Ethical Issues in the Global Arms Industry: A Role for Engineers

Ethical Dilemmas in the Global Defense Industry Conference
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This paper has four parts. The first two seek to clarify the subject of this conference, ethical issues in the global arms industry. The third sketches the role engineers have in much of the global arms industry. The last part considers one way that engineers might help with resolving some of the industry's ethical issues. While the first part of this paper should contain few surprises, the last three will, I hope, contain more.

1. Dilemmas and Defense

Let me begin with two differences between the official title of this conference and the title of my paper. First, I have substituted "issues" for "dilemmas". Second, I have substituted "arms" for "defense". The purpose of these changes is to avoid unnecessary disputes rather than to change the subject of the conference. Let me explain.

A "dilemma" is a situation in which a difficult choice has to be made between two (or more) equally undesirable alternatives.[1] If the alternatives were not *equally* undesirable, the choice would be easy: choose the more desirable alternative. There would be no dilemma (though the choice might, like most good choices, have its cost). My impression is that the main ethical issues, questions, problems, or quandaries posed by the global arms industry are not dilemmas (in this sense) but complex situations in which most of the choices on offer are hard to assess and many of the best choices have yet to be devised. Indeed, many of the issues, questions, problems, or quandaries are so ill-defined that we cannot say what a good choice would look like. We are dealing with a subject requiring the work philosophers typically do. We must understand the issues before we can have anything so tidy as a dilemma. Hence, my substitution of "issue" for "dilemma". I might have used "problem", "question", "quandary", or some other catch-all instead of "issue".

My substitution of “arms” for “defense” has a different rationale. I regard “defense” in such terms as “Defense Department”, “defense forces”, and “defensive weapons”, as a misleading euphemism. The “Defense Department” is the department of the American government that oversees war-making, offensive as well as defensive. In most countries that call their military “Defense Forces”, the military still consists of an army, air force, navy, and so on, all of which can, and sometimes do, engage in offensive warfare. Much the same is true of weapons. Few, if any, are purely defensive. Even a shield, that epitome of defense, can be used offensively, for example, to strike an opponent too focused on one’s sword arm. Rather than try to sort out whether a particular piece of equipment, say, an anti-aircraft missile or landmine, is an offensive or defensive weapon (or both), I have substituted “arms” for “defense”.

By “arms industry”, I mean all those organizations, whether commercial or not, that design, build, sell, or service weapons or related equipment for military use, provide military research, training, or advice, or otherwise aid the military. The military is that technological system—a combination of people and things—the purpose of which is to kill on a large scale. Though the military is typically an arm of government, it can also be an arm of non-governmental agencies, such as a business corporation (“private army”) or religious organization (the Knights Templar or the warrior monks of ancient Japan).

“Arms industry” (as used here) does not include the design, construction, sale, or servicing of weapons for non-military use, whether use by police, hobbyists, or civilians intent on self-defense or mayhem, even if the non-military weapon is indistinguishable from its military counterpart and manufactured in the same factory. So, while the manufacturer of ordinary bandages or backpackers’ dinners is not, as such, part of the arms industry, the manufacturer of field dressings or combat rations is. Products of the arms industry include aircraft, artillery, ammunition, electronic systems, light weapons, operations support, software, research, and uniforms.

While much of the arms industry is “domestic”, that is, serves the “home country”, a significant part is “international” or “global”, that is, serves the military of other countries, rebellions outside the home country, or other foreign military forces. Our subject is the *global* arms industry, that is, that part of the arms industry that is not domestic.[2]

The distinction between the global arms industry and domestic is, of course, artificial in at least two respects. First, much of the domestic arms industry seeks foreign customers if they

have a product they can sell abroad (and permission of their home government to sell it abroad). Foreign sales can reduce the unit cost of a product, help tie foreign customers to the home country, and otherwise serve domestic interests. Much of the global arms industry is, in this respect, also part of the domestic arms industry.

Second, much of what even a strictly domestic arms industry produces depends on raw materials, research, or subsystems produced outside the home country. Even a domestic arms industry must rely on international trade to provide much of what the military of the home country needs, everything from iron or rubber to computer chips or Kevlar. Much of the domestic arms industry is global in this respect—and has been for at least a century.

The distinction between the global arms industry and the domestic is nonetheless worth making. The patriotism that may justify producing arms for one's own country cannot justify producing arms for others, especially those not allied with the home country. The ethical issues of the global arms industry seem to differ in systematic ways from those of the domestic arms industry.

We must now turn to the ethical issues of the global arms industry.

2. Ethical issues

"Ethics" has at least three uses potentially relevant here. First, it can be a synonym for ordinary morality, those standards of conduct that apply to all moral agents simply because they are moral agents—"Don't kill", "Keep your promises", "Help the needy", and so on. Second, "ethics" can refer to those morally binding standards that apply to members of a group simply because they are members of that group. Legal ethics applies to lawyers and no one else; business ethics to people in business and no one else; and so on. Third, "ethics" can refer to a field of philosophy, that is, the attempt to understand morality (including its special standards) as part of a reasonable undertaking. Other names for "ethics" in this third sense include "moral theory" and "ethical theory". I shall hereafter reserve "ethics" for the special-standards sense, using "morality" for the first sense and "moral theory" for the third.

Given this terminology, some "ethical issues" identified in the call for our conference seem in part moral (whether or not they are also ethical, that is, whether or not they concern an

existing special standard or might lead to the adoption of such a standard). For example, the threat drones pose to people's privacy is a moral issue.[3] Every moral agent, even the agents of the global arms industry, should, all else equal, avoid contributing to the invasion of people's privacy. Other issues, such as what to do about "government officials [who] expect some form of quid pro quo for their cooperation", though ethical issues for most of the global arms industry, are no longer difficult issues. Most of the global arms industry have long since adopted a special standard resolving them. So, for example, the National Defense Industrial Association's "Statement of Defense Industry Ethics" says that:

> When contemplating any international sale to a governmental or quasi-governmental buyer, it is imperative that effective measures be undertaken to ensure full compliance, not only with the letter, but also the spirit of the Foreign Corrupt Practices Act, as amended, and the FCPA's bar against improper payments to foreign officials.[4]

Of course, we can debate whether such special standards are wise, morally required, merely morally permitted, or even morally wrong. But that debate is likely to do little more that return us to ground that business ethics (the philosophical study) has worked over pretty well during the last forty years.[5] I therefore propose to limit this paper to moral issues that the global arms industry faces while ordinary businesses do not (or , at least, do not face in the same way), issues not much discussed in business ethics.[6] I have identified six. No doubt there are others.

1. Weapons versus non-weapons. Much of what the global arms industry sells are weapons (artefacts designed to kill, wound, disable, or destroy) but much is not. For example, much of what the global arms industry sells consists of clothing, field kitchens, tents, and so on, artefacts harmless in themselves even in military service. And some of what the global arms industry sells is neither clearly a weapon nor clearly not a weapon, for example, body armor, observation drones, communications equipment, circuit boards, reflective paint, software, and other non-lethal elements of a "weapons system". How morally significant, then, is the distinction between weapons and non-weapons? Should the global arms industry consider the sale of non-weapons less morally objectionable than the sale of weapons or non-lethal elements of a weapons system? After all, every artefact embedded in the technological system we call "the military" is there to help the military do its job, which is (in part at least) to kill other human beings on a large scale, a morally dubious undertaking, especially if the regime directing the

military is itself morally dubious. (A morally dubious undertaking can, of course, turn out, all things considered, to be morally justified, but the burden of proof must fall on those claiming justification.)

2. Morally dubious regimes. Some customers of the global arms industry respect human rights but most, to varying degrees, do not. Of those that do not, some may simply deny their people certain basic rights, such as self-government or decent medical care, but many actively harm those under their control by, for example, imprisoning, torturing, or killing them for political, religious, or other beliefs, for forming various kinds of peaceful voluntary associations, or for speaking a certain language, dressing in a certain way, or the like. How abusive must a regime be before the global arms industry should refuse to sell it weapons. How abusive before the global arms industry should have no dealings with it at all? How important is the argument that if "we" do not sell to them, others will?

3. Cultural differences. By "culture", I mean a distinctive way of doing something, including the beliefs and evaluations that accompany the doing. So, for example, eating with knife, fork, and spoon is a gastronomic culture (a distinctive way to eat) while eating as such is not (since everyone eats). There are military cultures. For example, some militaries "live off the land" on which they fight, while others routinely bring all their supplies with them. Some routinely take prisoners; some do not. Some militaries force young men to serve while others take only volunteers. Some allow "children" (adolescents under 18) to be soldiers; some do not. How important should such cultural differences be to the global arms industry when deciding whether to take on a certain customer? Should international standards preempt non-complying military cultures?

4. Lawful artefacts having illegal uses. Most weapons have illegal uses as well as legal ones. For example, the same rifle that is legally used to kill a soldier in combat can be used illegally to kill enemy soldiers who have surrendered. Something similar is true of many non-weapons. For example, the same small electric generator that can lawfully be used to power field radar can be used illegally to deliver electric shocks to a prisoner's genitals. How important should the likelihood of illegal use of military equipment be to the decision to sell the equipment to a certain customer? Should military equipment be designed, as much as possible, to prevent illegal use?

5. Weapons likely to fall into the wrong hands. Much of what the arms industry sells can be stolen, resold, transferred to another by capture, or otherwise "diverted". How much responsibility should the global arms industry take for preventing its products falling into the wrong hands? For example, should the global arms industry refuse to sell to unstable regimes (a regime likely to lose control of its military soon) or regimes (such as the current regime in Iraq) with a record of losing many of its weapons to its non-state enemies? Should the products of the global arms industry be designed to make diversion of its products more difficult or less attractive (for example, by making rifles requiring unusual bullets or hard to replace parts)?

6. Relatively indiscriminate weapons. Some weapons are relatively indiscriminate, even when used by a sophisticated military. For example, landmines can as easily be set off by a civilian as by a soldier and even the US military can fail to retrieve all its mines when it departs. Landmines may go on killing and maiming civilians for decades after the end of the war justifying their use. Something similar is true of conventional bombs. Lost "duds" can explode long after the end of hostilities, killing anyone who happens to be nearby. While some weapons are relatively indiscriminate even in sophisticated hands, some are indiscriminate only in unsophisticated hands. For example, without good record keeping, a military may lose track of the age of artillery shells. Past-date shells may explode when they should not, say, when being transported on a rough road or even when being loaded into a naval gun. How much care should the global arms industry take to make weapons as discriminating as practical in the circumstances in which they are likely to be used?

The classic indiscriminate weapons are, of course, nuclear bombs, biological devices, and deadly gases, weapons that, I believe, are not currently part of the official global arms trade. I shall therefore ignore them here.[7]

3. Engineers in the global arms industry

Engineers have had a significant role in the arms industry since at least the 1700s. Their role has only increased as the products of the arms industry have become more sophisticated. Today one in ten US engineers works in military-related industry, including about 39,000 electrical engineers (just under 14% of all US electrical engineers) and about 6,000 aerospace engineers (just under 19% of all aerospace engineers).[8] Engineers design weapons and other

equipment the military needs, test them, sell them, and oversee their manufacture, maintenance, and even disposal. Indeed, it is hard to imagine today's arms industry without engineers, not only "bench engineers" but technical managers up to, and often including, senior management.[9] So, for example, of Lockheed Martin's eight vice presidents, three are engineers.[10] There is no reason to think that engineers do not have a similar part with respect to most products of the global arms industry or, at least, most of its most distinctive products.

Suppose, for example, that a certain large African country contacts a US manufacturer of modern jet fighters in order to buy twenty for its air force. The sale is likely to be a long process, lasting months or even years. At an early stage, the US manufacturer would have to send out engineers to assess the African country's airbases, maintenance practices, pilot training, local suppliers, and so on. A jet fighter requires a complex technological system to operate. The would-be customer may be surprised to learn that its runways are too short, that its fuel storage is inadequate, that its maintenance staff will have to be larger, better trained, and provided with more sophisticated tools, and so on. While some of this information is typically public, some is not, being proprietary or classified. Much of it will, in any case, be in a form engineers are used to and others are not. The African country will need its own engineers to talk to those of the US manufacturer.

The African country need not agree to all the requirements that the US manufacturer seeks to impose as part of the sale. It may suggest changes in the design of the jet fighters so that, for example, they can use fuel that the African country is already using for other aircraft. Indeed, after a full assessment, the parties may agree on a less sophisticated fighter. In any case, the final specifications for the fighter, including training, support, munitions, replacement parts, and so on, should be the result (in part) of extensive negotiations between the engineers of the US manufacturer and those of the African country.[11] Though the terms of such a sale are, in principle, entirely under the control of the US manufacturer's senior management and the African country's senior government officials, in practice many of the decisions, perhaps most, will be made by engineers, some quite junior, no one else having the information, time, and skills to appreciate their import.

The involvement of engineers typically does not end with the writing of specifications or even with the signing of the sales contract. Engineers will oversee the manufacture of the planes, not only making sure that every part satisfies the specifications and the whole is constructed

properly but also changing the specifications if, say, there is difficulty getting a specified part or a better part has become available. Given that there will typically be several years between the initial writing of specifications and the delivery of the last jet fighter, there may be many changes in the specifications, most quietly made by agreement among engineers. Some of these changes will, of course, be “no brainers”, but a substantial number may involve painful balancing of cost, reliability, timeliness, and so on. So, for example, a new part may be cheaper and, based on experience, as good as the old. But, since the part is new, experience with it must be short. The part may fail long before it should. Who knows? The engineers will have to rely on experience with parts analogous in one way or another to forecast the probable failure date of the new part—and decide accordingly. There may be a good deal of discussion between the manufacturer’s engineers and those of the African country.

The relationship between the engineers of the US manufacturer and those of the African country should not end when the last fighter is delivered. The US engineers should keep the African engineers informed of problems identified in similar aircraft elsewhere in the world and the solutions devised. The African engineers in turn should advise the US engineers of any problems they identify in the jets they purchased, anything from unusual wear on engine blades to difficulty getting ground crews to comply with required maintenance procedures. The purpose of this exchange of technical information between the manufacturer’s engineers and those of the African country is not simply to maintain the fighters; it is in part to improve them where possible, not only the fighters that the African country has purchased but other fighters in that family, both those yet to be built and those already in use elsewhere in the world. In principle, this exchange of information should continue until the last fighter delivered has ceased to exist. That is normal engineering.

While much of this exchange of information will go on long-distance, some of it may require “site visits”, for example, to see the troublesome dust clouds possibly contributing to unusual engine wear or the conditions under which maintenance must actually be performed.

The relationship between a manufacturer’s engineers and those of a customer can be both intimate and enduring. There is often a tension between the legal department’s “arm’s length” conception of how information should be shared and the engineers’ conception (something more like a long hug than a handshake). For example, engineers of a manufacturer can seldom do a good job of designing a sophisticated piece of equipment without knowing how it will be used,

under what conditions, and for how long. Similarly, a customer purchasing such equipment cannot be as helpful in its design as it could be unless it knows the details of manufacture, including some trade secrets and (in the case of a fighter jet) even some highly classified information.

4. How engineers might help resolve some ethical issues

Most engineers working in the global arms industry are civilians. Most who are not have nonetheless been trained in the same way as civilian engineers, work in much the same way as civilian engineers, and have little trouble communicating with civilian engineers. Engineering is (in this respect at least) a single profession. It is also a global profession. Engineers in Brazil, China, Nigeria, or India are trained much as are engineers in Germany, Japan, or the US. Engineers also share certain standards, whether formalized in a code of ethics or not. They are committed not simply to maintaining technology but to improving it for the benefit of humanity. Their first loyalty is (or, at least, is supposed to be) not to their employer but to "the public health, safety, and welfare".[12]

Much of what engineers share are technical standards. Some of these are governmental, such as the standards of safety issued by the Environmental Protection Agency or the Nuclear Regulatory Commission. But many technical standards, perhaps most, are not the work of government. Of these, some are the work of professional associations, such as American Society of Mechanical Engineers (ASME) or the Institute of Electrical and Electronic Engineers (IEEE). Others are the work of trade associations or other private groups, the best known of which today is probably the International Standards Organization (ISO).

Whatever the source of engineering's technical standards, they will, in large part, be the work of engineers. They will be the work of engineers because only engineers have the knowledge necessary to write them. The standards are not deduced from physics, chemistry, or any other natural science; nor are they simply common sense (though generally consistent with common sense). They are instead a product of engineering experience. Some of that experience derives from laboratory experiments, much like the experiments of natural science. The chief difference between the experiments of natural science and those of engineering (insofar as there

is any) is that engineers typically experiment on human artefacts, not natural objects. However, much of the engineering experience on which the writing of standards depends will not be experimental but "field experience", that is, experience of artefacts in use where the control necessary for experiment is absent, for example, when the left wing of a fighter jet falls off at twenty-thousand feet during combat training. Engineers try to learn as much as possible from every such unhappy experience. Unlike surgeons in the old joke, engineers do not bury their mistakes. Instead, they record their mistakes, study them, and try to learn from them, typically embedding what they learn in new technical standards.

The recent history of the global arms industry offers enough examples of unhappy experiences with the products of engineering, such as the many children killed or maimed by landmines in peace time, for engineers to begin to develop international standards for the global arms industry similar to engineering's other international standards. There are even a few signs that now is a good time to begin developing such standards. I shall briefly describe three of those signs.

First, there is a US statute, the Arms Export Control Act, and the International Traffic in Arms Regulations (ITAR) issued under it. Since 1976, these have governed what military information and artefacts may be shared with "non-US persons". US persons (including organizations) can face heavy fines if they have, without authorization or the use of an exemption, provided non-US persons with access to ITAR-protected military articles, services, or technical data. Until the end of the Cold War, the focus of ITAR enforcement was preventing the Soviet Union from obtaining US military technology. Since 1990, the focus has increasingly become preventing weapons and weapons technology falling into the wrong hands, especially the hands of terrorists or rogue states.[13]

Second, in 2004, the National Defense Industry Association (NDIA), a US trade association, published a "Statement of Defense Industry Ethics", making several small revisions in 2009. Most of the larger US participants in the arms industry have adopted codes of ethics including provisions similar to those in the Statement. The Statement seems to reject making ethics relative to geographical cultures: the arms industry is to "[i]mplement effective ethics programs for company activities at home or abroad." The Statement is, however, almost silent about the health, safety, and welfare of people outside the US. The nearest the Statement comes to providing any guidance on that issue is the requirement that members of the arms industry

"[e]stablish corporate integrity as a business asset, rather than a requirement to satisfy regulators, by making ethics compliance integral to all aspects of corporate life and culture, including employee appraisals and promotions, to foster an environment where employees aspire to do the right thing." For engineers at least, doing "the right thing" seems to include taking into account, for example, the welfare of non-US children whom landmines might kill or injure. Such children are part of the "public" whose safety, health, and welfare engineers are supposed to hold "paramount".[14]

More important, the Statement does not treat ethical knowledge as proprietary. Instead, it urges members of the arms industry to "[c]ontribute to the common good of our industry and promote industry ethics whenever and wherever possible by sharing best practices in ethics and business conduct among NDIA members and including ethics training in NDIA sponsored events."[15]

Third, there is an initiative of the United Nations, the Arms Trade Treaty. Though it came into force on December 24, 2014, the first report detailing its implementation is not scheduled for publication until December 24, 2015.[16] So, we do not yet know how many of the states engaged in the global arms trade will sign the treaty, but it is a good guess that the most important, especially, China, Russia, and the US, will not—or, at least, will not sign it in the next few years. Still, the Treaty is an important step in regulating the global arms industry. It certainly provides a starting point for writing global standards for engineers.

The Treaty is 1) to "establish the highest possible common international standards for regulating or improving the regulation of the international trade in conventional arms" and 2) to "prevent and eradicate the illicit trade in conventional arms and prevent their diversion". The Treaty applies to all conventional arms within the following categories: battle tanks; armored combat vehicles; large-caliber artillery systems; combat aircraft; attack helicopters; warships; missiles and missile launchers; and small arms and light weapons.[17] The Treaty seems to cover non-lethal *parts* of weapon systems, such as radar or observation drones. It does not, it seems, cover non-lethal equipment, such as trucks, transport aircraft, body armor, or field kitchens.

How do these three documents provide a justification for the sources of engineering's standards, especially its international sources, to begin developing standards for the global arms industry that might help to resolve the ethical issues identified in Part 2 above? Let me give a

simple example: If there were an international standard prohibiting engineers from involvement with the sale of complete weapons or parts of weapons of any sort to a regime likely to misuse them, the standard would simply echo the Treaty. If, in addition, the engineering standards contained criteria for identifying weapons likely to be misused and the sort of regime likely to misuse them, engineers might then inform an employer considering sale of such weapons or parts of such weapons to such a regime that the sale not only violates international standards but is inconsistent with good engineering. Engineers can have no part in such a sale. Involvement would be unprofessional.

A source of engineering's standards, such as IEEE or ISO, would have a justification for issuing such a standard. Article 7 of the Arms Trade Treaty specifically requires a signatory State considering licensing an export to "assess the potential that the conventional arms or items [in question]" may be misused in various ways, for example, to "commit or facilitate a serious violation of international humanitarian law.... [or] human rights law." While the Treaty's authors probably thought of the decision to license as primarily governmental, there is nothing in that understanding to forbid a member of the global arms industry from deciding not to seek its government's permission or for engineers working in the global arms industry from appealing to their own ethical standards when asked to participate in such a transaction. Their employer is (according to the NDIA Statement) supposed to want engineers to "do the right thing" and standing by (morally justified) professional standards is doing just that.

Of course, engineers individually are not qualified to assess the likelihood that a particular regime will misuse a particular weapon, even though they are likely to know much about how the weapon can be misused. So, any standard developed for the use of engineers would have to include the sort of information an engineer would need to make such an assessment. That information might come in a quite simple form, for example, in the form of a checklist asking (among other things) how this or that human rights group rates the regime, what uses the regime has made of weapons in the recent past, and so on. An individual engineer could then inform the appropriate superior, "We need to check out the following to be sure that this sale meets international engineering standards."

This sort of individual response may not seem like much help with the ethical issues identified in Part 2. After all, the engineer's superior might simply ignore the international

standard and replace an engineer unwilling to participate in the sale with an engineer who is willing or with a willing non-engineer.

While it is true that a superior might do that, there is good reason to think that response is, all things considered, unlikely. Such a response can have substantial costs, especially when the manager most needs an engineer. There are at least three sources of that cost: First, engineers are not interchangeable. They are often quite specialized. The engineer first asked to participate in the sale is likely to be the most qualified. The replacement (assuming one can be found) is likely to be less qualified. Therefore, the substitution may increase the risk of bad decisions as the sale progresses. Second, the risk of bad decisions is even higher if the substitute for the engineer is a non-engineer. Engineers are generally brought into sales only when they are needed, only when they are likely to have knowledge or insight non-engineers lack. Third, overruling an engineer on a matter involving application of an engineering standard risks harm to the manager. If anything later goes wrong, the manager who overruled the engineer will be open to blame, even if he found another engineer or a "scientific expert" to replace the unwilling engineer. He was on notice that there might be a problem and he did not "do the right thing". If, on the other hand, he goes along with the engineer's recommendation, he can at least claim that he was acting on the best technical advice available.

These are all relatively short-term costs of one manager's respecting or not respecting the engineering standard in question. There is also at least one long-term cost worth considering if the organization makes a practice of overruling engineers on such issues. Widespread lack of respect for engineering standards may have a bad effect on the morale of the organization's engineers generally and so, on the ability of the organization to recruit and keep the most marketable engineers, not only the most marketable "bench engineers" but also the most marketable higher-ranking engineers (including senior management).

We have, of course, been assuming that the engineer's superior is unsympathetic to the appeal to engineering standards. That is a worst-case scenario. In practice, the superior is likely to be another engineer, one for whom engineering standards carry considerable weight, even if he is now acting as a manager rather than an engineer. And the organization in which these two engineers work is likely to have its own code of ethics, compliance procedures, and the like designed (as the NDIA Statement requires) to ensure, as much as possible, that organization employees, including engineers, "do the right thing." The ethical environment of the

organization is likely to be far friendlier to engineering standards than we have tacitly been assuming in dealing with this example.

This is, admittedly, a relatively simple example of a standard that might be adopted, one that does not look particularly technical. The standards actually adopted—for example, criteria for "safe landmines" requiring them to resist light touches, to disarm automatically after a certain period, and so on—are likely to look much more technical, making the overruling of the engineer look even more risky.

Acknowledgments

I presented the first version of this paper to the Philosophy Colloquium, Illinois Institute of Technology, March 6, 2015, to which I owe several improvements.

Notes

[1] This is the typical dictionary definition of "dilemma" (when the term is not simply wasted as a synonym for "hard choice"). However, until the last few decades, philosophers have had a much-more-precise definition of "dilemma", that is, as an inference having the following form: P v Q, P—> R, Q—>R, therefore R. I regret the eclipse of that technical sense.

[2] In defining "global" in this way, I may seem to be departing from the original call for this conference. The call (Finkelstein email, December 5, 2014) listed among relevant "dilemmas" two that seem to apply to the domestic arms industry at least as much as to the global arms industry (italics mine):

> Sometimes the industry can provide a necessary and ethically sound *national* security product only by using materials that are potentially legally problematic, such as "conflict minerals." Should the global defense industry be held to a higher standard than other industries given the sensitive and potentially controversial nature of its enterprise? Or perhaps a more relaxed standard, given the critical nature of its function and the overwhelming importance of a strong *national* defense….
>
> Finally, many of the dilemmas that arise at the intersection of ethical and legal standards pertain to new technologies, such as surveillance equipment and cutting edge defensive weapons systems. Often there are objections to such technologies on ethical grounds: do advanced surveillance technologies violate privacy norms, especially when they [the technologies] can be used on civilian populations? Should the industry be responsive to objections to technological development in *national* defense, such as the frequent concerns expressed that smart weapons are replacing human judgment on the battle field?

Concerns about "national defense" carry weight only when the nation in question is one's own—and, by the definition I proposed, the global arms industry is concerned (in part) with helping other nations make war; it is the domestic arms industry that is concerned with *the* national defense. I have therefore treated these two paragraphs as including "slips of the word processor" rather than as part of the conference definition.

[3] Finkelstein email, December 5, 2014: "Often there are objections to such technologies on ethical grounds: do advanced surveillance technologies violate privacy norms, especially when they can be used on civilian populations?"

[4] http://www.nationaldefensemagazine.org/archive/2011/March/Pages/StatementofDefenseIndustryEthics.aspx (accessed January 10, 2015). Lockheed Martin, a sponsor of this conference, has taken a similar position: "We have zero tolerance for corruption." Lockheed Martin, *Setting the Standard: Code of Ethics and Business Conduct*, p. 25, http://www.lockheedmartin.com/us/who-we-are/ethics/code-of-ethics.html (accessed December 28, 2014). That page includes enough explanation of what the standard means to make it clear that the quid pro quo in question is probably unethical.

[5] That is, since the Lockheed bribery scandal of the early 1970s. Interestingly, Lockheed is ancestor of Lockheed Martin. http://en.wikipedia.org/wiki/Lockheed_bribery_scandals (accessed January 5, 2015). For recent work on bribery in global business ethics, see, for example, Margo Cleveland, Christopher M. Favo, and Thomas J. Frecka, "Trends in the International Fight Against Bribery and Corruption", *Journal of Business Ethics* 90 (2009), Supplement: 199-244; or the initial discussion and references in Edmund F. Byrne, "Towards Enforceable Bans on Illicit Businesses: From Moral Relativism to Human Rights", *Journal of Business Ethics* (2014): 119–130.

[6] By "not much discussed in business ethics", I actually mean "virtually undiscussed". The following are the few discussions I have found: Gavin Maitland, "The Ethics of the International Arms Trade", *Business Ethics: A European Review* 7 (October 1998): 200-204; Edmund F. Byrne, "Assessing Arms Makers Corporate Social Responsibility", *Journal of Business Ethics* (2007) 74: 201–217; and Barton H. Halpern and Keith F. Snider, "Products That Kill and Corporate Social Responsibility: The Case of U.S. Defense Firms", *Armed Forces & Society* 38 (2012): 604-624.

[7] For more on these, see Jacque G. Richardson, "The bane of 'inhumane' weapons and overkill: An overview on increasingly lethal arms and the inadequacy of regulatory controls", *Science and Engineering Ethics* 10 (2004): 667-692.

[8] US Chamber of Commerce, *Defense Trade: Keeping America Secure and Competitive* (March 2007), p. 8, www.uschamber.com/sites/default/files/legacy/issues/defense/files/defensetrade.pdf (accessed December 30, 2014); Department of Defense, "Defense-Related Employment of Skilled Labor: An Introduction to LDEPPS" (March 2011), p. 4. www.economics.osd.mil/LDEPPS_Primer.pdf (accessed December 30, 2014).

[9] For a fuller discussion of the importance of engineers to the arms industry, see Aaron Fichtelberg, "Applying the Rules of Just War Theory to Engineers in the Arms Industry", *Science and Engineering Ethics* 12 (2006): 685-700.

[10] See biographies of: Patrick M. Dewar, Executive VP; Dale P. Bennett, VP for Mission Systems and Training; Richard F. Ambrose, VP for Space Systems, http://www.lockheedmartin.com/us/who-we-are/leadership.html (accessed December 30, 2014).

[11] The parenthetical "in part" recognizes the role that the US government would normally have in such a sale.

[12] For those who doubt this claim, see the first three chapters of my *Thinking like an Engineer: Essays in the Ethics of a Profession* (Oxford University Press: New York, 1998), as well as the more recent: "Is Engineering a Profession Everywhere?" *Philosophia* 37 (June 2009): 211-225; "Defining Engineering—From Chicago to Shantou", *Monist* 92 (July 2009): 325–339; "Does 'Public' mean an engineer's nation?" *2014 IEEE International Symposium on Ethics in Science, Technology, and Engineering* (Chicago, IL: 23-24 May 2014): 1-4. DOI: 10.1109/ ETHICS.2014.6893405; and "'Global Engineering Ethics': Re-inventing the Wheel?" *Engineering Ethics for a Globalized World*, edited by Colleen Murphy, et al. (Springer, forthcoming). Compare Fichtelberg (2006) which seems to miss the import of the engineer's obligation to the "public".

[13] http://en.wikipedia.org/wiki/International_Traffic_in_Arms_Regulations (accessed January 3, 2015).

[14] For a defense of this claim, see my "Thinking like an Engineer: The Place of a Code of Ethics in the Practice of a Profession", *Philosophy and Public Affairs* 20 (Spring 1991): 150-167.

[15] http://www.nationaldefensemagazine.org/archive/2011/March/Pages/StatementofDefenseIndustryEthics.aspx (accessed January 10, 2015)

[16] http://www.un.org/disarmament/ATT/ (accessed January 3, 2015).

[17] Art. 1 and Art. 2, The Arms Trade Treaty, http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/67/234&Lang=E (accessed January 3, 2015)