so as not to be prejudicial to the future. As for the analyses themselves, the Committee considered that to study the augmented soldier theme, it should **identify principles and operational recommendations, rather than draft guidance on use or define instructions for the various practices, which are responsibilities of a different kind.**

4. Therefore, the Committee set out to achieve **three objectives:**

- **seek ways and means of maintaining the operational superiority of our armed forces in a demanding strategic context;**
- **fully uphold the fundamental values of our civilisation, notably the dignity of the human person ;**
and
- **comply with the principles and rules governing the action of the French armed forces and humanitarian law.**

II. GUIDING PRINCIPLES

P1. While certain ethical, legal and scientific considerations concerning the "augmented human" can have a broad scope and, therefore, concern "the augmented soldier," the topic of the augmented soldier **must be addressed from its unique perspective**: this uniqueness is primarily related to the constitutional nature of the armed forces' mission, to military status, to the general statute of the military, to the rules of general discipline and to the strict regulation of combat action by domestic and international law.

P2. Soldier augmentations must comply with the framework assigned to the French armed forces and their training programs, aim exclusively to gain or maintain the operational superiority of our armed forces while preserving the physical and mental health of our soldiers, and meet requirements of general interest and not individual requests.

P3. Any soldier, whatever their training or speciality, could be deployed in combat and could, in some cases, be concerned by an augmentation of their abilities.

P4. Although, considering their purpose, medical repair procedures are outside the scope of this opinion, special attention should nonetheless be paid, on the one hand, to repair procedures that allow soldiers to resume active duty and which, in so doing, give them superior performances to other soldiers and, on the other, to the consequences of procedures carried out before discharge or return to civilian life.

P5. Procedures on a soldier in the private sphere occurring before entry into military duty or while the soldier is in active duty are outside the scope of this opinion unless they are comparable to an augmentation and have a connection with military duty.

P6. For the purpose of this opinion, augmentation practices do not cover all devices, weapons or techniques that augment a soldier's abilities to fight or defend, but only those that lead to crossing the **body barrier**. They encompass, firstly, practices, techniques, technologies, and devices, medical or not, which consist in invasively intervening on the soldier to increase their physical, cognitive, perceptive, and psychological abilities and, secondly, practices designed to prevent a health risk, particularly vaccination and medication, as well as certain substances administered for augmentation purposes.

P7. A periodic assessment of this opinion is considered necessary to integrate the very rapid changes in technologies and uses.
P8. Research on the augmented soldier, as in defence innovation in general, must not be inhibited, to avoid the risk of our armed forces falling behind in terms of capabilities.

P9. In the context of increasingly serious conflicts and unpredictable strategic environments described by the 2017 *Revue stratégique de défense et de sécurité nationale*, tools must be found and optimised in order to **preserve or improve the operational capability of the armed forces, while observing the principle of respect for human dignity**; this includes soldier augmentations that can contribute to resilience in crisis situations, foster operational ascendancy, take by surprise, and synchronise efforts while saving on forces.

P10. The principle of using augmentations is not contrary to the **founding values of our armed forces, namely courage, honour and sense of sacrifice**, provided that such use is regulated, proportionate and consistent with the operational imperatives of our forces.

P11. Soldier augmentations should not provide justification for reducing the resources made available to the armed forces, reducing formats or training, or even, save in exceptional circumstances, for increasing current standards (length of duty, etc.).

P12. **Any augmentation must always be developed and used within the framework** of the capability and operational organisation of the armed forces and be continuously supported by the medical corps.

P13. **While research in the field of augmentations must be open, it must comply with rules of medical ethics and be guaranteed by the Committee for the Protection of Persons of the Ministry of the Armed Forces.**

III. THE COMMITTEE'S GUIDELINES

- G1. Assess the impacts of each augmentation on the physical and mental health of soldiers, by including at least:
- The short-, medium- and long-term adverse effects;
 - An assessment of the risk of addiction;
 - Risks of imbalance between certain brain or physical functions;
 - Potential difficulties upon returning to civilian life caused by the augmentation.
- G2. Analyse the risk-benefit ratio for each augmentation, including cyber risks.
- G3. Identify the effective gain of each augmentation compared to an alternative solution.
- G4. Draft doctrine for the use of each augmentation explaining, in particular, the purpose, conditions of use, need for contextualisation with a given situation, the responsibilities of each player and what is expected from them.
- G5. Get support from the medical corps throughout the life cycle of an augmentation (assessment of health risks, definition and control of substances, prostheses and implants, development of guidance for use by the command, conditions of prior tests, medical or even psychological follow-up).
- G6. Always seek reversibility when using augmentation.
- G7. Based on the impacts feared, assess the need for a transition period and medical follow-up or psychological support, including support for return to civilian life.
- G8. Pay attention to risks of social pressure and, in particular, ensure that an augmentation does not generate exclusion from a group.
- G9. Systematically inform the soldier, in advance, of the risks inherent in an augmentation, and ensure traceability of the act and long-term follow-up to take into account changes occurring over time in the state of knowledge about potential consequences.
- G10. Establish the need to obtain consent as a principle, subject to any justified exceptions, and, in this case, formally define at the appropriate level any necessary situations in which it could be overridden.
- G11. When initiating any augmentation project, identify the need to review its lawfulness.
- G12. Prohibit any augmentation considered likely to reduce the controlled use of force, to cause a loss of humaneness, or which would be contrary to the principle of respect for human dignity.
- G13. Prohibit any cognitive augmentation of soldiers that would affect the free will they must have in firing action.
- G14. Prohibit any augmentation which could lead a soldier to overstep the bounds of their disciplinary obligations.
- G15. Prohibit eugenic or genetic practices for the purposes of soldier augmentation.

- G16. Prohibit any augmentation that could jeopardise a soldier's integration into society or their return to civilian life in all its aspects.
- G17. Prohibit use of any augmentation if its impacts and side effects have not first been researched.

PREAMBLE

1. On 10 January 2020, the French Ministry of the Armed Forces asked the Defence Ethics Committee to give an opinion on the "augmented soldier."
2. Considering the terms of the Committee's mission, the scope of this opinion concerns the armed forces (army, air force and naval force), the training programs attached to them and the tri-service organisations, within the meaning and for the application of Articles L 3211-1 and L 3211-1-1 of the French Defence Code, to the exclusion, therefore, of the National Gendarmerie.
3. To develop this opinion, the Committee:
 - analysed the reference standards in domestic and international law defining the framework in which considerations concerning the augmented soldier must be discussed. These reference standards are listed in Appendix 1.
 - perused publications and communications on the topic of the augmented soldier. They present the possibilities, opened by scientific and technological developments, of augmenting, either now or in future, certain physical, cognitive, perceptive, and psychological abilities of soldiers. They also raise ethical, legal, and medical questions that can stem from such augmentation. The Committee notes, furthermore, that soldiers or Defence think tanks have very often provided valuable contributions on this topic.
 - interviewed key figures and competent authorities who/which fuelled the Committee's thinking.
4. Thus informed, the Committee decided not to examine each augmentation individually, but to define a generic analytical grid with a view to answering the following questions:
 - I What should "augmented soldier" be understood to mean and what is the selected scope?
 - II Why use soldier augmentation and what risks and dilemmas does such use entail?
 - III How should soldier augmentation be used?

This is the meaning of the following opinion, which was discussed at a plenary session of the Defence Ethics Committee on 1 July 2020, according to the required procedures.

I. WHAT SHOULD "AUGMENTED SOLDIER" BE UNDERSTOOD TO MEAN AND WHAT IS THE SELECTED SCOPE?

A. CLARIFYING THE TERMINOLOGY

5. The Committee notes that the term "*augmented soldier*," although now in use, deserves to be clarified.
6. While the English term "*enhancement*" has connotations since it implies the idea of an augmentation coupled with an improvement, the term "*augmentation*" is not without ambiguity. It could indeed suggest that the use of augmented abilities would have only positive impacts when, in fact, certain adverse effects could be detrimental to the efficiency of our armed forces, to the soldiers themselves, or to their present and future environment. However, as the alternative terms "*transformation*" or "*modification*" do not appear any more suitable, and the terms "*augmented human*" and "*augmented soldier*" are today part of everyday language, **the Committee did not consider it appropriate to depart from current practices.**

B. A NECESSARY AND DIRECT CONNECTION WITH THE MILITARY FUNCTION

7. The Committee notes that the very concept of "augmented soldier" must be explained, since it would be wrong to think that this concept is merely the military version of "augmented human" and that the questions raised are, therefore, merely the transposition of this broader issue into the world of defence. However, while certain ethical, legal, and scientific considerations concerning the "augmented human" can have a broad scope and, therefore, concern "the augmented soldier", it is important to **address the topic of the augmented soldier from its unique perspective**, without overlooking the civilian issues.

This uniqueness is primarily related to the mission of the armed forces and the resulting military status, namely:

- **the constitutional nature of the armed forces' mission**, which contributes to safeguarding the fundamental interests of the Nation, including its independence and territorial integrity,
- **the constitutional principle of having armed force at disposal**, which means that certain rights and freedoms enjoyed by citizens can be prohibited or restricted for soldiers,
- **military status and the general statute of the military¹**, which are imposed on the military function and form a unique legal system, notably with the primacy of the mission and exceptional ordinary law constraints:
 - Article L 4111-1 of the French Defence Code: *Status as a member of the armed forces requires under all circumstances a spirit of sacrifice, which may include the ultimate sacrifice, discipline, availability, loyalty, and neutrality.*
 - L 4121-1: *Soldiers enjoy all the rights and freedoms granted to citizens. However, they may be banned from or limited in exercising some of those rights and freedoms, in accordance with the conditions laid down in this book.*

¹ As a reminder, military statute, which is both legislative and regulatory, stems from the constitutional foundations of military status. These foundations govern the military function consisting of the men and women who are governed by this status and statute.

- L 4122-1: *Soldiers have a duty to obey the orders of their superiors and are responsible for the execution of missions with which they are entrusted.*

Secondly, this uniqueness is expressed in the armed forces' general rules of discipline, codified in Articles D.4122-1 to D.4122-11, which stipulate:

- on the one hand, **the obligations attaching to military duty**, namely:

- honour and dignity,
- obedience to orders received,
- full responsibility of the command for orders given,
- primacy of the mission and the engagement of all in action against the enemy, conducted with energy and self-sacrifice, including risking one's life, until success is achieved, or all means of action are exhausted.

- on the other hand, **rules governing the use of armed force and combat actions**, including in particular:

- the prohibition placed on superiors or subordinates to give or execute orders that are contrary to French or international laws,
- compliance with the laws of the French Republic, which specially punish crimes against humanity, war crimes, and offences committed during an international or non-international armed conflict,
- the subjection of soldiers to the obligations arising under international law applicable to armed conflicts and the obligation to train them in understanding and complying with such law,
- the obligation to direct attacks exclusively against military targets and the requirement of proportionality between the violent action and the expected military advantage.

Guiding Principle No. 1: While certain ethical, legal and scientific considerations concerning the "augmented man" can have a broad scope and, therefore, concern "the augmented soldier," the topic of the augmented soldier must be addressed from its unique perspective: this uniqueness is primarily related to the constitutional nature of the armed forces' mission, to military status, to the general statute of the military, to the rules of general discipline and to the strict regulation of combat action by domestic and international law.

8. As a result of the above, the Committee is of the opinion that **possible soldier augmentations** must:
 - Comply with the framework assigned to the French armed forces.
 - Aim exclusively to gain or maintain the operational superiority of our armed forces while preserving the physical and mental health of our soldiers.
 - Meet requirements of general interest and not individual requests.

Guiding Principle No. 2: Soldier augmentations must comply with the framework assigned to the French armed forces and their formations, aim exclusively to gain or maintain the operational superiority of our armed forces while preserving the physical and mental health of our soldiers, and meet requirements of general interest and not individual requests.

9. Furthermore, the Committee considers that the concept of "augmented soldier" and therefore, its scope of application, must be addressed in the framework of the **military function as a whole**. Even though certain uses could be limited to particular circumstances or available only to certain units, as will be explained below, it should be noted that pursuant to Article D.4122-4 of the Defence Code *"Combat effectiveness demands that each soldier participate in the action against the enemy with energy and self-sacrifice, even at the risk of their own life, until the received mission is accomplished. If taken prisoner, a combatant remains a soldier whose duty is to escape from captivity, to resist pressure and to seek to return to combat."* It follows that **any soldier**, whatever their training or speciality, **could be deployed in combat and could, in some cases, be concerned by an augmentation of their abilities**.

Guiding Principle No. 3: Any soldier, whatever their training or speciality, could be deployed in combat and could, in some cases, be affected by an augmentation of their abilities.

C. INVASIVE PROCEDURES AND SUBSTANCES DESIGNED TO AUGMENT ABILITIES

10. After analysing the considerations in this area and defining the purposes of an augmentation, the Committee retains in the scope of this opinion those which cross the body barrier:
- a) **Practices, techniques, technologies, and devices, whether medical or otherwise**, that consist in intervening on the soldier in an invasive manner to augment their physical, cognitive, perceptive, and psychological abilities, including medicines, prostheses or implants. These are **augmentations of abilities compared to the "natural" state of a soldier** which can either improve existing abilities (e.g., night vision, pain tolerance, cognitive performances), or give them new ones (e.g., connectivity to a weapon system or to other soldiers, geolocation chip, blood pressure sensor).
 - b) **Practices designed to prevent a health risk**, particularly vaccination and medication.
 - c) Certain **substances administered for augmentation purposes, whether they are medicines or not** (for example, slow-released caffeine, functional foods with benefits in wakefulness, or Modafinil, a medicine prescribed for narcolepsy), and which aim to increase the soldier's resistance, i.e.:
 - To avoid the appearance of certain symptoms (pain, stress, fatigue, etc.).
 - To avoid certain syndromes (such as post-traumatic stress syndrome) caused directly or indirectly by operational engagements.

11. Although, **considering their purpose**, medical repair procedures are outside the scope of this opinion, **the Committee is nonetheless of the opinion that** special attention should be paid to procedures that allow soldiers to resume active duty and which, in so doing, give them superior performances to other soldiers. **This is also the case of procedures carried out before discharge or return to civilian life.**

Guiding Principle No. 4: Although, considering their purpose, medical repair procedures are outside the scope of this opinion, special attention should nonetheless be paid, on the one hand, to repair procedures that allow soldiers to resume active duty and which, in so doing, give them superior performances to other soldiers and, on the other, to the consequences of procedures carried out before discharge or return to civilian life.

12. **Procedures on a soldier in the private sphere** (e.g., myopia surgery, use of drugs, etc.) **are excluded from this opinion**, unless they are connected to the military duty. In this respect, two cases should be differentiated:

- Procedures occurring **before entry into military duty**, which are outside the scope of this opinion, unless they could affect duty, this point to be assessed at the time of the medical fitness check-up.
- Procedures carried out **while the soldier is in active duty**, but **outside and unconnected with it**, which shall be assessed after the event by the medical corps during regular fitness and pre-deployment check-ups.

Guiding Principle No. 5: Procedures on a soldier in the private sphere occurring before entry into military duty or while the soldier is in active duty are outside the scope of this opinion unless they are comparable to an augmentation and have a connection with military duty.

13. In addition, **the Committee has excluded** from the concept of augmented soldier for the purpose of this opinion, **non-invasive augmentations which do not intervene directly on the soldier, even if they help to improve their ability to fight.**

Therefore, this opinion does not include, in a general manner, **equipment** in the sense of weapon systems, but also **soldier accessories** where they do not directly affect the body. Thus, as an example, exoskeletons² that require no surgery or fitting of an implant to be controlled are not considered in the scope of the study.

This is also the case of **training and operational preparation as well as the physical preparation and hardening of soldiers**. Although these practices are designed to improve individual and collective abilities to fight, they are not included in the scope of this opinion. In particular, psychological techniques such as potential optimisation techniques designed to reduce stress levels, monitor loss of alertness and improve performance, through relaxation, breathing control or mental imaging techniques, will not be addressed herein.

² Physically assistive exoskeletons are structures that duplicate the human skeleton in order to assist in the performance of a task or activity. Some take the form of orthotic devices fitted to the human body to relieve it of loads and prevent musculoskeletal disorders. Others, which are the subject of research in the medical field, use brain implants to enable injured or disabled people to regain the use of their limbs.

The Committee wondered whether the neurofeedback³ technique should be regarded as falling within the scope of this opinion. Although this neuro-enhancement technique raises questions, the Committee regards it as peripheral because it would be non-invasive and would be done knowingly by the soldier.

Guiding Principle No. 6: For the purpose of this opinion, augmentation practices do not cover all devices, weapons or techniques that augment a soldier's abilities to fight or defend, but only those that lead to crossing the body barrier. They encompass, firstly, practices, techniques, technologies and devices, whether or not medical, which consist in invasively intervening on the soldier to increase their physical, cognitive, perceptive and psychological abilities and, secondly, practices designed to prevent a health risk, particularly vaccination and medication, as well as certain substances administered for augmentation purposes.

14. Lastly, **certain items of special equipment do not constitute augmentations within the meaning of this opinion.** This is the case, for example, of virtual reality headsets or any other forms of interface that do not affect the integrity of the human body (UAV pilot cockpit, digital battle station, etc.). The digital transformation of a soldier's environment and its impact on soldier perceptions of the theatre of operations also raise ethical issues (such as the possible alteration of discernment or the ability to act knowingly); however, these are not augmentations and the problems posed are of a different order. They could as necessary be the Subject of subsequent work by the Committee.

D. A TEN-YEAR TIMEFRAME

15. The Committee has limited the scope of its reflection in time. Therefore, this opinion covers:

- current practices, such as:

- military use of alertness-altering substances governed by the instruction of 4 May 2015;
- preventive treatment for diseases such as malaria;
- mandatory military vaccination as provided for by Article D. 4122-13 of the Defence Code.

- possible developments over a ten-year period: to remain firmly rooted in reality and in the near future, the Committee **limited the study to the time equivalent of two military planning laws.** As the field of new technologies evolves very fast, a thirty-year timeframe could be swiftly out of phase and therefore ineffective or, conversely, represent a premature obstacle.

16. Even within this timeframe, **the Committee considers that this opinion should be periodically assessed to take account of any necessary technological developments and changing uses.**

³ Improvement of cognitive performance by retroactive analysis of brain activity; this technique is used for therapeutic purposes to train a person to regulate their brain activity; it can be based on electroencephalogram, MRI or spectroscopy. The brain's activity is made visible to the patient who then becomes aware of their brain activity and able to regulate it.

Guiding Principle No. 7: A periodic assessment of this opinion is considered necessary to integrate the very rapid changes in technologies and uses.

II. WHY USE SOLDIER AUGMENTATION, AND WHAT RISKS AND DILEMMAS DO SUCH USE ENTAIL?

A. A SENSITIVE STRATEGIC CONTEXT REQUIRING ANTICIPATORY REFLECTION

17. The 2017 *Revue stratégique de défense et de sécurité nationale*⁴ (Strategic Review of Defence and National Security) reports on a context of **increasingly serious conflicts** with increasingly sophisticated threats. The strategic environment is therefore dominated by **unpredictability** more than ever before since the end of the Cold War. Both government and other players now have a considerably broader set of solutions at their disposal to achieve their political aims, without needing to engage their forces in direct confrontations. Growing arsenals, the dissemination of contemporary conventional equipment and technological progress provide them with advanced military resources. In parallel, the dissemination of new technologies from the commercial world now facilitates access to capacities which, until recently, were available solely to governments. Combined with innovative modes of action, **these developments can challenge the operational and technological superiority of armed forces** in the West and in all environments – land, sea, and air – but also in cyber space and outer space that are becoming fully fledged areas of conflict. They also systematically render French military engagements more complex and more costly, as current conflicts have already shown. At the same time, some governments are stepping up their efforts in very high-tech systems, with the risk of European military powers being left behind.

Faced with these threats and aggravating factors of crises, this strategic review also underlines national cohesion and the resilience of functions essential to state continuity and life of the Nation as the vital bases of our freedom of action. In particular, the **resilience of armed forces and services is again becoming an operational challenge**. Finally, in light of engagements over the past decade, the principle of "mass" remains a key factor of operational superiority. It is becoming necessary to have sufficient forces on the ground, at sea and in the air to operate in vast and complex conflict zones, whilst also raising a defence against attacks by saturation.

18. In this context, which places our soldiers in great demand, tools must be found to preserve or improve the operational capability of the armed forces. The concept of employment of forces thus identifies the following key factors: moral fortitude and relationship of power, as well as **agility, ability to combine technological superiority and operational skills**, information management, **the capacity to act in exceptional conditions** and **the ability to cope with complex and changing operational environments**.

19. Therefore, soldier augmentations that can contribute to resilience in crisis situations, foster operational ascendancy, take by surprise, and synchronise efforts while saving on forces, have an undeniable operational advantage. Of those considered in prospective scenarios detailed in Appendix 2, examples include augmentations that would improve:

- the perceptive and cognitive abilities used by soldiers to monitor their environment and analyse and adapt to the situation, by acting with discernment;
- a soldier's abilities in terms of physical performance, speed, endurance and body resilience;

⁴ Accessible on the website of the French Ministry of the Armed Forces at <https://www.defense.gouv.fr/dgris/politique-de-defense/revue-strategique/revue-strategique>

- a soldier's ability to interact and integrate with the combat zone through their capacity to communicate.

20. With a view to sustainably maintaining the rank of our armed forces in Europe and the rest of the world, research on the augmented soldier must not be inhibited. In this field, as in defence innovation in general, the risk of our armed forces falling behind in terms of capabilities, or even dropping in status compared to our allies, must be prevented.

Guiding Principle No. 8: Research on the augmented soldier, as in defence innovation in general, must not be inhibited, to avoid the risk of our armed forces falling behind in terms of capabilities.

21. Furthermore, by facilitating the achievement of missions and the integration of soldiers into the operational environment, **augmentation can, in some ways, limit factors of trauma in operational engagements** and thereby help to preserve their mental health. Also, by improving command of this environment, an augmentation can help soldiers to **preserve their personal integrity through heightened awareness**, particularly as regards their obligations in terms of proportionality, controlled use of force and respect for protected persons (cf. paragraph 7).
22. Consequently, the Committee emphasises that soldier augmentation must not be contrary to the

Guiding Principle No. 9: In the context of increasingly serious conflicts and unpredictable strategic environments described by the 2017 *Revue stratégique de défense et de sécurité nationale*, tools must be found and optimised in order to preserve or improve the operational capability of the armed forces while observing the principle of respect for human dignity; this includes soldier augmentations that can contribute to resilience in crisis situations, foster operational ascendancy, take by surprise, and synchronise efforts while saving on forces.

Guiding Principle No. 10: The principle of using augmentations is not contrary to the founding values of our armed forces, namely courage, honour, and sense of sacrifice, provided that such use is regulated, proportionate, and consistent with the operational imperatives of our forces.

values of military duty, namely courage, honour, sacrifice for the purpose of the mission, availability, and controlled use of force. On the contrary, soldier augmentations aim to place soldiers in the best conditions to carry out their operational missions in an increasingly complex strategic context. In fact, the questions, conditions for implementation and red lines suggested in this opinion reflect these values that are deeply rooted in the armed forces and of which the nation is proud.

23. While there is no denying the strategic context and the potential of soldier augmentation, attention must nonetheless be paid to the risks it could entail.

B. MULTIPLE RISKS INHERENT IN SOLDIER AUGMENTATION

Potential Risks for the Soldier's Health

24. Augmentations, as considered by the Committee, are likely to have side effects on the soldier's health. They may be adverse effects after each use⁵ or over the long term (e.g., weight gain or increased likelihood of cancer), caused by the repeated ingestion of a substance. There could also be other effects such as the rejection of an implant or transplant.
25. If only because of the satisfaction or feeling of power it can provide, an augmentation of any nature **could lead to addiction and dependence**, due in particular to the "reward system" it can create. Addictions are not specific to augmentations; for example, studies are in progress on the dependence created by repeated and prolonged use of digital screens⁶.
26. An augmentation of one function of the human body could lead to side effects on others, and "debilitate" them, **thereby creating an imbalance between certain brain or physical functions**. Even if the augmentation is not permanent, the augmented soldier could debilitate certain functions, perhaps even irreversibly⁷.
For example, the use of certain medicines that temporarily suppress hunger and thirst, or even pain, do not necessarily replace the body's need to eat or receive treatment. Any use of them, even as a last resort, could therefore **inhibit a soldier's instinct to survive**.

Risk of Social Pressure

27. Outside specific cases, augmenting only some members of a combat unit (squadron, crew, or task force) could be problematic. Within a given unit, **the augmented soldiers might regard the others as a hindrance or even a danger**. Conversely, non-augmented soldiers may feel they are under **pressure from their team** (task force, superiors, etc.) to be augmented, putting them in a situation of **"implicit coercion"**.⁸
28. Particular attention is also paid to repair surgery leading to an augmentation, as it is highly coveted. For example, some soldiers may be tempted to request or be asked to replace a healthy limb with an artificial one to augment their physical abilities. On a less extreme level, soldiers might be tempted to undergo eye surgery to improve their sight.
Consequently, there could be demands in civil society for augmentations reserved solely for the military.

The Issue of Social Integration of Soldiers

⁵ For example, concerning slow-release caffeine, the Medical Corps has identified the usual adverse effects of dietary caffeine: nausea, mild sleep disorders, tremor, nervousness, anxiety, increased heart rate and increased urination.

⁶ The observatory for good screen use <https://lebonusagedesecrans.fr> identifies examples of addictions related to new technologies.

⁷ Note that such a phenomenon is again not specific to the augmentations studied by the Committee; some studies on the impact of using navigation services question how this technology could "debilitate" the geographical orientation functions of the human brain.

⁸ Term explained by the French National Consultative Ethics Committee for Health and Life Sciences in its opinion No. 122 on the use of biomedical techniques for "neuro-enhancement."

29. All soldiers are also citizens who **return to their social environment** after a military operation or at the end of their career. However, certain physical, physiological, or psychological effects of augmentations could affect their return to civilian life⁹.

Two cases can be mentioned as purely fictitious examples:

- a soldier whose amputated arm has been replaced with a non-removable prosthesis, which is also a weapon, could not therefore return to civilian life;
- a soldier who has been "augmented" for a military operation but who would not tolerate the absence of further augmentation upon returning to civilian life.

Risk of Dehumanisation

30. Controlling the risk of dehumanisation is essential. First, a non-controlled augmentation could be regarded as a degradation of the soldier's person, which would be contrary to the constitutional principle of safeguarding human dignity.¹⁰ Second, certain substances could lead to a form of disinhibition, increased aggressiveness, loss of discernment or even dehumanisation in the soldier, and therefore a risk in terms of compliance with *international law applicable to armed conflicts*¹¹; such a disinhibited soldier could render themselves guilty of failing to *respect and humanely treat all protected persons*¹¹ and use more than *absolutely necessary armed force*.¹² They might no longer be capable of assessing the proportionality of their acts or the lawfulness of orders received in relation to domestic law, or their compliance with international law applicable in armed conflicts.¹³ One example would be taking substances that prevent a soldier from feeling fear, compassion or doubt; a soldier must act knowingly and with discernment¹⁴ and must not regard death, whether inflicted on others or their own, as a situation that does not concern them. Such substances could turn a soldier into a cold person, a mere technician of death. To quote Marshall de Lattre de Tassigny, "*A tool is but the extension of a man's hand.*" This risk of distancing soldiers from the enemy is already taken into account in the doctrines that accompany the introduction of new weapon systems, as was the case recently with the operational introduction of armed UAV. Furthermore, these substances could lead soldiers to take unnecessary risks, endangering themselves and their group, due to a poor assessment of the danger.

⁹ This would indeed be contrary to the spirit of Article L.4111-1 of the French Defence Code according to which the statute of the military *offers those who leave military duty the means to return to a professional activity in civilian life and ensures that military retirees maintain a connection with the institution.*

¹⁰ Constitutional Council decision no. 94-343/344 DC of 27 July 1994.

¹¹ Cf. Article D.4122-7 of the Defence Code

¹² Cf. Article L.4123-12 of the Defence Code

¹³ Cf. Article D.4122-3 of the Defence Code

¹⁴ Cf. Article D.4122-8 which stipulates that Soldiers in combat must respect and humanely treat all persons protected by applicable international conventions, as well as their property.

Risk of Seeing New Vulnerabilities Emerge

Guideline No. 1: Assess the impacts of each augmentation on the physical and mental health of soldiers, by including at least:

- **The short-, medium- and long-term adverse effects;**
- **An assessment of the risk of addiction;**
- **Risks of imbalance between certain brain or physical functions;**
- **Potential difficulties upon returning to civilian life caused by the augmentation.**

31. Some soldier augmentation techniques, even when they are designed to preserve or enhance operational capabilities, could be a source of vulnerability. For example, a brain implant or a prosthesis integrating embedded computing could represent an opportunity that an enemy could exploit. By analogy, such vulnerabilities to cyberattacks have already been found in pacemakers or insulin pumps.

III. HOW SHOULD SOLDIER AUGMENTATION BE USED?

A. THE NEED TO BE PART OF THE CAPABILITY AND OPERATIONAL ORGANISATION OF THE ARMED FORCES

32. The various stages in the development and operational use of augmentation involve different responsibilities:

- a. Under the authority of the Defence Minister, **capability choices** are made under the responsibility of the **Chief of the Defence Staff**.¹⁵ Soldier augmentations should not provide justification for reducing the resources made available to the armed forces or for challenging existing formats. Any augmentation should **above all be necessary and adapted**, meaning that it improves or preserves the operational capability and condition of soldiers and helps to deal with a given situation. It is for the high command, with full knowledge of the medical and ethical aspects, **to assess the risk-benefit ratio of each augmentation by clearly identifying the effective gain compared to other solutions**, and to make its decision with due regard for proportionality.

Guideline No. 2: Analyse the risk-benefit ratio for each augmentation, including cyber risks.

Guideline No. 3: Identify the effective gain of each augmentation compared to an alternative solution.

Therefore, as an example, capability decisions regarding augmentation that the high command could be required to make in the medium term may include:

- In the field of stress control, should non-invasive potential-optimising techniques be preferred to the use of substances?
- Should sports activities be preferred to tools and substances that "artificially" boost physical abilities?
- Should the most sensitive augmentations (in terms of adverse side effects, complementary abilities, etc.) be reserved for the most exposed units (Special Forces, etc.) or soldiers who have specific responsibilities?
- Should retina surgery or the use of night vision-enhancing substances be used instead of night-vision binoculars or augmented reality devices?
- Should augmented reality environments providing a simplified depiction of the tactical situation be preferred to the use of substances which boost soldier perception or alertness?

¹⁵ Cf. Article R.3121-2 of the Defence Code.

In any event, augmentations must not, save in exceptional circumstances, be a pretext for adopting more stringent standards (training, rest time, etc.).

Guiding Principle No. 11: Soldier augmentations should not provide justification for reducing the resources made available to the armed forces, reducing formats or training, or even, save in exceptional circumstances, for increasing current standards (length of duty, etc.).

- b. **The field of education, training and operational preparation** of the armed forces is the responsibility of the Chiefs of Staff (under the authority of the Chief of the Defence Staff); they are therefore responsible for developing the concepts and doctrines of use and for providing instruction and training and assessing whether military capabilities are fit for use.¹⁶ In the same way as in the field of capability, the Committee believes that each augmentation should be covered by doctrine for its use, explaining the purposes, conditions of use and what is expected of each player.
- c. **In the field of military operations**, the Chief of the Defence Staff and the chain of command associated with each operation shall be responsible for ordering the use of a given form of augmentation based on advice from the medical corps. In particular, the use of certain types of augmentation could be limited to specific situations (such as exceptional circumstances, an extremely sustained operational activity or as a last resort).

In principle, the use of augmentations in operational situations does not concern law and order engagements on the national territory. However, in some specific operational situations, the high command may use augmentation based on factors of time, place, type of threat, form of intervention and assessment of risks. For example, it may be necessary to use substances to protect the soldier's health, preserve operational capabilities and avoid a health risk in a health crisis caused by a pandemic or major industrial accident, or when faced with a bacteriological or chemical threat (situation of biological defence of the armed forces¹⁷). Such use could contribute to the resilience of the Nation as a supplement to other government means.¹⁸

If, in some operational situations of this kind, the speed of development and approval of an augmentation is not connected to that of the capability, **the principles of responsibility of the chain of command, assessment of the risk-benefit ratio, contextualisation with the current situation, and continuous support by the medical corps must nevertheless guide decisions.**

Guideline No. 4: Draft doctrine for the use of each augmentation explaining, in particular, the purpose, conditions of use, need for contextualisation with the given situation, the responsibilities of each person and what is expected of them.

¹⁶ Cf. Article R.3121-25, 28 and 29 of the Defence Code

¹⁷ Cf. joint publication PIA 3.8.1(A)DBA(2017) No. D-17-002681/DEF/EMA/PLANS/MA/DR of 15 May 2017.

¹⁸ Cf. joint publication PIA-3.60.8_NRBC-TN(2017) No. D-17-0017004/ DEF/EMA/PLANS/MA/DR of 22 March 2017.

B. THE NEED FOR ONGOING SUPPORT BY THE MEDICAL CORPS (SSA)

33. It would not appear necessary for the key principles, from design to operational commissioning and then use of an augmentation, to depart from the organisation of the French Ministry of the Armed Forces, as set out in instruction No. 744/DEF/EMA/SC_PERF/BORG – No. 744/DEF/DCSSA/PC/MA of 4 May 2015 on military use of alertness-altering substances.

34. In general, the medical corps provides medical support to the armed forces, especially during operations but also in terms of preparing forces. Its missions are explained in Articles R.3232-11 to 3232-14 of the Defence Code and its organisation is defined in the Order of 11 July 2018. Furthermore, Decree no. 2008-933 of 12 September 2008 defines the specific statute of military physicians and Decree no. 2008-967 of 16 September 2008 sets out the rules of ethics specific to them. In particular, the medical corps has specific power to prescribe the use of substances even before they are granted market authorisation.

35. During all the phases mentioned above, the medical corps is therefore involved in different respects:

1. It gives both the command and soldiers prior advice on the nature of the augmentation, the expected effects, and the risks of adverse effects, while evaluating the risks and monitoring them over time.
2. It defines and supervises the supply of substances, prostheses and implants to the armed forces and draws up guidelines for use by the command.
3. It defines the test procedures to be carried out in advance to take into account the variations in individual reactions to augmentations.
4. It provides the necessary medical follow-up after the augmentation, including upon return to civilian life.
5. It provides a scientific and technical guarantee in the medical field in the broad sense, within the framework of compliance with best practices.

Guiding principle No. 12: Any augmentation must always be developed and used within the framework of the capability and operational organisation of the armed forces and be continuously supported by the medical corps.

36. The medical corps therefore plays a very singular role, insofar as it advises the command in the context of the defined collective mission, and provides individual soldier management.

Guideline No. 5: The Medical Corps must provide support throughout the life cycle of an augmentation (assessment of health risks, definition and control of substances, prostheses and implants, development of guidance for use by the command, conditions of prior tests, medical or even psychological follow-up).

37. As explained above, research is vital to avoid the risk of our armed forces being left behind in terms of capability. The armed forces have a Committee for the Protection of Persons¹⁹; in accordance with Article L1123-2 of the Health Code, its members are chosen with a view to

¹⁹ In accordance with Article 1123-16 of the Health Code.

ensuring independence and diverse expertise in the field of research involving human subjects, and with regard to ethical, social, psychological and legal questions.

Therefore, the Committee considers that, in addition to the red lines explained in section III.F, research in the field of augmentations should be very open as a matter of principle. It must respect rules of medical ethics and be supported by the Committee for the Protection of Persons (CPP) specific to the Ministry of the Armed Forces, to guarantee fundamental rights while taking into account the unique nature of use of the armed forces.

Guiding Principle No. 13: While research in the field of augmentations must be open, it must comply with rules of medical ethics and be guaranteed by the Committee for the Protection of Persons of the Ministry of the Armed Forces.

C. SYSTEMATICALLY TAKE INTO ACCOUNT THE IMPACTS OF AUGMENTATIONS ON SOLDIERS

38. In many cases, both domestic and foreign operations have an impact on soldiers, such as injuries or post-traumatic stress syndrome. The situation is similar when a soldier is going to be augmented; even if impact analyses are carried out before introducing an augmentation, there is no such thing as "zero risk": **adverse effects are always possible, and no one can guarantee that an augmentation will be systematically and completely reversible.** The post-mission transition periods²⁰ organised after certain operations, particularly to prevent certain effects of operational stress, are also an opportunity, if necessary, to break soldiers from the "habit" of using their augmentation, before returning to their family and friends in France.

In addition, the Defence Code provides that *"soldiers shall be provided with the necessary conditions of health and safety to preserve their health and physical integrity during their duty."*²¹ This principle is transposed by the concept of military authority *"responsible for taking necessary measures to ensure the safety and protect the physical and mental health of soldiers, regardless of the geographical location of the activity,"* even if this means adapting *"these provisions and principles to local circumstances and the operating environment."*²²

Thus, in line with the duty of the high command to protect soldiers, reversibility must be sought as much as possible when developing each augmentation. Consequently, the long-term effects of an augmentation **must not be incompatible with the soldier's private life after operational deployment or upon their return to civilian life.**

Guideline No. 6: Always seek reversibility when using augmentation.

39. In terms of prevention, on the occasion of a prior medical fitness check-up, soldiers who have previously been identified as liable to develop addictions could be ruled out from augmentation.

²⁰ The purposes and organisation of these post-mission transition periods are detailed in the joint doctrine DIA-4.14_PERS(2013) No. 163 /DEF/CICDE/NP of 26 September 2013, amended on 25 June 2014.

²¹ Article L. 4123-19 of the Defence Code.

²² Articles R.4123-53 and 54 of the Defence Code.

Furthermore, prior medical tests should be carried out to check tolerance and prevent any adverse side effects.

40. Depending on the type of augmentations and their impacts on soldiers and their environment, the medical corps should assess the need for a medical follow-up or even psychological support, including support for return to civilian life.

Guideline No. 7: Based on the impacts feared, assess the need for a transition period and medical follow-ups or psychological support, including support for return to civilian life.

41. It is for the command to decide on the concept of use, to order implementation, and to identify troops that are to be augmented and those that are not. **However, the Committee considers that the utmost attention should be paid to ensuring that an augmentation does not lead to exclusion from a group.** In order to maintain coherence and cohesion within a given unit, **soldiers who have the same qualifications, are capable of performing similar duties and are supposed to complete the same mission, should generally be augmented in the same way,** unless they are unfit for augmentation or intolerant due to side effects.

Guideline No. 8: Pay attention to risks of social pressure and, in particular, ensure that an augmentation does not generate exclusion from a group.

D. FIND THE RIGHT BALANCE BETWEEN SOLDIER CONSENT, OBLIGATION, AND INFORMATION

42. Prior to any medical intervention, a citizen must give their consent, in accordance with Article 16 - 3 of the French Civil Code pursuant to which "*There may be no interference with the integrity of the human body except in case of medical necessity for the person or exceptionally in the therapeutic interest of another,*" and "*The consent of the person concerned must be obtained beforehand, except when their condition necessitates a therapeutic intervention to which they are not able to assent.*" This principle of prior consent is confirmed again in the rules of ethics specific to military physicians.²³
43. However, soldiers are governed by a **special statute** explained in the first section, which imposes upon them a spirit of sacrifice, potentially restricted rights compared to other citizens and obedience to received orders. In addition, **in some operational situations, it will be inappropriate for a military commander to have a heterogeneous combat group in which some members are augmented and others are not.**
44. In any event, and this is a crucial point, the Committee considers it **vital for soldiers to be informed of the risks inherent in any augmentation,** even when the high command decides to

²³ Article 6 of Decree no. 2008-967 of 16 September 2008 defining the rules of ethics for military physicians specifies that: "*Except in an emergency or a situation in which it is impossible, the physician must seek the consent of the patient and respect his or her wishes in the event of refusal, after having warned the patient of the foreseeable consequences of the decision*". Pursuant to Article 40: "*No mutilating intervention may be performed without compelling medical reasons and, in an emergency or a situation in which it is impossible, without the person concerned and, where applicable, his or her legal representatives having been informed and having given their consent*".

order the augmentation without prior consent. **Soldiers must be given explicit information, which can be traced**, to protect both the institution and the soldiers concerned. This process must be **followed up over the long term** to take into account changes occurring over time in the state of knowledge about the potential consequences of an augmentation.

Guideline No. 9: Systematically inform the soldier, in advance, of the risks inherent in an augmentation, and ensure the traceability of the act and a long-term follow-up to consider changes occurring over time in the state of knowledge about potential consequences.

45. On a case-by-case basis, the command **must therefore reconcile** the principle of obtaining consent with the principles of having armed force at disposal and obedience to orders dictated by strategic necessities. **Therefore, depending on the type of augmentation, the inherent risks, the expected operational benefit and the context of use, the conditions of obtaining consent, or whether it should be overridden, must be determined.** This reconciliation is already done when our soldiers are forced to be vaccinated or to take medical treatment to protect them against a health risk (such as malaria infection). On the other hand, the use of alertness-altering substances shall, at this stage, be subject to the prior consent of each soldier; any refusal to ingest caffeine would not jeopardise operational capability because the natural physical abilities of many soldiers are such that the use of these substances is not necessary.²⁴

Guideline No. 10: Establish the need to obtain consent as a principle, subject to any justified exceptions and, in this case, formally define at the appropriate level any necessary situations in which it could be overridden.

E. EXAMINE LAWFULNESS WHENEVER NECESSARY

46. Article 36 of Protocol I additional to the Geneva Conventions of 12 August 1949 relating to the protection of victims of international armed conflicts of 8 June 1977 (Protocol I) provides that *"In the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party is under an obligation to determine whether its employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party."*

47. In principle, the concept of augmented soldier, which is difficult to liken to the concept of weapon, must be given special treatment with regard to international law, human rights and domestic law. However, **the augmentation process could be subject to International Humanitarian Law as a "means of warfare" if the augmentation is specifically designed to inflict death, injury or harm on persons or property, or as a "method of warfare" if the use of these processes is an integral part of offensive capabilities.** For example, a weapon embedded in a prosthesis is a means of warfare, whereas a brain implant used to control an armed UAV is a

²⁴ The analyses conducted by Dr. Gras on the use of slow-release caffeine reproduced in the *Guide pratique de gestion du cycle veille – sommeil en milieu militaire* produced by the military corps indicate that 37% of air force pilots involved in the HARMATTAN operation did not take such substances in 2011, despite flying at night.

method of warfare. Therefore, when initiating any augmentation project, the need for a lawfulness review must be identified.

Guideline No. 11: When initiating any augmentation project, identify the need to review its lawfulness.

48. Provision is made for the performance of such lawfulness reviews in the ministerial instruction no. 6255/ARM/CAB of 31 October 2019.

F. INVIOABLE RED LINES

49. Given the nature of augmentations and potential technological developments, the Committee considered the following points to be red lines which must not be crossed.

50. In light of the considerations developed in paragraph 30 and in line with the framework assigned to the French armed forces, the Committee rules out any augmentation considered likely to reduce the controlled use of force, or cause a loss of humaneness, or which would be contrary to the principle of respect for human dignity.

Guideline No. 12: Prohibit any augmentation considered likely to reduce the controlled use of force, or cause a loss of humaneness, or which would be contrary to the principle of respect for human dignity.

51. The Committee considers any cognitive augmentation of soldiers that would affect the free will they must have in firing action to be unacceptable.

Guideline No. 13: Prohibit any cognitive augmentation of soldiers that would affect the free will they must have in firing action.

52. The Committee rules out any augmentation which could lead a soldier to overstep the bounds of their disciplinary obligations.

Guideline No. 14: Prohibit any augmentation which could lead a soldier to overstep the bounds of their disciplinary obligations.

53. Despite the unique nature of the statute of the military, the Committee considers that there is no possible justification, whatever the circumstances, for departing from Article 16-4 of the

54. Civil Code²⁵ on genetic modifications. There appears to be no legitimate reason for considering any eugenic practice for the purpose of soldier augmentation.

Guideline No. 15: Prohibit eugenic or genetic practices for the purposes of soldier augmentation.

55. In accordance with the developments set out in paragraphs 29 and 38, the Committee considers it unacceptable to consider using any soldier augmentation that would jeopardise their integration into society or be incompatible with their return to civilian life.

Guideline No. 16: Prohibit any augmentation that could jeopardise a soldier's integration into society or their return to civilian life.

Guideline No. 17: Prohibit use of any augmentation if its impacts and side effects have not first been researched.

56. The Committee is of the opinion that it is impossible to consider using an augmentation, with or without prior consent, if its impacts or side effects have not first been researched. Even if our armed forces are required to intervene in the most extreme situations, this would be contrary to the obligations to protect physical and mental health and to the spirit of this opinion. Any argument relying on the concept of *ultimate sacrifice* in such extreme situations would be inadmissible.

²⁵ "Any eugenic practice which aims at organising the selection of persons is forbidden. Any medical procedure whose purpose is to cause the birth of a child genetically identical to another person alive or dead is forbidden."

APPENDIX I

REFERENCE STANDARDS TAKEN INTO ACCOUNT FOR THE COMMITTEE'S OPINION

Beyond ethical considerations, this appendix lists the provisions defining the normative framework within which the question of the augmented soldier was examined:

- The French Constitution, particularly its Preamble and Articles 5, 15, 20, 21 and 55 establishing the constitutional principles of national independence, safeguarding the fundamental interests of the nation, free disposal of armed force²⁶ and the superior authority of treaties.
- Obligations arising from international law applicable to armed conflicts, particularly the four Geneva Conventions, and the two additional protocols mentioned in Article D.4122-7 of the French Defence Code.
- Article D.4122-8 of the Defence Code on respect for protected persons by servicemen in combat.
- Articles 16 to 16-9 of the French Civil Code on respect for the human body.
- The following articles of the Defence Code:
 - o L.3211-2²⁷, L.4111-1 *et seq.* and Articles D.4122-1 to 4122-11 establishing the general rules of discipline of the armed forces.
 - o L.4123-12 specifying the legal protection and criminal liability of a member of the armed forces when using force in self-defence or during a military operation outside French territory.
- Military Planning Act No. 2018-607 of 13 July 2018 for the years 2019 to 2025 and particularly the strategy review appended thereto.
- Articles R.3111-1, R.3121-1 to 20 of the Defence Code on the duties of the Chief of the Defence Staff.
- Articles R.3121-25 to 32 of the Defence Code on the duties of the Chiefs of Staff of the army, naval force and air force.
- Articles R.3232-11 to R.3232-14 of the Defence Code on the medical corps.
- The order of the Minister for the Armed Forces of 17 July 2019 establishing the Defence Ethics Committee.
- Ministerial Instruction no. 6255/ARM/CAB of 31 October 2019 on examining the lawfulness of new weapons and new means and methods of warfare, pursuant to Article 36 of Protocol I to the Geneva Conventions of 12 August 1949.
- Instruction No. 744/DEF/EMA/SC_PERF/BORG – No. 744/DEF/DCSSA/PC/MA of 4 May 2015 on military use of alertness-altering substances.

²⁶ And QPC no. 2014-450 of 27 February 2015 and QPC 2014-432 of 28 November 2014.

²⁷ Which stipulates that "The Armed Forces of the Republic serve the Nation. Their mission is to prepare and ensure the defence of the homeland and its best interests by armed force."

APPENDIX 2

EXAMPLES OF AUGMENTATIONS INCLUDED IN THE SCOPE OF THE STUDY

For illustration, this appendix lists some examples of augmentations taken into consideration when preparing this opinion, which were presented by the research centre of the Saint-Cyr Coëtquidan Military Academy. This appendix then indicates whether the augmentation is available in the civilian world or in the French Armed Forces.

These are not augmentations recommended by the Committee or the Military Academy. The list below aims solely to open the possibilities within the timeframe defined by the Committee.

	Commercially available or used in the civilian world	Available in the Armed Forces
Ingested substances that reduce fatigue	Yes (off the shelf)	Yes
Ingested substances that facilitate recovery after intense activity	Yes (off the shelf)	Yes
Ingested substances that reduce stress	Yes (off the shelf)	Yes
Ingested substances that heighten alertness	Yes (off the shelf)	Yes
Ingested substances that prevent or substantially reduce the feeling of pain after a serious injury	On prescription	Yes
Vaccines	On prescription	Yes
Antimalarial drugs	On prescription	Yes
Ingested substances that improve resistance to isolation or after capture by the enemy	No	No
Ingested substances that suppress the feeling of hunger or	Yes (off the shelf)	No
Ear surgery to hear very high or low frequencies	No	No
Body implants for geolocating friendly soldiers	No	No
Body implants for remote collection of physiological parameters (e.g., blood pressure)	No	No
Body implants that deliver an anti-stress substance if stress is too high	No	No
Body implants that allow control of a weapon system	No	No

Body implants that enhance brain capacity through deep brain stimulation	No	No
Body implants that provide access to infrastructure via presentation of a chip	Yes, for access to certain services or leisure activities	No