Catholic Relief Services
Global Solidarity Network

Humanitarian Engineering in International Water Development:

by Dennis Warner
Senior Technical Advisor - Water Supply, Sanitation and Water Resources Development
Catholic Relief Services, Baltimore, MD
January 20, 2011

Humanitarian Engineering as a Career Choice

Much of our popular culture and the institutions that support it honor the warrior and ignore the peacemaker. The technologies of death seem to receive disproportionate attention compared to the technologies of life. The Pentagon spends hundreds of millions of dollars annually to promote service in the military, with a good part of this total emphasizing the development and use of military technologies. When was the last time you saw an advertisement or recruiting notice promising engineers an exciting and rewarding career in promoting peaceful solutions through the application of technologies? Perhaps you happened to see a Peace Corps ad on late night TV, but probably nothing more.

Military occupations, especially those involving the application of modern technologies, capture the attention of the public and give it high visibility and support. Humanitarian engineering, on the other hand, is not a well-defined concept and receives little or no attention from the public. As a result, humanitarian engineering as a career track for young professionals barely exists and is difficult to identify.

Let me give you my definition of humanitarian engineering. First, take the characteristics of a typical military recruiting advertisement – professional growth, foreign travel, service to country, personal satisfaction. Second, replace the basic concept of technologies of death that are at the heart of military engineering with the basic concept of technologies of life that are at the heart of humanitarian engineering. Third, focus societal concerns upon the inequities, injustices and conflicts that afflict so many countries. And fourth, blend all of these factors into the following definition of humanitarian engineering:

> ***Humanitarian engineering is the application of technology to control or modify the physical environment in ways that promote communication and interaction among stakeholders in order to avert or minimize injustice and violent conflict.***

The practice of humanitarian engineering, as defined above, requires a variety of skills:

- knowledge of relevant technologies
- sensitivity to the needs of people
- understanding of social aspects of injustices and how they lead to violent conflict
- appreciation of cultural, ethical and moral differences between people
- willingness to learn and grow

Humanitarian engineering is the active use of engineering knowledge to promote right relationships between people and a just existence for all. It supports the establishment of a "*culture of peace*". It is not neutral towards the application of technology but morally and ethically committed to using technology to reduce conflict and inequity.

The objectives of humanitarian engineering differ from those of classical, or conventional, engineering. Classical engineering responds to markets and is usually concerned with the efficiency of inputs (technical design; materials costs) and the physical functioning of outputs (operation of a pump; flow rate in a pipeline). Humanitarian engineering, on the other hand, while also concerned with traditional technical factors, gives primary emphasis to the social consequences of outputs (reduction of poverty; return of refugees to reconstructed cities).

The solutions in humanitarian engineering also may differ from those of classical engineering. In classical engineering, which is generally determinate in nature, if you put in the right information, you expect to get the correct answer. The necessary variables and the information for these variables can be defined in terms of technologies. Humanitarian engineering, however, because it deals with the needs and perceptions of people, is generally indeterminate in nature, and may have several possible solutions. There are more unknown factors than there are methods of solution. Its variables must be defined in terms of technologies as influenced by social needs. We cannot easily define the right variables in humanitarian engineering because we do not fully understand the social issues. Therefore, there may be many correct solutions in humanitarian engineering.

The distinctions between military, classical and humanitarian engineering can be summed up as follows:

> ***Military engineering: technologies applied to promoting military solutions (conflict-driven).***
> ***Civilian/classical engineering: technologies applied to serving societal needs (market-driven).***
> ***Humanitarian engineering: technologies applied to promoting peaceful solutions (human rights-driven).***

Where can we find opportunities for the practice of humanitarian engineering? My focus here will emphasize humanitarian engineering in an international development context because this is where most of my professional experiences originated.

Humanitarian Engineering in Disasters

There are several common situations in which humanitarian engineering is applicable. One area includes natural disasters and man-made accidents. Natural disasters include earthquakes, floods, famines and environmental degradation, while man-made accidents include chemical releases, nuclear explosions and the failure of major structures, such as dams, levees and bridges. When extreme events occur, either natural or man-made, the lives and safety of large numbers of people are affected by the engineering responses to the resulting emergencies. At the same time, the nature of the engineering responses, while addressing immediate problems, may inadvertently cause problems among the people they are intended to help.

The lessons of both natural and man-made disasters, whether they are hurricanes, earthquakes, oil spills or nuclear reactor melt-downs, is that immediate responses are necessary but long-term solutions are essential. If engineering technologies address only the immediate needs – the suffering, the homeless, the dying - but do not contribute to fundamental long-term solutions to prevent or at least mitigate similar disasters, they leave people vulnerable to both future physical disasters and social conflicts. The problems are further complicated when natural or man-made disasters occur in areas of armed conflict.

Humanitarian Engineering in Conflicts

Another area in which humanitarian engineering may be applicable includes armed conflicts, civil wars and general insurgencies. Although engineering is often used as a tool of war, it is not unreasonable to see that it also can be used as a tool for peace. Engineering facilities and services that benefit all sides engaged in a conflict can provide a common basis for subsequent dialogue. A new road that connects the territories of two warring parties can be seen as either an invasion route or a channel for communication and eventual cooperation. The purpose for which it comes to be used will depend very much on the interaction between the two parties at the time the decisions to build the road were made.

Sometimes third parties, unaffiliated with any of the warring groups, can provide engineering solutions that are supported by all sides. There are many examples of United Nations' organizations, such as UNICEF, UNDP, UNRWA and UNHCR as well as the International Red Cross (ICRC), working in war zones to minimize the effects of conflicts. Many of these conflicts pit government forces against insurgents, with the international organizations finding themselves working in areas controlled by both sides. Recent examples of such conflicts include civil wars in Sudan, Angola, Mozambique, Somalia and Georgia.

A more relevant opportunity for humanitarian engineering is the immediate aftermath and reconstruction period following wars and armed conflicts. Engineering works that help meet people's urgent needs for food, water, shelter and security are essential. National Red Cross and Red Crescent societies, as well as various international humanitarian organizations, often play a major role in countries trying to rebuild from the devastations of war. However, if these efforts are not carried out in a spirit of cooperation and respect for all sides after a conflict has ended, they probably will not promote peace. An occupying military force or a foreign-controlled government, for example, cannot easily command cooperation between dissident parties, even with the lure of restored infrastructure. This is the lesson of present day Iraq. The reconstruction of schools, water systems and bridges in that tortured country has resulted in many new or restored physical facilities, but in the absence of respect and cooperation among all parties, including religious and ethnic groups and American military forces, an environment of conflict remains.

Humanitarian Engineering to Reduce Inequities

A third area for humanitarian engineering includes situations in which severe inequities, or injustices, exist between groups. While not as dramatic as natural disasters or armed conflicts, social and economic inequities provide the seeds for future societal conflicts. Problems arising from inequalities generally require a response focused upon a development approach. The main issues of concern include poverty, public health, education and environmental sanitation. Poverty and a greatly unequal distribution of resources between social groups can lead to envy, anger, and outright violence. Revolutions often are triggered by disparities in wealth or power. It is in this area, the reduction of inequities, that humanitarian engineering may have its greatest impact. Typical examples of the application of engineering technologies to reduce inequities include the provision of improved public services for the poor (water supplies, roads, telecommunication and other physical infrastructure) as well as access to private services (housing, food distribution and transportation).

There are many ways in which engineers can use technologies to reduce societal inequities. One way is to improve the level of public services available to the poor so that the obvious inequities

in health, nutrition and basic quality of life are reduced. This could involve 24-hour water supply services in areas that suffer from frequent interruptions. Even more basic would be the provision of safe drinking water to communities that traditionally have been overlooked by their governments. Currently, 1.1 billion people on Earth do not have access to an improved water supply and 2.6 billion do not have a sanitary way of disposing of their own bodily wastes. These people become ill more often and die sooner than their fellow citizens in the communities with improved sanitation systems. If not addressed, the disparities between the haves and the have-nots tend to grow, further separating the rich from the poor and providing the preconditions for future conflicts. Engineering technologies can provide or at least improve basic services. When carried out to improve the quality of life and to involve the relevant stakeholders, both rich and poor, they promote peace and the avoidance of conflict.

How Can We Prepare for a Career in Humanitarian Engineering?

To start, we should turn to the colleges and universities that instill the basic concepts of professional ethics. Students can begin by enriching their engineering programs with studies of peace environments and peace outcomes. This probably will require spending some time looking into courses in sociology, politics and history. It must be recognized, however, that adding peace studies will place additional demands on engineering programs that are already heavy with technical requirements. Unfortunately, there are no programs or courses devoted to humanitarian engineering in our colleges and universities at this time. A young student will have difficulty in identifying both appropriate courses and university faculty capable of mentoring students interested in humanitarian engineering. As a result, the student will have to shoulder much of the responsibility of finding sympathetic faculty interested in such programs.

The next step is for the student to go outside the classroom and work, or spend some time as a volunteer, with a non-governmental organization (NGO) or other organization that promotes peace-related applications of technology. Possibilities include student-run organizations such as Engineers Without Borders and Engineers for a Sustainable World, as well as international NGOs such as Habitat for Humanity, CARE and Water for the People. On completion of his studies, the new engineer could join the Peace Corps and immediately experience the opportunity to apply technologies in developing countries. Continued involvement with humanitarian engineering will depend upon an individual's professional interests.

One important track is an academic appointment that provides opportunities for teaching and research on humanitarian engineering. A university faculty position offers the possibility of encouraging students to consider the career aspects of humanitarian engineering. This should include discussions of societal responsibilities, professional ethics and the roles of applied technology in promoting peace. All students should learn that at some point in their engineering career it is understood that they accept a period of service as a volunteer with a charitable organization or work in some service-oriented mode as a contribution to the profession of humanitarian engineering and the people it serves. Young engineers should be cautioned against expecting that their years of study and preparation thereby entitle them to fat salaries and other societal rewards. The basis of humanitarian engineering studies is that we all have obligations to each other. Indeed, we are brothers and sisters to all peoples.

As a graduate engineer, there are many career tracks in humanitarian engineering. Potential employers include federal and local governments as well as international development agencies. For work in developing countries, the most important agencies include the U.S. Government (USAID, OFDA, EPA, and the Departments of State, Agriculture, and Health and Human Services), United Nations agencies (UNICEF, WHO, UNDP), and non governmental

organizations (CARE, World Vision, CRS), plus many private sector firms in the consulting, construction and manufacturing sectors. As in the case of university studies, there are no defined positions or programs designated as humanitarian engineering. The individual will have to determine for himself whether the objectives of the organization and the requirements of the available positions encourage the use of technology to promote peace through communication and interaction among stakeholders. This will require not only a good grounding in engineering and in professional ethics but also a personal dedication to using one's talents and experience to reduce injustice and the potential for violent conflict.

Conclusion

Humanitarian engineering is an alternative to the two standard models of engineering: military engineering to meet the war-related needs of the military and classical engineering to meet the market-driven technology needs of the civilian population. The alternative of humanitarian engineering is the conscious application of technology to the mitigation of conflicts and the promotion of peace.

As an operational discipline, humanitarian engineering has many aspects that are not well understood. The concept is very new and has yet to be given the academic and professional rigor it must have to compete with other engineering disciplines. This rigor will come in time. It will come when the outcomes of engineering efforts are measured in terms of their contribution to promoting peace through the reduction of social and economic inequities and the encouragement of communication and cooperation among all parties. It will arise from the efforts of engineering practitioners in the field, university researchers in the library, teachers in the classroom and from people, such as you, in universities, institutes and government offices around the world.

The challenge of humanitarian engineering is to be at the same time a facilitator of change serving the needs of a community and a promoter of a culture of peace ensuring it a sustainable future. The times we live in demand that we put our knowledge and dreams to making the world both a better and a safer place. There is no alternative to humanitarian engineering if the world is to survive the inequities, disasters and conflicts we find all around us.

References

Vesilind, P. Aarne (2005). **Humanitarian engineering: When Personal Values and Engineering Careers Converge.** Lakeshore Press: Woodsville, NH

Warner, Dennis. Personal files and internal agency reports.

World Health Organization (1984). **The International Drinking Water Supply and Sanitation Decade: Review of National Baseline Data (as at 31 December 1980)**. WHO Offset Publication No. 85. WHO: Geneva.