

Ethics Essay

What are the ethical implications of working for an arms manufacturer as an engineer, which responsibilities come with it and to what degree are engineers accountable for application of their product?

The arms industry

The worldwide spending on military equipment was estimated to be 1.531 trillion US dollars in 2009, which is 6% more than in 2008 and 49% more since the year 2000. Following the trend, and taking into account the worlds changing state with Asia's nations on the rise, striving for military recognition, the world's military expenditure is expected to continue to rise. (1)

Five of the biggest benefactors of this rise in expenditures are the companies (2):

- BOEING, employing about 160,000 workers and creating 60.90 billion US dollars annual revenue (2008).
- LOCKHEED MARTIN, with 140,000 employees and an annual revenue of 45.19 billion US dollars (2009).
- THE EADS, comprising 119,500 people which generate 42.82 billion US dollars annual revenue (2009).
- NORTHROP GRUMMAN, with a workforce of 120,000 men and women, making 33.89 billion US dollars revenue (2008).
- BAE SYSTEMS, with its staff of 107,000 people and annual revenue of 33.63 billion US dollars (2009).

Popular views

From a fifth year master student:

"I received an offer from Lockheed Martin to work for them once I finish my studies. I will decline. They build mean planes."

From a first year upon hearing the above:

"But they are so cool!"

The fifth year student was my statics tutor in my first year; the other one a fellow student. During my three and a half years of study at the TU Delft, I have talked to some people about working as an aerospace engineer for an arms manufacturer. I have also found a number of discussions on the internet on the topic.

Most students' view on the moral issue depends on the kind of weapon, platform or technology. They are averse to developing a new generation of deadly chemical nerve agent or the latest anti-personnel mine. However they would be less hesitant to developing an anti-air missile or an autopilot for a combat aircraft.

It can be generally said that within the student body of our faculty, the opinion is upheld that the more indiscriminant and brutal a weapon is in first instance, the more morally objectionable is affiliation with it. In the case of the land mine, it harms anybody unfortunate enough to step on it. It harms in first instance and the harm done is especially violent. Thus most of our students would not want to work for a landmine producer. The same holds for the chemical gas.

On the contrary, the autopilot does not harm anybody directly, but in a later instance, so argue some. Generally though, developing a military autopilot or any supporting technology not directly involved in killing or harming, is thought of as acceptable by our students.

Thus level of ***involvement of the product in killing, indiscriminancy of the product and brutality of the product*** matter apparently.

A student I talked to encountered a differing moral dilemma. Whereas he would not like to be involved in the development of an attack helicopter, he is interested in rotorcraft structures. He wonders whether or not he does morally wrong, when researching into helicopter technology, for example new rotor blades, which could be used for the latest attack helicopter, but as well for civil purposes.

The topic he touched upon is ***degree of personal involvement***. He believes that whilst the engineer working on the weapons system is morally wrong, the one developing the rotor blades which could be used for civil purposes too, is less involved and doing less wrong.

Coming back to the example in the introduction to this section, the first year student would work for LOCKHEED MARTIN, because they build cool planes. What he is expressing is high technological interest. This scenario is found a lot at our faculty. Generally said most students, especially the younger ones, have no issues with involvement in fighter aircraft mainly because of their technological appeal.

Another often cited reason for working for an arms manufacturer is the alleged better pay compared to the civil aerospace sector. Thus ***technological and financial interest*** also matter to most of our students.

Nuclear weapons are a different topic. Whilst most agree that a nuclear weapon free world is desirable, an often heard opinion is that their existence ensures peace by their imposing nature. No country would attack a country in possession of nuclear weapons, because of fear of retaliation. Thus the ***political context*** justifies their existence and development. On the other hand their indiscriminancy and brutal effect let some students to believe involvement in their development to be immoral.

From the examples above, seven key factors which are important when reasoning whether or not individuals find it (im)moral to work for an arms manufacturer can be distinguished. These are:

Level of involvement of the product in killing or injuring, indiscriminancy of the product, brutality of the product, degree of personal involvement in the development, technological interests, financial interests and political context.

The ethical problem as I see it existing

Of all engineering fields none is more affiliated with the arms industry than aerospace engineering. This is exemplified by the fact that BOEING is not only the world's largest aerospace company in terms of revenue, orders and delivery, but also the largest aerospace and defense contractor in the world in terms of defense-related revenue. About half of BOEING's employees and revenue stem from its military sector Boeing Defense, Space & Security. (2)

Because of this, and the circumstance that many of our students, including the author, perceive the aerospace defense industry to be more interesting than the civil aerospace sector, working for an arms manufacturer is a real option for many TU DELFT graduates.

There are codes of ethics and codes of conduct for engineers of almost any civil engineering field, which give an ethical framework to guide moral decisions. There exist also theories and principals regarding war itself, the most renown being JUS AD BELLUM and JUS IN BELLO. Strangely though, there are no ethical constructs for engineers working in the arms industry. Instead they often are perceived and perceive themselves as civil engineers. For example, the code of ethics of LOCKHEED MARTIN, one of the world's largest weapon manufacturers, is titled *SETTING THE STANDARD* (3). It could easily be exchanged by one from any civil engineering firm, as it contains exclusively details on ethical business practice. Not a word is spent on ethical aspects of the weapons LOCKHEED MARTIN produces.

One reason codes of ethics exist for engineers is for them to be able to deal with the responsibilities they have due to the profound effect that their actions or inactions can have on society. The latter is even more true for engineers in the arms industry, their doings can have and already have had a profound effects not just on a society, but on the history of mankind. Technologies such as gunpowder and the nuclear bomb and even a single product such as the AK-47, altered wars and shaped our history. This is not reflected in common ethical conducts of weapon engineers.

For these reasons I pose the following question, which I answer in this essay:

What are the ethical implications of working for an arms manufacturer as an engineer, which responsibilities come with it and to what degree are engineers accountable for application of their product?

Theories

I base this essay on two ethical theories, CONSEQUENTIALISM and PASSIVE RESPONSIBILITY (4), and give two different perspectives by applying more widely excepted concepts, CIVIL LAW and JUS AD BELLUM and JUS IN BELLO (5).

For assessing the righteousness of working for an arms manufacturer I use CONSEQUENTIALISM, by asking the questions: What are the consequences of an engineer working for a weapons manufacturer? Are these consequences desirable and is it thus moral to work for a weapons manufacturer (4)?

Since weapon manufacturers, or rather their products, are possibly involved in armed conflicts, another way of interpretation is by subjecting the weapon manufacturers and their employees to the principles of JUS AD BELLUM and JUS IN BELLO. These concepts encompass criteria for a just war. While possibly not known by their name to the reader, their content is found in many international agreements, most prominently the UN CHARTER (6), the GENEVA CONVENTION (7), the HAGUE CONVENTIONS (7) and the JUDGMENT OF THE INTERNATIONAL MILITARY TRIBUNAL AT NUREMBERG (8).

In assessing the responsibility of individual engineers for application of their product, I turn to the concept of PASSIVE RESPONSIBILITY, more specifically the four conditions that need to apply in order to hold someone reasonably responsible: ***Wrong-doing, Causal contribution, Foreseeability, Freedom of action*** (4).

A different perspective can be obtained by looking at matters from a CIVIL LAW point of view. CIVIL LAW is thought to be as just and fair by most people. Thus by applying CIVIL LAW in a thought experiment to a scenario, a widely accepted and relatable moral framework can be employed. A country specific CIVIL LAW is not required here. Liability and guilt are treated sufficiently similar in penal law of most western democracies for the sake of exemplification in this essay.

Actors and their interests

Governments

The primary concern of any government is the safety and wellbeing of its citizens. A well-equipped standing army guarantees national security in case of self-defense and pre-emptive strikes and is used to enforce national interests such as to secure resources or exert political pressure. The strength of this army is determined to large extend by the technological level of its equipment. Thus any government has an interest to receive high tech military equipment, be it by importing it or producing it within its borders. Therefor there are actually two good reasons for a government to increase military industrial activity, for its own needs and to export for good money.

Soldiers

Soldiers are executing the will of the government and are the end-users of the military products. It is in their interest to receive the best equipment possible, not just to be more effective as an army but ultimately to increase their individual chances of survival.

Company Representatives

Company Representatives, thus stake holders and top level managers, share a primary concern, which is to increase revenues of the company. Revenues increase with increased sales, which in turn depend on price of the product and effectiveness. Since the military industrial complex is heavily state funded (1) (9) in most countries and the number one client is the state, too, it comes as no surprise that the company representatives try to stay on the good side of governments.

Engineers, other employees

Engineers and other employees working for an arms manufacturer contribute in one way or another, directly or indirectly, to the design of weapons. As with anyone seeking employment, engineers want to make a good living, to earn money. Eventually they want to build a career. Important to many engineers is participation in interesting projects, to live their tech enthusiasm. Applicable to some engineers in the arms industry is the wish to contribute to national security.

Scenarios

All following scenarios are hypothetical and are meant to serve the purpose of illustration.

Scenario I

An engineer, we shall call him Tom, works on a new anti-personnel landmine as a senior engineer. He is told that the mine has to fulfill the following list of requirements. It has to be cheap and easy to handle, hard to detect and hard to clear out. Overall it has to be effective and versatile. Tom does researches and finds out that the requirement of cheap and effective is combinable by reducing the amount of explosive charge. As a result, the mine does not kill, but instead severely injures the victim such as taking a foot or the leg. This way it takes two to three other targets to take care of the wounded, demoralizing the enemy forces, rendering the mine more effective.

Scenario II

Christine has been hired to work on a next generation multirole jet fighter. It is designed to be capable of tactical missions such as reconnaissance, ground attack and air defense. Possible applications to be taken into account during design are the war against terrorism, thus asymmetric warfare.

Scenario III

Philip has been accepted into a position with a helicopter manufacturer, which produces both civil and military helicopters. He is involved in the design of a high tech helicopter blade and he learns that it will find application in a civil search and rescue version, but also in the latest attack helicopter. Philip is not involved in either program directly, instead his task is somewhat more fundamental. Whatever his findings and designs are, they still have to be tailored to the specific context they are being employed to.

Interpretation of Scenario I

Public View

From what I have seen and heard, most people find this kind of work morally unacceptable. Coming back to the seven key factors distinguished earlier, I claim that most people would not like to do Tom's work for moral reasons, because:

His product is very involved in injuring. As a matter of fact it is the very cause of injury. The product is indiscriminant of combatant and non-combatant, it is rigorously violent and he is personally very involved.

Consequentialism

The consequences of a person stepping on a mine the type that Tom produces are, that that person loses a leg or a foot, or perhaps dies. If the person survives it will have suffered tremendous pain and will be crippled for the rest of his life.

One can argue that they can be used for a just cause, in a just war for example, complying with the *JUS AD BELLUM* principle. As a matter of fact, this is the very nature of *CONSEQUENTIALISM*, "*the end justifies the means*". This is upset by the fact that 34% of victims of mines are non-combatants, 24% are children, which accounts for about 25,000 individuals a year (10). This can certainly not be a desirable end of any armed combat, whether the cause was just or not.

But again it is arguable, that mines are produced and stockpiled as a deterrent, much like nuclear weapons these days or poisonous gas during World War II. An enemy would think twice about employing mines, if he has to count on the opponent using them in retaliation. More simplistic, mines count towards an army's weapons arsenal, so it renders a country more powerful and threatening, without even a single mine ever put in place. But history showed that most any mine developed has been put to use, sooner or later.

Say Tom does not know what is contained in the above paragraphs, then the sheer violence and suffering unleashed by the product is in my opinion an undesirable outcome and should be avoided. As he is working actively on the development of these mines, he does morally wrong by aiding to an unethical outcome. If he knew about the 34% non-combatant victim rate, this claim would be even more true.

Jus ad Bellum - Jus in Bello

The use of weapons that cause suffering such as the landmine Tom is producing do not comply with the *JUS IN BELLO* criteria proportionality and discriminancy. By the *JUS IN BELLO* teachings, landmines are inherently unethical to use (11). Since Tom does not use them himself, does that exempt him from responsibility? Landmines cannot be used in an ethically correct way by the *JUS IN BELLO* principles. Since Tom has no control as to whether and how these mines are used, by developing these mines he accepts the fact that they will eventually be used. By accepting this he makes himself responsible. This will be explained in more detail in the next paragraph.

Passive Responsibility

Let's apply the four conditions that need to apply to hold someone reasonably accountable.

It has already been established that landmines cannot be used in an ethical way. So assume now, Tom's mines have been deployed. This is the **wrong doing**.

Since he has helped developing these mines, he has a **causal contribution** to their deployment.

Tom has no control as to whether and how these mines are used. By developing these mines he helps create the opportunity that they will be used. While it was not foreseeable when, where and how the mines are used, it was foreseeable that his work will contribute to this opportunity of use, fulfilling the **foreseeability** criteria.

Freedom of Action is given, as we assume Tom took the job without external pressure.

All four criteria are fulfilled, thus Tom is responsible by the passive responsibility scheme.

Civil law

In any generic western democracy one is pursued by the law for crimes. Helping in carrying out a crime, for example by standing guard, providing logistics or weapons, without participating in the actual primary crime, is considered **accomplice liability** and is a crime, too. If analogously deploying mines is an ethical breach, so is contributing to their deployment, be it "only" by developing them. That is off course, if we use CIVIL LAW as the ethical foundation.

Interpretation of Scenario II

Public View

Many people do not find working for an aerospace weapons manufacturer unethical. In scenario II, this has to do with the perception that, the product is not necessarily killing or injuring. It can perform multiple functions. Its indiscriminancy is also very debatable. Unlike a mine, the plane requires an operator, a pilot, at all times, who is also responsible for using the weapons at his will. The target, if there is one, is very specific: another plane, a building, a truck, etc. Also a military plane is not inherently violent. If another plane is "*killed*", it most likely explodes, similarly targets on the ground. That military airplanes are not perceived as violent also stems from the fact that in their portrayal in movies or games, it is not humans that these planes attack, but objects. At last technological interest, tech enthusiasm is influencing public opinion. Because most people are fascinated by military airplanes nature, they tend to be more lenient on ethical objections.

Consequentialism

In order to apply CONSEQUENTIALISM to this scenario, it is vital to distinguish the consequences of Christine working on a military airplane and evaluating these. This is not easy as easy as in the land mine scenario and more open to one's own interpretation.

The consequence of engineers working on a jet fighter is that there will be a new jet fighter. Ideally for the engineers and their employer, this new jet fighter will be bought by countries, preferably in large numbers. The new fighter increases the military strength of the country which bought it. The military strength can then be used passively, as a threat, as a deterrent, to exert political pressure, or actively when projecting military power. As an intermediate result we say, there is a causal relation between Christine working for an arms manufacturer and an increase in potential to project military power by a country buying products from this arms manufacturer. Thus the morality of the projection of military power is important.

If a country uses the new jet fighter in an unethical cause, or in an unethical way, Christine has contributed to this cause, and has thus acted unethically according to CONSEQUENTIALISM.

Unfortunately this realization does not help much, if one was to acknowledge the existence of multiple military conflicts in which Christine's fighter jet has been used in an ethical and in an unethical fashion. Say her jet has been used in the first and the second gulf war. According to the JUS AD BELLUM principles and in public perception, the first gulf war was just. Neither holds for the second gulf war (12) (13) (14).

One good consequence of her development is that it sparks new developments, also in the civil sector. It is often the case that new technologies find application first in military products and latter in civil ones. The development she is sparking might save or improve lives sooner than it would have if the military development was not pioneering.

Whether Christine is acting ethically correct or not according to CONSEQUENTIALISM depends on the interpretation of the consequences. This is in this case highly subjective.

Jus ad Bellum - Jus in Bello

It is safe to say that a jet fighter generally complies with the JUS IN BELLO principles. That is, it still depends on the operator, but it is **not** an inherently cruel and indiscriminate weapon which can only be used unethically, such as anti-personnel mines.

Nevertheless while the jet itself might not violate JUS IN BELLO principles, there is the possibility it contributes to doing so. For example if it were to use aerial deployment mines or protect a bombing run of civil targets.

As already established, the jet fighter might be used in a conflict, which does not comply with the JUS AD BELLUM principles.

To what extent Christine carries responsibility for possible violation of JUS AD BELLUM and JUS IN BELLO, we shall see in the next paragraph.

Passive Responsibility

Assume Christine's jet fighter is participating in an armed conflict which is by the JUS AD BELLUM principles unethical, and/or her jet fighter contributes to unethical actions of war. This is the **wrongdoing**.

Christine designed a weapon, which is not unethical by default. But if her weapon participated directly in a war crime, or made the war possible due to its superiority, than since she designed it, she had a **causal contribution** to the wrongdoing.

Now assume that during the course of the unethical use of military force, her jet fighter did nothing but stay in stand-by mode for eventual threats which never occurred. No unit ever took any action although they were prepared to, as a backup. Does Christine still contribute to the wrong-doing? The weapon, the jet, contributed to the wrong-doing because it gave the attacking forces security. It increased their chances of victory because they had it at their disposal at all times. It can be argued that the attack would not have happened without the backing of Christine's jet, for fear of loss. Analogously, the second gulf war was only possible because of the vast technological advantage the *coalition of the willing* had over the Iraqi forces. The coalition would not have gone to war without knowing they had a range of effective weapons and support platforms for any imaginable situation. Just because one such weapon or support platform did not come to use does not change the fact that it is contributing to the war by increasing chances of victory.

Thus no matter if, where and how Christine's jet comes into action during an unethical use of military power, she has a **causal contribution** to it.

Christine cannot foresee wars and unethical use of her jet, although a good look at history would have told her that there is a significant chance of it happening. However the precautionary principle should replace the foreseeability requirement. Christine cannot rule out unethical use of her jet and certainly cannot prevent it. The **foreseeability** requirement is fulfilled.

At last the **freedom of action** requirement is fulfilled, as we assume nobody forced her to work on the mentioned jet.

Thus all four criteria are fulfilled. By the passive responsibility scheme Christine carries responsibility for unethical wars or unethical actions of war to which her product contributed. It is irrelevant whether or not her product has actively contributed to the breach of ethics, as long as it had a causal contribution. This causal contribution can also be of reassuring or encouraging nature.

Civil law

It was already mentioned that in a generic western democracy, an action that is aiding or encouraging primary actors to carry out a crime, is a crime, too. If waging an immoral war or carrying out immoral actions in a war were a breach of ethics, then developing and providing the ones waging war with weapons or supporting platforms were a breach of ethics, too. Be it military jet, AWACS radar planes or a transporter.

Now coming back to the case where Christine's jets were never used, but on constant stand-by. Under CIVIL LAW, someone encouraging the primary actor to do a crime, by offering support of whatever nature, is still partially responsible for the primary crime. That the offered support has not been accepted does not matter as long the offer of the support alone has had an encouraging effect. By a similar logic Christine is still partially guilty because the development of her jet has encouraged an unethical action of war.

Interpretation of Scenario III

Public View

In public opinion the way I perceive it, it is not objectionable to do the work Philip does. The level of involvement of the product in killing or injuring is very low, indiscriminancy of the product is hardly applicable, same holds for brutality of the product.

Consequentialism

Just as before, vital for judging Philips work on an ethical basis are the consequences of his work. Since his work is not directly associated with any product, his work has multiple consequences, which have to be evaluated. This is not an easy task. Whilst his work might contribute to an attack helicopter, supporting unethical causes, it might just as well make a new search and rescue helicopter more efficient and save lives. Potentially his findings are so good, that they are employed on many future helicopters, most of them civil, saving lives and maybe fuel. In short, it is hard if not impossible to assess if such fundamental work does more good or more bad, let alone because good and bad are very subjective.

Jus ad Bellum - Jus in Bello

The concepts of JUS AD BELLUM and JUS IN BELLO are really not applicable to the kind of fundamental work Philip does.

Passive Responsibility

Once more assume the **wrong-doing** to be in Philips findings being used for an attack helicopter which supports an unethical war.

Philips **causal contribution** is debatable, primarily because it is so high up the causal chain. Does his work contribute in one way or another to an unethical war? Yes, but does not the same hold for almost anyone? If Philip would have a

mentionable causal contribution, than by the same logic would his secretary, the canteen staff of the helicopter company, tax payers of the war waging country or basically everybody that does not take action against the war. At some point there is simply too little causal contribution to acknowledge it. On that account I believe the causal contribution criterion fails to comply for Philip.

The **foreseeability** criterion is fulfilled, as he knows about the military helicopter application. The precautionary principle replaces the foreseeability requirement. Philip cannot rule out unethical use of his technology and certainly cannot prevent it.

At last **the freedom of action** requirement is fulfilled, as we assume nobody forced him to work for the mentioned helicopter manufacturer.

Because the causal contribution criterion does not comply, Philip does not carry responsibility by the passive responsibility scheme.

Civil Law

Looking at this under the analogy of CIVIL LAW, one would conclude that there is too little that contributes to the crime.

Answering the Question

On the basis of Consequentialism

Consequentialism puts outcome above means. Arguing via CONSEQUENTIALISM implies judging the possible consequences, weighing them against each other and based out that outcome determine the right action. This is also where the inherent troubles lie with CONSEQUENTIALISM, determining the consequences and their desirability is subjective and notoriously difficult.

One could argue as simplistic by saying the consequence should be that no one should ever be hurt by manmade weapons, therefore one should not produce weapons. A world without weapons is mere a pious hope than an achievable target for any foreseeable time. Proclaiming that all weapons are bad and their development evil is not embracing all aspects of reality. There are times and have been times, when the developments of weapons have saved lives. Weapons such as the T-34 tank and the B-17 bomber contributed majorly to the war against Nazi-Germany. Without them the war would have lasted longer and nobody knows how many millions of people would have additionally lost their lives.

Instead CONSEQUENTIALISM gives a better answer to more focused questions. Is it immoral to work for a land-mine manufacturer? Yes it is. This has been explained in a previous chapter, but an important additional reason is that there exists a real chance of achieving a landmine free world. Proof of that is that $\frac{3}{4}$ of all the world's nations have signed the Ottawa treaty (7). Developing a new type of anti-personnel mine is making an actual difference, for the worse.

One necessity of arguing via CONSEQUENTIALISM is knowing the consequences of ones doing. This is one responsibility of an engineer working in the arms industry at least if he wants to act morally correct. **An engineer must know what is done with his work.**

Jus ad Bellum - Jus in Bello

Under the criterions of JUS IN BELLO, certain weapons are inherently unethical. These are weapons which kill or harm indiscriminately, combatants and non-combatants alike, such as anti-personnel mines, nuclear weapons or any weapon of mass destruction. Other weapon that cause disproportionate harm and are more violent than necessary are equally inherently unethical, such as flamethrowers (5) (11). Similarly JUS IN BELLO also declares certain actions immoral, such as harming non-combatants or a surrendering enemy. At last JUS AD BELLUM gives criteria for a just cause for war.

What an engineer can be held accountable for is best argued via PASSIVE RESPONSIBILITY.

On the basis of Passive Responsibility

The concept of PASSIVE RESPONSIBILITY is very useful in assessing the responsibilities of engineers, once a wrong-doing has been established by the principles of *JUS AD BELLUM* and *JUS IN BELLO*.

Say a wrong-doing has been recognized which involves a weapon, a support platform or a technology developed in part by a given engineer. It is almost always possible to establish some causal contribution from the engineer to this wrong doing. This has already been proven in scenario I, for an engineer developing mines and in scenario II for an engineer developing jet fighters. The causal contribution becomes only then too small to be worth mentioning, when the technology or product is not directly associated with a use as a weapon, as proven in scenario III. **Summarizing, there is a causal connection between engineer and the wrong-doing, if the engineer is working on anything primarily to be used by the force engaged in the wrong doing, be it a machine gun or a parachute.**

Foreseeability is usually given, unless the engineer knew very little about this world. But then she would probably not be an engineer. Also CONSEQUENTIALISM gives as one criterion for an ethical engineer to be informed about the consequences of her work. Alone by that reasoning foreseeability can often be assumed given.

Freedom of action is also mostly applicable. At least in any generic western democracy, no engineer is forced to work for any company.

On the Basis of Civil Law

Civil law is often capable of providing another frame of reference to turn to, especially because it is accepted by most people. Its outcome is very similar to PASSIVE RESPONSIBILITY.

My view, Conclusion

Many people consider working in the arms industry to be like working for any civil engineering company, just with a different market and the extra thrill. But it's not. It's fundamentally different. For an individual to act ethically correct working in the arms industry, a number of criteria have to be fulfilled.

The fact that most engineers in the weapons industry see themselves as civilians is severely out of line with reality. It has been mentioned that numerous weapons have influenced not just wars, but history forever. During WW2 a regular war of the engineers has begun, each side trying to outperform the other and providing ones troops with better equipment. Even before that, a massive turn on WW1 was brought by those engineers that developed the first tanks. Today, America's military dominance stems to large part from advanced weapons systems. America would not have entered into the gulf wars, if it was not for a vast technological advantage. In short, weapon engineers influence wars.

So how can it be that they are perceived as civilians? Has Openheimer, father of the atomic bomb, not made more difference to warfare than most soldiers ever will? Or Wernher von Braun, inventor of the infamous V1 or V2? Or how about Mr. Kalashnikov, the inventor of the number one worldwide most used automatic gun? Does the mere fact that these people did not go through military training and are not enlisted as soldiers exempt them from the same responsibilities soldiers have? There is no reason why not.

As a matter of fact engineers have been an integral part of any armed forces. This has become particular true ever since WW2. As a result of that, evaluation of ethical behavior does not start merely at the front line, where soldiers might or might not use unethical weapons or engage in ethical or unethical activities of war. It does not even start at a general's desk who decides strategies or which weapons to use. It does not start in any senate, general assembly or president's

desk. It starts at the root, where weapons are born. At the drawing board. And those that create weapons are just as responsible for their use as the one actually using them.

Acknowledging that engineers carry responsibility is just the beginning. The questions as to how much and for what actions still remain.

Unethical conducts of war are pretty clearly outlined by the principles of *JUS AD BELLUM* and *JUS IN BELLO*. Apart from that, most people have an intrinsic feeling of what is wrong and right when it comes to war. Most acknowledge that civilian lives shall be spared and unnecessary suffering avoided. If a breach in ethical behavior is identified, *CONSEQUENTIALISM*, *PASSIVE RESPONSIBILITY* and a look at *CIVIL LAW* establish a connection between breach in ethical behavior and the actions of an engineer.

CONSEQUENTIALISM is hard to apply when the consequences are very diverse and hard to oversee, which is the case in dual use products. Anyone has to answer for himself, is the latest transport helicopter doing more good in humanitarian or search and rescue operations, or more bad by supporting possible unethical military operations. The realization that there are matters left to one's own interpretation is not an excuse for not doing so. **It would be irresponsible to go ahead with development without reflection, whereas it is responsible to do so after contemplation and if one found the good consequences to outweigh the bad.**

An interesting case I encountered is the Iraq war. Most students I talked to oppose the war and agree that it was an unlawful invasion. Yet they get excited about the prospect of working for any arms manufacturer on any product that made this war possible. It is a consequence of engineers working for arms manufactures, supplying the American troops that the US army had the strength to go into war without expecting large casualties. This war would not have happened if it was not for technological superiority, provided by engineers. If one thinks that this war is unethical, than by *CONSEQUENTIALISM* any aid to this war is unethical, too.

The concept of *PASSIVE RESPONSIBILITY* is useful for assessing responsibility. Given a wrong-doing, freedom of action can be assumed given for any western democracy. Leaves foreseeability and causal contribution. Foreseeability can in many cases also be assumed given. If foreseeability does not hold for the engineer, because she did not research the consequences of her doing properly, this does not relieve her from responsibility for her actions as established earlier. I believe there are very little cases where it really is not foreseeable what will happen with one's technology and products, especially if it is a weapon.

The real determining factor when using the concept of *PASSIVE RESPONSIBILITY* is causal contribution. This one is pretty clear when an engineer is designing a weapon. It remains relatively clear also for supporting systems if they enhance or promote the use of the weapon that is responsible for the wrong-doing. It becomes more vague and difficult to assess for dual use systems and more fundamental research. **I find causal contribution to be the main criteria for the responsibility of engineers for use or miss-use of their developments.**

At last a lookout to *CIVIL LAW* is useful in getting over some of the frequently encountered arguments. An often heard one is that engineers claim they are not responsible for the atrocities a certain development of theirs helps to commit. *"I am just doing what I am paid to do!"*; *"I am just developing weapons, not firing them!"*. Adolf Eichmann, logistical mastermind of the deportation of millions of Jews to concentration camps used a similar rhetoric during his trial in Israel. *"An order is an order"* is what he said, and *that he never commanded nor participated in any murders himself*. All he did was organize transports. He was found guilty and hanged (8). Rightly so. In *CIVIL LAW*, if a killer has already shoot a number of victims and is about to shoot more, his accomplice who is loading the gun over and over again, standing by and observing, will be found guilty by the court.

Another often heard argument that can be answered with the CIVIL LAW analogy is that of *"If I don't do it, somebody else will."* It is blatantly obvious that this is no argument in front of the law. Guilt is not reduced by the mere fact that somebody else would have done it otherwise. If someone offers money to kill another person, three people volunteer, then the notion that there were two more to step in carries no significance whatsoever.

None of the four concepts of moral used in this essay accept the reason *tech interest* as a justification to engage in an otherwise unethical activity. I am personally bemused, sometimes disappointed, that people do think it is. It is not a matter of proving why it is not a justification. Rather there simply are no reasons other than selfishness and lack of virtues. Is torching a forest justifiable by claiming one's interest in fire? Is steeling justifiable by one's desire in money? When have *interests* ever been a moral justification for taking immoral actions?

Note that neither the CIVIL LAW analogy, not the concept of PASSIVE RESPONSIBILITY, nor the theories of just war offer any answer to the dual use problem. Also for the scenario in which the same system is being applied in a just and a non-just cause, there is no answer by these concepts. The same holds for the argument that advancement in military engineering stimulates advancements in civil technology, which can be the cause of good.

Say an engineer worked for a company producing weapons supporting a just cause, but also a different unjust cause. Is he acting ethically correct, incorrect or neutral? Following the CIVIL LAW, JUST WAR or PASSIVE RESPONSIBILITY theories, the answer would be ethically *incorrect*. That is because an unethical action cannot be undone. Different though CONSEQUENTIALISM. Here the ethical and unethical deeds are weighed against each other.

There are cases where I personally prefer to turn to CONSEQUENTIALISM, especially when something bigger is at stake. For example, was it unethical for engineers to work on the American Mustang fighter aircraft, even though it supported bombings of civilian population, an act not complying with JUS IN BELLO? I say no, it was not. Because ultimately it helped to bring down possibly the most unethical regime of all times.

Now one may look at today's world and ask, is it unethical to work today for a modern weapons manufacturer such as LOCKHEED MARTIN? By the just war theories the Iraq war from 2003 is an unjust war (13) (14). LOCKHEED MARTIN's products have contributed to this war by the PASSIVE RESPONSIBILITY scheme and the CIVIL LAW analogy. Thus the answer is yes, it is unethical. Turning to CONSEQUENTIALISM one asks, *"Does not the fact that these weapons protect us by deterring possible aggressors outweigh their unethical use?"* This is something anyone desiring to work for such a company has to find out for him or herself. I wonder: *"What aggressors are there to central Europe that my country needs the latest 5th generation fighter to protect me?"*

Bibliography

1. **Shah, Anup.** World Military Spending. *Global Issues*. [Online] July 07, 2010. [Cited: 01 27, 2011.] <http://www.globalissues.org/article/75/world-military-spending>.
2. *wikiinvest*. [Online] [Cited: January 26, 2011.] http://www.wikininvest.com/stock/Boeing_Company_%28BA%29/Data/Income_Statement.
3. Setting the Standard. *lockheedmartin.com*. [Online] October 2008. [Cited: January 27, 2011.] <http://www.lockheedmartin.com/data/assets/corporate/documents/ethics/setting-the-standard.pdf>.
4. **Poel, I. R. van de.** *Ethics and Technology for Aerospace Engineering*. Delft : s.n., 2008.
5. **Moseley, Alexander.** Just War Theory. *Internet Encyclopedia of Philosophy*. [Online] February 10, 2009. [Cited: January 27, 2011.] <http://www.iep.utm.edu/justwar/>.
6. Charter of the United Nations. *UN.org*. [Online] June 26, 1945. [Cited: January 27, 2011.] <http://www.un.org/en/documents/charter/index.shtml>.
7. International Humanitarian Law - Treaties & Documents. *International Committee of the Red Cross*. [Online] [Cited: January 27, 2011.] <http://www.icrc.org/ihl.nsf/TOPICS?OpenView>.
8. Trial of the Major War Criminals. *Military Legal Resources*. [Online] [Cited: January 01, 2011.] http://www.loc.gov/rr/frd/Military_Law/NT_major-war-criminals.html.
9. Eliminating Taxpayer Subsidies for Arms Sales. *Federation of American Scientists*. [Online] [Cited: January 27, 2011.] <http://www.fas.org/asmp/campaigns/subsidy.html>.
10. **Jeffrey, Sue J.** *Antipersonnel mines: who are the victims?* Geneva : International Committee of the Red Cross, 1996.
11. *Applying the Rules of Just War Theory to Engineers in the Arms Industry*. **Fichtelberg, Aaron**. Delaware : Science and Engineering Ethics, 2006.
12. *World View of US Role Goes From Bad to Worse* . s.l. : BBC World Service, 2007.
13. **Ewen MacAskill, Julian Borger.** Iraq war was illegal and breached UN charter, says Annan. *guardian.co.uk*. [Online] September 16, 2004. [Cited: January 27, 2011.] <http://www.guardian.co.uk/world/2004/sep/16/iraq.iraq>.
14. **Hirsch, Afua.** Iraq invasion violated international law, Dutch inquiry finds. *guardian.co.uk*. [Online] January 12, 2010. [Cited: January 27, 2011.] <http://www.guardian.co.uk/world/2010/jan/12/iraq-invasion-violated-interational-law-dutch-inquiry-finds>.