In 2011, Engineers Australia recognised the vital role members of the engineering team play in the national and international humanitarian effort. The Year of Humanitarian Engineering showcased the leadership demonstrated by the profession and encouraged more individuals and organisations to be involved in humanitarian engineering.
Abstract

Engineers Australia celebrated the Year of Humanitarian Engineering in 2011 and one of the key components of the year was an exploration of the role of engineers in acute emergencies. The humanitarian imperative is complex and demanding, and the concept of humanitarian engineering offers the opportunity to connect laterally across the profession, with a unity of purpose.

Through a wider definition of humanitarian engineering a greater part of the profession can take part in social outcomes, which sits comfortably with the notions of commercial profit and the interests of governments. Humanitarian engineering is action taken by individuals and organisations, both government and non-government. It should not be viewed as purely the domain of the volunteer and indeed challenges the notions of pure humanitarianism. Critically, it is about delivering improved engineering action to disadvantaged people and communities who need it the most, whether through natural disaster or conflict.

This Report identifies nine themes of future endeavour:

- Understand Values
- Understand Small Systems
- Understand Psychosocial Demands
- Deliver for Community
- Deliver Improved Community Resilience
- Deliver Intelligent Risk Management
- Deliver a Networked Approach
- Deliver Improved Connection
- Deliver Greater Industry Engagement.

The Report aims to deliver a strategy for change based on shared value in the engineering profession. The future strategy aims to explore and confirm values, develop action plans based on principles and forge networks across the engineering profession. Strong and senior leadership within the engineering profession is required to inspire engineers to be part of a changing culture which values humanitarian engineering work.
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Introduction

The drive to improve humanitarian outcomes is critical to global social cohesion. Humanitarian engineering is a social concept which encourages improved employment and engagement of engineering resources, delivering humanitarian outcomes. It is new as a unifying concept but old in practice, as engineers have always been part of recovery from disaster and ongoing development programs. Humanitarian action and development aid have well developed definitions. AusAID’s Humanitarian Action Policy goal is to “save lives, alleviate suffering and maintain human dignity during and in the aftermath of conflict, natural disasters and other humanitarian crises, as well as to strengthen preparedness for the occurrence of such situations”\(^1\). It may therefore be distinguished from development aid, which seeks to address the underlying socioeconomic factors which may have led to a crisis or emergency. The continuum of humanitarian engineering attempts to support both humanitarian action and development.

Increased emphasis on humanitarian engineering offers the potential to improve lateral connection across the profession providing a bond through unity of purpose. Humanitarian engineering is action taken by individuals and organisations, both government and non-government. It should not be viewed as purely the domain of the volunteer and challenges the notions of pure humanitarianism. Indeed the wider definition of humanitarian engineering means a greater part of the profession can take part in social outcomes, which sits comfortably with the notions of commercial profit, the interests of nation states and responsibilities of state and local governments. Critically, it is about delivering improved engineering action to disadvantaged people and communities.

This Report concentrates on the humanitarian action function of humanitarian engineering and summarises the workshops delivered by Engineers Australia. The workshops examined the role of engineers in acute emergencies in the Year of Humanitarian Engineering. This summary is contained at Addendum 2 to this report. The main body of the report sets out to analyse humanitarian engineering in disasters, conflicts and complex emergencies and offer a vision for enhanced engineering efforts in delivering humanitarian outcomes. The Report identifies nine themes of endeavour and potential strategies for change.

Definition

Engineers Australia defined humanitarian engineering for the 2011 Year of Humanitarian Engineering as:

“Humanitarian engineering brings enhanced well-being, welfare, and comfort to any individual or community in disadvantaged circumstances and is inclusive of research, design, manufacturing and construction. The issues to be addressed in engineering terms might include chronic ongoing conditions for an individual or group, or be associated with high-impact disasters and emergencies which imperil large numbers of people.”\(^2\)

\(^{1}\) Australian Agency for International Development, Humanitarian Action Policy, December 2011, Canberra P5.
\(^{2}\) Engineers Australia Year of Humanitarian Engineering Definition adopted by Council of Engineers Australia Sydney 28 August 2010.
This definition consciously attempts to widen the methods by which the engineering profession can contribute to humanitarian outcomes. Humanitarian engineering as a relatively new concept does not have many comparative definitions but should be contrasted with the Colorado School of Mines definition:

“Humanitarian engineering in the most general terms is the artful drawing on science to direct the resources of nature with active compassion to meet the basic needs of all – especially the powerless, poor, or otherwise marginalised.”

This definition is not explicit in attempting to reach across the engineering profession and therefore it is open to traditional limiting notions. It includes one critical term; ‘active compassion’. Active compassion is the delivery of tangible benefits to disadvantaged people. Some very valuable humanitarian goals are generational and sometimes less tangible. Humanitarian engineering is the bridge to long term societal change, as it provides active compassion. An example is construction of Health Clinics which are attentive to female needs, providing steps towards the Millennium Development Goals of gender equality and maternal health.

Humanitarian engineering is not charity and neither definition implies this.

“Charity just isn’t enough. Charity is, sadly, only the leftovers—the spare cash and leftovers are never going to be enough to solve all the problems of the world... charity is not driving change.”

Humanitarian engineering is not an argument for altruist ‘virtuous’ engineering for free. There is a place for a concept of limited ‘free’ engineering services within a wider concept of pro-bono engineering. The implicit value of humanitarian engineering is the delivery of engineering work to those that are disadvantaged. There is shared value and importantly shared benefits, which are both material and social. Therefore, humanitarian engineering challenges conventional notions of separation between humanitarianism and engineering.

**Connecting Humanitarianism and Engineering**

“The conventional view serves to protect us from the painful job of thinking”

John Kenneth Galbraith

Humanitarian engineering is a mystery not a puzzle. A puzzle grows simpler with the addition of each new piece of information, while a mystery requires judgment, an assessment of uncertainty and maybe the need to grapple with philosophy. In this way humanitarian engineering challenges the engineering profession every day. There are technological breakthroughs in scientific and engineering domains which cannot be missed, and alternatively there is the danger of continuing

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5 Oliver-Bennetts S. Dr and Purcell S. *Snapshot of Pro Bono Engineering*. This report was produced Engineers Australia in 2011 as part of *The Year of Humanitarian Engineering*.
7 Gregory F. Treverton *High-Performance Government: Structure, Leadership, Incentives*, RAND Corporation, 2005
successful methods of the past which are no longer appropriate. Organisational and technological adaptations are necessary parts of the concept of humanitarian engineering.

Engineering

Engineering has been central to the economic growth which has characterised the rise of industrial capitalism. Science with engineering enabled the commercial and social advantage of the industrial revolution in the Western World, and in turn helped shape the economic and geopolitical circumstances of today. Engineers have developed transportation that has enabled humankind to travel to the moon and back, they have also given politicians the means to destroy humanity.\(^8\) However, there is a broader social purpose of engineering which is not communicated by this relationship of engineering advancement with industrial capitalism. The Engineers Australia Code of Ethics states:

“As engineering practitioners, we use our knowledge and skills for the benefit of the community to create engineering solutions for a sustainable future. In doing so, we strive to serve the community ahead of other personal or sectional interests.”\(^9\)

Further, the Institute of Professional Engineers New Zealand defines the purpose of engineering as:

“Engineers will translate into action the dreams of humanity, traditional knowledge and the concepts of science to achieve sustainable management of the planet through the creative application of technology.”\(^10\)

Together these ethical statements point to serving the community though skills that exploit the advantage of technology. But there remain many questions: What is community? Whose community? How good are those skills? And who benefits from the advantage of technology? The engineering profession has some significant challenges in the application of the ethical purpose described by Engineers Australia and Institute of Professional of Engineers New Zealand

Historically, mainstream engineering was divided into the four broad disciplines of chemical, civil, electrical and mechanical engineering, with several branches within each discipline covering an enormous range of fields. Now there is the emergence of many new disciplines of engineering. Some of these new major fields of engineering include: Aerospace Engineering, Risk Engineering, and Biomedical Engineering. This broadening of the scope of engineering and recognition of a wider ethical purpose, means the concept of humanitarian engineering has the potential to grow within the engineering profession.

Humanitarianism

The United Nations (UN) has defined four humanitarian principles:

- Humanity, which is the provision of assistance to people in distress without discrimination;
- Impartiality, where action is based solely on need;
- Neutrality, where humanitarian action must not favour any side in an armed conflict; and


• Independence, where humanitarian action must be kept separate from political, economic, military or other objectives.

These four humanitarian principles are underpinned by the notion of ‘do no harm’\(^{11}\) and, taken together, constitute the accepted framework for humanitarian operations by Non-Government Organisations (NGO).

These principles underpin successful humanitarian work around the world, but in a complex world cannot always been achieved in an absolute form. World Vision points to this with the HISS-CAM framework for humanitarian emergencies based on principled pragmatism.\(^{12}\) Independence is a particularly vexed principle; indeed it is at odds with an evolving interconnected global community attempting to achieve humanitarian outcomes. Shared value, corporate social responsibility, joined up government, whole of government and triple bottom line, are just some of the phrases attempting to define the new agenda of results through networks. Humanitarian engineering is a shared concept that challenges the traditional notion of pure independence.

**The Humanitarian Imperative in Disasters and Conflict**

The engineering profession supports the response and recovery of communities from natural disasters and conflict. Australia continues to be afflicted by punishing droughts, consuming bushfires, destructive cyclones and devastating floods. This has been proven again with the devastation of the Black Saturday bushfires in February 2009 and then repeated floods events from 2010 to 2012 in Eastern Australia. The Asia Pacific region suffers repeatedly from significant disasters such as the New Zealand Canterbury Earthquakes and the Great East Japan earthquake and tsunami in 2011. The Asia Pacific Disaster Report 2010 describes it in the following terms:

“.....between 1980-1989 and 1999-2009, the number of disaster events reported globally increased from 1,690 to 3,886. Over the whole period of 1980-2009, 45 per cent of these were in Asia and the Pacific....Asia-Pacific has been the region that suffered the largest number of disasters over these years”\(^{13}\)

Conflict afflicts many parts of the world with fragile Nation States are often suffering from conflict or in post conflict rebuilding, when faced with the additional trauma of disaster creating complex emergencies. What characterises current conflicts and large emergencies is the need for interaction across Governments, between Government agencies at varying levels, with Non Government Organisations and Industry. Engineers have a stake in all these organisations. The acute phase of disasters, conflicts and complex emergencies implicitly involves the response to immediate humanitarian needs, but also is about setting the preconditions for long term recovery. Critical to sustainable humanitarian outcomes is successful transition from response to recovery. For conflict and complex emergencies it involves the difficult phase of stabilisation before undertaking transition.


\(^{13}\) UNESCAP &ISDR, *Protecting Development Gains Reducing Disaster Vulnerability and Building Resilience in Asia and the Pacific*, the Asia-Pacific Disaster Report, 2010, p. 26
Natural disasters are increasing in frequency, scale and impact. Conflict may also intensify in the coming decades as the world’s population continues to rise and the demand for limited natural resources continues to grow. There is a compelling and demanding humanitarian imperative at home and abroad.

“Humanitarian action can mean the difference between life and death for many thousands of people each year. It helps people prepare for, respond to and recover from crisis, so that they can get back to leading productive lives more quickly. Humanitarian action helps to protect and rebuild hard-won development gains by providing access to life-saving help such as food assistance, education and health services.”

Key Stakeholders

There is no shortage of stakeholders in the delivering of humanitarian action. By some it is considered the ‘tsunami after the tsunami’ and the coordination of these organisational stakeholders is a vexed and complex problem. The global system is full of disjunctions, and difference between organisations is real and perceived. However, the difference of purpose between entities is what defines the special skills that individuals, professions and organisations bring to humanitarian action. A discussion of the Key Stakeholders is at Addendum 1 to this report.

Engineers Australia Year of Humanitarian Engineering 2011

A detailed summary of the Workshops which examined engineer’s role in acute emergencies as part of Engineers Australia 2011 Year of Humanitarian Engineering is described at Addendum 2 to this report.

Themes of Endeavour

The material gathered throughout the Year of Humanitarian Engineering workshop series summarised at Addendum 2, provided many unique insights which have been gathered together into nine themes. This aggregation of ideas based on the workshops into themes aims to provide the framework for improved delivery of humanitarian outcomes by engineers in acute emergencies. The nine themes can be broadly grouped into issues requiring a deeper understanding and what must be delivered.

Understand Values

“The public good of Justice . . . is the main pillar that upholds the whole edifice. If it is removed, the great, the immense fabric of human society . . . must in a moment crumble into atoms”

It is wrong to assume justice is not the domain of engineers, and the engineer undertakes his functions free of such moral dilemmas. Without clear notions of justice, engineering could not succeed and confronting this connection explains why humanitarian engineering is a ‘mystery not a puzzle’. Our values and ethical basis as engineers, and more widely as Australians, were discussed at every workshop. Further, the question of how far ‘our values’ should be transferred to other cultures was widely discussed. The answer expressed from an International and Indigenous Australian viewpoint was that Australian engineers have, at times, been guilty of delivering preconceived solutions to their commercial benefit. Sometimes engineers build what they want and not what is needed. This may be challenged by many Australians and whether this is reality or perception matters little, because it is the view of those being assisted. Humanitarian engineering cannot succeed if there are any lingering questions of just provision of engineering services.

There is, however, a valued relationship between the Australian public and the engineering profession, evidenced by the continued high rating as an ethical and honest profession\(^\text{16}\). This high degree of trust between the profession and the public demonstrates that training, education and workplaces are ethically sound. Further, it provides an excellent basis of values to build a bond of humanitarian engineering across the profession. In order to maintain trust with the public, the engineer must act ethically and the statement of that ethical ‘contract’ is the Engineers Australia Ethical Charter. While the Charter provides a cornerstone of the concept of humanitarian engineering, it remains the responsibility of all engineers to provide engineering outcomes within a values framework.

Further in a positive lens, it is worth considering what makes Australians different to other cultures. Without debating egalitarian notions of mateship, it is remarkable to note that the statures that appear outside of the Australian War Memorial are of ‘humanitarians in uniform’, Sir Edward Weary Dunlop and Simpson with his donkey. Surely this points to what Australians value most in times of conflict and perhaps contrasts Australians with others.

It is reassuring that Australian engineers have a sound ethical basis in a pluralistic caring society, nevertheless many engineers feel that they must opt out of mainstream engineering to pursue any humanitarian engineering work. It appears there is a disconnect between notions of work and financial achievement and humanitarian value. This was demonstrated clearly by the demographic of participation in the workshops which was attended by young and old engineers and missed the ‘mortgage belt’. It appears that hard working engineering professionals are unable to justify time away from work, which does not directly contribute to the tasks of the day. This is not a judgment on the individual but an expression of the demands of our society.

The benefit of debating and understanding values in the engineering profession is that it connects people with ideas. The construct of Health Wellbeing for Indigenous Australians described by Dr Pettersen offers an insight to this type of connection when she described a conceptual framework of interconnectedness between spiritual, cultural, social, psychological, and physical dimensions.\(^\text{17}\)

\(^{16}\) 2011 Roy Morgan Image of Professions Survey accessed at http://www.roymorgan.com/news/polls/2011/4655/ on 19 Mar 2012. In the annual Roy Morgan Image of Professions survey 89% (unchanged in a year) of Australians aged 14 and over rate Nurses as the most ethical and honest profession — the 16th year in a row since Nurses were first included on the survey in 1994. Pharmacists (85%, up 1%), Doctors (79%, down 3%) and School teachers (73%, down 3%) have been consistently ranked near the top while Engineers (69%, unchanged); Dentists (68%, down 1%) also regularly rate highly

\(^{17}\) L. Pettersen, Dr, Presentation to Engineers Australia Workshop ‘Indigenous Health’, Darwin 3 Nov 2011.
There is much that is inherently good in engineering values which could be promoted more widely, but there are also areas which deserve examination. Values can be quickly and easily eroded, and when faced with the complex problems of acute emergencies, values will be questioned. We may not be viewed by others in the way we wish. If response and recovery from disaster and conflict is merely seen as the domain of the altruistic and not valued as ‘normal’ work then the concept of humanitarian engineering is doomed to failure.

**Understand Small Systems**

The concept of understanding small systems is linked to understanding values and was a key notion of Andrew Cleland CEO of the Institution of Professional Engineers New Zealand. It was reinforced throughout the workshop series. Understanding small systems is a pragmatic expression of delivering engineering solutions appropriate to the needs of others. It acknowledges that many engineers in Australia may not be able to adapt their thinking from complex urban engineering challenges to those of small rural communities impacted by disaster or conflict. The scale of disaster may be immense and the devastation to community enormous, but the expectations of recovery will be significantly different from those of an advanced urban community. For instance, it is highly plausible in many countries of the South West Pacific that supply of electrical power was intermittent before the disaster, and it may be counterproductive to engineer a ‘big solution to the power problem’ in recovery.

This notion of appropriate technology and systems sometimes competes with the laudable notion of ‘build back better’. ‘Build back better’ was the signature statement of President Bill Clinton during the early recovery from the 2004 Asian Tsunami, and commonplace in disaster recovery strategies. It is a statement of optimism that provides communities the inspiration to recover. However, ‘Build back better’ is sometimes reconstruction in our image, can be expensive and not necessary in some circumstances, ultimately damaging community sustainability. A well meaning engineer operating in disaster recovery can have unintended damaging effects on small systems.

Understanding small systems is therefore a bridge between recovery and capacity building, providing a framework to ensure unintended consequences do not occur. The capacity building methodology for small systems is based on the six pillars:

- **Individual** – to ensure the needs of individual technical practitioners are met
- **Institutional** – to ensure there are educational, professional, technical and statutory institutions in place
- **Technical** – to ensure there are technical standards, technical literature and guidance material to underpin and support good engineering and technological practices.
- **Decision-making** – to ensure decision makers have sufficient information or access to knowledge and skills to make logical and rational decisions.

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• **Business** – to ensure there are stable and responsible business, commercial enterprises and financial institutions.

• **Resources and supplies** – to ensure that there is access to appropriate, affordable and suitable materials to use in building and maintaining of infrastructure.

Engineers with highly developed specialist skills may not be the best engineers for employment in disaster recovery when considering small systems. Perhaps a shire engineer from regional Queensland who has dealt with the impact of flooding of regional communities has a better understanding of what defines success in a small system, than an engineer who dealt with the floods in Brisbane. Unquestionably, the engineering profession values the specialist who deals with complex problems more highly than generalists in remote locations, but sometimes, successful specialists can dominate recovery teams and the community in need, with big ideas for change. While the specialist is master in urban environments the generalist is the master in small system recovery. Those who select engineers for deployments to emergencies understand this challenge, and humanitarian engineering must value those who understand small systems.

The deeper issue for humanitarian engineering in Australia is how you maintain a group of valued individuals who understand small systems in an increasingly urbanised country? Alternatively how might we deliver wider skills to urban engineers who wish to undertake humanitarian engineering? This is not about deployment skills but an argument for wider understanding that comes from education, which gives engineers greater agility in thinking.

**Understand Psychosocial Demands**

Engineers engaged in delivering humanitarian outcomes must understand the psychosocial stress being suffered by a community in distress, and the consequential demands placed on them. An inability to recognise psychosocial stress and preparation to deal with it can have long term detrimental effects on individuals. This is not an argument for engineers to don another professional hat, rather it is an expression of the need to reach out and embrace concepts that are not part of a normal engineering workplace. Occupational health and safety is widely understood by the profession as not only beneficial to workers safety but also productivity, and psychosocial stress is part of the occupational health and safety regime for engineers responding to disasters and conflict. Addressing psychosocial stress is principally an activity which promotes the prevention, mitigation and treatment of stress and humanitarian engineering is strengthened through the psychosocial support of staff, projects and management systems.

REDR (Australia) places great emphasis on the psychosocial demands of humanitarian work. Few humanitarian workers think about or prepare adequately enough for the variety of adjustment challenges that they are likely to encounter at the different phases of deployment. Although culture shock is commonly expected on entry to the field, “re-entry” shock at the end of a deployment is by contrast often not prepared for nor anticipated. Traumatic events can also shatter previously held assumptions and compassion fatigue is a very real and present challenge. Within the concept of humanitarian engineering, engineers need to pay attention to an integrated, systematic approach to

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20 P. Singh President of the Fiji Institution of Engineers, *Presentation to Engineers Australia Workshop ‘Supporting Disaster Response in the South West Pacific’*, Sydney 20 Oct 2011
the psychosocial issues of crisis management. Including pre-crisis planning and education, large group crisis management briefing; small group critical incident support; individual psychological first aid strategies for follow up and referral. Humanitarian work can be strongly motivating, challenging and interesting rewarding experience, but the reality can also be alarming.

Human behaviour in extreme conditions is widely studied and relevant to understanding a distressed community. Mr Pascoe of the Stathewen community pointed to the difficulties of working with disaster affects on people. These are normal people in abnormal circumstances, they are not disabled but probably disoriented and almost certainly overwhelmed. Emergency impacted people do not become panicked, aimless or stupid. Indeed they become more focused and more innovative. A practitioner of humanitarian engineering, who works with affected people, rather than around them, will have far greater success.

**Deliver for Community**

“Doctors Save Lives, Engineers save Communities”\(^{21}\)

Mr Lindsay, President of Engineers Australia 2011, when making this statement does not mean to diminish the extraordinary efforts of the medical profession in the delivering of humanitarian outcomes. He aims to point out that in a humanitarian sense, the concentration is often on the individual not the community, and sometimes humanitarian action can concentrate on the delivery of aid to individuals and families for the emergency only. The transition from relief to recovery with the reconstruction of communities is where the efforts of engineers come to the fore, yet it is rarely promoted within humanitarian or engineering circles, as often the eye of the emergency has passed on. The rush of support with immediate relief is critical, but the vacuum of support that does follow when conditions stabilise, can be damaging to communities. The engineer can help bridge that gap through medium term developments. From the delivery of clean water and power, to the design of sanitation services and communications infrastructure, engineers’ ingenuity helps solve many problems facing communities as they recover.

Smarter recovery is delivered by understanding the needs of the community, allowing the community to lead their own recovery and giving the community information, responsiveness and results. Engineers are experienced in developing and delivering solutions for clients through negotiation. This is a good skill to bring forward into early recovery as good facilitation/negotiation/partnership with community enhances social benefit. This should not imply this task of engineering in early recovery is easy. Identifying the community purpose is difficult, leaders difficult to identify and cultural imperatives can be misunderstood. Engineers should never adopt the solution first and enforce a strategy for reconstruction. Mr Pascoe highlighted the positive approach by the construction company Grocon in the community clean up after the’ Black Saturday’ fires in Victoria 2009. The Grocon representatives facilitated and negotiated arrangements for property owners directly with the community with flexibility and understanding. Engineers play an important role in improving the quality of life of people beset by disadvantage by helping communities recover from floods, earthquakes and other disasters as quickly as possible.

\(^{21}\) M. Lindsay, President Engineers Australia, Opening Year of humanitarian Engineering Melbourne 30 Nov 2010.
Deliver Improved Community Resilience

The impacts of disasters on the community are not necessarily determined by the scale of a disaster but are significantly influenced by the preparedness of the community. Community resilience is the capacity of groups to withstand, recover from, and respond positively to crisis or adversity. Community resilience is often described as having three properties: resistance, recovery and creativity. Humanitarian engineering influences all three of these properties. Resistance in the community is affected in part by a systematic approach, reliant on technical mastery of engineering. High professional standards and training of engineers leading to quality engineering works enables the community to better resist disaster. This resistance is not only in physical terms but also the social value based on trust in engineers, which makes communities feel safe from disasters. For example, the construction of dams and levees keep communities safe, but when engineering fails to deliver the expected safety, the bond of social trust is broken. Disaster risk reduction builds this community resistance and is the practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment.

An example of the influence of engineering in disaster risk reduction is GeoScience Australia which undertakes a highly specialised process of understanding vulnerability, mapping potential consequence and providing advice on appropriate design. A highly resilient community can withstand considerable disruption before undergoing long-term change.

The rate and quality of the recovery allows the community to pull through or bounce back to its pre-disaster state. An effective surge of engineering capacity is required in early phases which bridges the disaster to ongoing development projects (for developing countries) and to normal growth in developed countries. An effective surge of engineering capacity is rarely if ever achieved, and there certainly cannot be a standing engineering resource left idle waiting for a disaster. In Australia the Australian Defence Force is often called upon to fill that gap. Improved preparedness through better mobilisation of engineers will assist the management of recovery. Essentially there should be a process of mobilisation for early recovery similar to the Urban Search And Rescue (USAR) capability in emergency management. The CEO of the Queensland Recovery Authority pointed to a need for improved preparedness of all professions not just engineering and the Commonwealth Government has raised the Australian Civilian Corps to help fill this gap in overseas operations. Preparedness drives all other elements of the disaster cycle as described at Figure 1 below. The risk of disaster and cost associated with recovery demand an improved regime of engineering preparedness.

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22 Australian Government, Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA).
23 Recent examples of this are the failure of the levees in New Orleans during Hurricane Katrina in the US and the review into release of water from the Wivenhoe Dam during the floods of South East Queensland of 2011.
24 United Nations (2009), UNISDR Terminology on Disaster Risk Reduction. Geneva, Switzerland
25 M. Edwards, GeoScience Australia, Presentation to Engineers Australia Workshop ‘Disaster Risk Reduction’, Melbourne 18 Oct 2011
Creativity means learning from the effects of crisis or disaster, and then improving and adapting to changed circumstances. Creative engineering underpins a path of continual improvement in community resilience, and the concept of humanitarian engineering aims to achieve adaptive learning which allows engineers to be agile in developing solutions. Much is in place already with ongoing review of engineering practice which is always attempting to make best use of new technology. This includes the traditional review of standards that occurs after each disaster. Creativity is created through education and capacity development, and this is another example where humanitarian engineering bridges development and humanitarian action.

**Deliver Intelligent Risk Management**

The domain of risk engineering has much to offer to humanitarian engineering, as the understanding of risk and vulnerability underpins disaster risk management. Delivery of intelligent risk management highlights that engineering which delivers humanitarian outcomes, can be done by engineers undertaking daily tasks in a normal work environment. In the aftermath of disaster events, many communities and their respective government officials ponder how to manage the preparation for and the consequences of, the next disaster. The far-reaching effects of disasters, combined with their frequency, reinforce the desire by communities and governments to seek an
answer to the simply articulated question: What could have been done before and after a disaster to minimise community harm? Society expects government officials to take all reasonable and practical steps to ensure that their safety is preserved, and being specialists, engineers are generally engaged in their area of practice in order to enhance society’s safety. Thus engineers must be competent to provide the necessary expertise that will prevent society harm, through the failure of engineering, when subjected to the effects of natural disasters. Moreover, engineers must be able to describe in plain terms what measures have been taken to protect society, and what risks society remains exposed to. However, as recent disasters have demonstrated, prevention is not always possible or achievable despite best engineering efforts. Engineers, government planning officials, and insurers, have an equal share in contributing to assessing and preparing a risk management strategy that minimises harm to society resulting from natural disasters.

The World Federation of Engineering Organisation (WFEO) represents 90 Engineering organisations and 15 million engineers worldwide, with a vision of “Developing and applying engineering to constructively resolve international and national issues for the benefit of humanity”. It has ten Standing Committees of which the Committee for Disaster Risk Management established in 2009, is hosted by the Japan Federation of Engineering Societies. Dr Marlene Kanga has made a proposed contribution to the Committee for Disaster Risk Management by Australia. The proposal is for a Sub-Committee for Capacity Building in disaster risk management, which will examine the relationship between sustainable economic development and effective disaster risk management, and the application of engineering for humanitarian outcomes. This Sub-Committee proposes to:

- Develop a Capacity Building Manual which provides information and support to develop disaster risk management practices and programs appropriate to the social and economic needs of the country
- Focus on good practices such as:
  - Government governance frameworks
  - Implementation of non-structural measures e.g. Land use planning
  - Tools for natural hazard awareness and disaster risk reduction awareness e.g. natural hazard risk modelling, early warning
  - Implementation of natural hazard emergency readiness and response plans
  - Natural hazard risk communication strategies
  - Natural disaster risk financing
  - Natural disaster awareness education.

Deliver a Networked Approach

The chaotic environment which involves humanitarian engineering in acute emergencies can be overwhelming. The challenges are immense from professional, personal, and organisational aspects. Humanitarian engineers can deliver a systems based approach and assist with the difficult task of dealing with uncertainty. The key to dealing with uncertainty is the determination of what is certain and an ability to see environments as a network of interwoven elements. Engineers through systems training go beyond the surface of the current situation, and attempt to identify causal factors which govern the development of the decision environment. An excellent example of this

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27 M. Kanga, Deputy President Engineers Australia, Presentation to Engineers Australia Workshop "Risk Management", Sydney 20 Oct 2011
was given by Mr Mark Edwards when describing the predictive vulnerability work done by GeoScience Australia.\textsuperscript{28} In a construct of Hazard/Exposure/Vulnerability/Impact, he explained vulnerability is where science can make the most difference by structural examination, construction of models and provision of adaption options.

An enlightening view arose at several workshops with discussion of the ‘library’ and ‘information retrieval’ models which offer opposing philosophies for coping with uncertainty. The vertically integrated hierarchy of engineering and disaster management organisations reflects the ‘library’ culture which defines the dominant model for resolving uncertainty in overwhelming situations like disaster response. Increasingly the new ‘information retrieval’ culture shifts the focus from hierarchical ‘command and control’ and filtering of information by management to wider availability and access of knowledge across lower levels of the organisation. The potential to access engineering specialists directly across organisations is available but directly challenges traditional notions of authority, accountability and leadership. A note of caution is worthy because uncontrolled networking of well meaning potentially ill-informed specialists responding to and assisting recovery from disaster would surely cause a second disaster. Evolution not revolution is the sound path for improvement.

Previous generations have been raised and trained in a ‘library’ culture but engineers and scientists are leading the adaption to an information-retrieval culture. This will require new forms of administration and organisation where the social technologies best harness knowledge growth, and this network-based future moves organisations toward an ‘information retrieval’ culture. What this offers for humanitarian engineering is twofold; an opportunity to connect the concept of humanitarian engineering through previously unavailable networking opportunities, and secondly an ability to adapt to the community needs in a more coherent fashion.\textsuperscript{29}

The application of social networking analysis for building community resilience is the subject of research in several countries. Building resilience is not only about preparation for disasters, the study of how networks deal with broader social issues is expected to bring new insights to dealing with distressed communities. Research on how communities deal with issues such as ethnic oppression may also aid understanding on community resilience from which to draw upon in emergencies. Social networking analysis is also being examined in other contexts such as behaviours that arise as a consequence of a disaster and the improved understanding of behaviours of individuals and organisations could lead to better planning and the promotion of resilience.\textsuperscript{30}

A vibrant network of humanitarian engineering with the tools of social networking will collect, analyse, understand, model, and incorporate network data into decision-making processes that assist humanitarian outcomes. Additionally, the skill sets and attributes of network members can be better understood in order to identify members that may emerge as trusted leaders within their domains. These individuals can then be enlisted to effectively disseminate information to their colleagues in separate networks. The network of humanitarian engineering offers the opportunity

\textsuperscript{28} M. Edwards, GeoScience Australia, Presentation to Engineers Australia Workshop “Disaster Risk Reduction”, Melbourne 18 Oct 2011.
\textsuperscript{29} D. Schmidtchen, Dr, The Rise of the Strategic Private, Technology, control and change in a Network Enabled Military. Commonwealth of Australia 2006, pp 146 to 150.
\textsuperscript{30} Duffy N, Using Social Media to Build Community Disaster Resilience, Journal of Emergency Management Australia 1/2012, pp1-6
to be problem solving across vertical organisations and offers an opportunity for organisational agility not previously possible.

**Deliver Improved Connection**

Humanitarian action is a crowded environment with international, regional, sub-regional, national, public and private sector and non-government protagonists competing for space. The UN OCHA has the immense responsibility of coordinating these competitive actors for international disasters. This complex environment demands the need for collaboration between all entities, but coordination can only occur if all actors wish to be coordinated. The fact is many prefer ‘freedom of action’ over ‘unity of effort’.

Coordinating the crowded and unmanageable span of organisations and resources providing assistance in disasters, requires a new approach. Rather than seek one coordinator which manages the response of the disaster, the coordination will occur through a network of coordination cells, improving the internal operation of the cells and the overall system of coordination through improved relationships and defined boundaries. Effective multi-agency crisis management requires a ‘unity of effort’ through networks, rather than traditional hierarchical methods. Networked humanitarian engineering provides an example of how this devolved and new model of coordination can work. Interoperability based on specialist responsibilities (where engineering is one profession), builds trust between small multi-national professional teams providing a pathway to ongoing confidence building. The aim is to bring a 21st century approach based on networking and interoperability, as opposed to a hierarchical bureaucratic 20th century approach. Engineers placed in all organisations allow for improved connection across organisations.

There is no more important area for this enhanced connection then the vexed transition from recovery to response, which historically, has been poorly managed. “Recovery starts when the response starts, and the change in tempo from operational response to the long-term focus on recovery sometimes seems like we’re putting the brakes on, but instead recovery should be a whole system ramping up.”\(^{31}\), The planning for transition from relief through early recovery to long term recovery was a key consideration for the Victorian State Emergency Committee in the immediate aftermath of the 2009 Bushfire Disaster. The complexity of transition for the early recovery from this disaster is seen at Figure 2. The concept of community service hubs including a wide range of services were designed to meet that need for the delivery support to the community before the full recovery process of the Victorian Government was able to kick in.\(^{32}\) Improved techniques of transition like Community Service Hubs, which manage services such as Infrastructure are critical to successful recovery. Engineering services across several domains are connectors through transition and should be part of a better informed and smoother connection from relief through to recovery.

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Deliver Greater Industry Engagement

The humanitarian community has traditionally looked on the private sector primarily as donors and, in fact, corporate donations for humanitarian relief have steadily increased over the past several decades. Yet, in recent years there has been a growing global call for greater direct involvement by the private sector in disaster response. The emphasis has shifted from seeing the private sector’s role as a donor to being more actively engaged in sharing expertise and capacity, both to reduce suffering and to help rebuild communities following a disaster, as well as to play a critical role in disaster risk reduction through prevention and preparedness.

Unfortunately, in Australia there has been relatively little effort to understand the potential for contributions by specific industries, or to develop models of engagement that recognise the need for local action and ownership while being replicable, scalable and justifiable in business terms. In the immediate aftermath of a disaster, a construction company already operating in an area affected by a disaster is ideally positioned to contribute labour, materials and equipment that can save lives and reduce suffering. In addition to proximity, the company is likely to have the advantage of pre-established local networks and supply chains, relationships with local government, and a unique understanding of regulatory frameworks that may be lacking in the humanitarian agencies arriving on the scene. The distribution of food, water, medical supplies and shelter materials can be undertaken much more rapidly and efficiently by a large workforce that is immediately deployable and knows the local area. Assets such as earthmoving equipment can immediately be used for

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This concept of transition was developed at a series of multi-agency meetings in the first three days after the Black Saturday fires by the State Emergency Response Committee, Melbourne, 9 to 12 Feb 2009.
clearing debris. Company vehicles can be used for the distribution of humanitarian assistance. Generators can supply temporary power, and company offices and satellite communications can prove critical in assisting the coordination of the response.

The World Economic Forum has developed a new framework for the engagement of the engineering & construction industry sector during relief, recovery and prevention efforts as a result of natural disasters. ³⁴ This report aims to serve as a catalyst for greater private sector involvement in responding to natural disasters, and goes beyond the traditional notions of achieving humanitarian action through volunteers. It uses the most powerful engineering capacity which resides in industry to undertake humanitarian engineering. It combines global profit and not-for-profit endeavour in a new arrangement and allows the integration of state capabilities into private platforms. Government provides the platform for ‘build back better’ through public/private partnerships.

With the devolution and outsourcing of Government functions to the commercial sector in Western nations over the last thirty years to gain efficiency, many businesses are now directly involved as responders. This deliberate action by Governments has added to the ‘crowded space’ challenge experienced in international disasters. The United Nations World for Food Program and many nation states have standing contracts providing logistical and intimate support contracts with companies to deliver humanitarian aid. These contracts provide guaranteed support against the terms of the contract but must still be coordinated to meet the needs of the affected state. Due to the nature of the contractual relationships and obligations on both parties, it is sometimes difficult to adjust to changing needs without paying a significant premium to guarantee supply. Businesses are keen to exercise ‘shared values’ and if contracted will fulfil the terms of contract to assist countries in the time of need and often will forgo the competitive battle for profit to met a common humanitarian goal.

The United States Federal Emergency Management Agency (FEMA) is clearly ahead of Australian emergency agencies in the utilisation of commercial engineering agencies. Following the Hurricane Katrina disaster the United States made extraordinary changes to the systems of response and recovery. One area was the engagement of the engineering industry. The standing contract arrangements aim to set standards and clear understanding of the obligations between Government and Industry. This is a fundamental part of maintaining community resilience in the US and provides support for state, local governments and private non-profit organisations requiring recovery services including; damage assessment, cost estimating, and eligibility determination. Another example is Noetic’s Dademo Model to build capacity through engineering. It is a plan to improve equality and the standards of education and health in Papua New Guinea through the improvement and development of infrastructure in accordance with PNG 2050 Vision. It is based on the use of engineers in a nation building role in a civil-military partnership.

Relationships with Industry and Academic Institutions are essential to research and development outcomes in disaster management. For instance management of the humanitarian aid supply chain is critical to an improved response to disaster, and understanding transportation and warehouse needs is critical for humanitarian engineering. Greater coordination of the existing warehouses with distribution will deliver improved response and engineering work is always required to support

humanitarian logistics, which is the lifeblood of humanitarian aid. Business also provides pathways to commercial technologies that may influence disaster operations such as improved communication systems for rapid deployment, or early warning of impending disaster. Academic institutions can combine under guidance to develop policy and guidelines that will assist in meeting some of the organisational and political challenges of responding to disasters. These external to government organisations can provide much needed support that helps prepare for disasters in the future.

Changing the Future

The Henry review into Australian Tax Reform makes the observation:

“We expect that the Australian economy can continue its well-established high rate of economic expansion, provided policy reforms continue to support growth and structural change. This is vital for us. It will ensure that Australians can continue to deliver all of the things they most value — including improving living standards, support for the needy, fairness, social advancement, security and protection of the environment."

The tax system is a social and economic infrastructure, which points to what is important for the spending of Australian collective wealth. Humanitarian engineering is indeed something which improves living standards, and provides support for the needy, fairness and social advancement. It potentially provides a pathway that will deliver social advancement.

Build an Engaged Network

The future of humanitarian engineering is based upon the themes Deliver a Networked Approach and Deliver Improved Connection. Humanitarian engineering is not an argument for another stovepipe of excellence in engineering; it is a network that binds engineering excellence for humanitarian action. This multidisciplinary network will include members of the engineering team, consulting firms, contractors, government agencies, and not for profit organisations. Those who are involved or want to become involved in humanitarian action will be able to access this network and strengthen their capacity to assist the disadvantaged.

Leveraging connections through platforms and networks widely available within the knowledge domain, connections will be made between people and ideas, allowing possibilities not previously attempted. The humanitarian engineering network will take advantage of such concepts as social networking analysis assisting community resilience and the Government Web 2.0 project.

Build a Lasting Change in Culture

There are three current influences with the potential to drive lasting change in the culture of humanitarian action:

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35 Australian Government Taxation Review 2010
• There is growing disillusionment with the current system of humanitarian action in acute emergencies. To claim the current system cannot be improved, merely roots us in accepting that humanitarian action cannot be improved.

• There is growing professionalism in the shared value programs of Industry. The emphasis has shifted from seeing the private sector’s role as a donor, to being more actively engaged in sharing expertise and capacity, both to reduce suffering and to help rebuild communities following a disaster. As well as to play a critical role in disaster risk reduction through prevention and preparedness.

• There is growing desire for individuals to have societal impacts within normal work environment. Engineers want to contribute professional skills to humanitarian action not contribute money with an uncertain level of professional delivery of engineering.  

The aim of building a lasting change in culture is to overcome organisational and institutional barriers and reconfiguring boundaries. One of the greatest challenges is the relationship between engineers and government. The strengths of government are routines, repeatability, resources, reliability, authority and coercion. Conversely, the weaknesses of Government are its lack of agility, process driven focus, scalability and poor improvisation. Unfortunately, engineers lack a clear voice inside Commonwealth Government departments and agencies. For instance, the direct voice of legal profession is voiced through an Attorney General, and teaching through Education. Unfortunately, Engineers are viewed as technical thinkers, unable to grasp strategic machinations of government. In turn, the result is Government is now not a good buyer of engineering humanitarian action, as it lacks engineering knowledge within government. The COAG National Resilience plan mentions the word engineering once and the Drafting Team never consulted with Engineers Australia in the development process of the Plan. This barrier of lack of respect for engineering within government circles must be broken.

The Independent Review into Aid Effectiveness by the Australian Government in 2011 recommended that the aid program should increase its emphasis on private sector development and strengthening civil society. In the South West Pacific and Timor Leste:

- Aid-funded projects are not developing adequate and appropriate local engineering capability or capacity.

- Construction capability is low to very low (technical and trades), and there is poor supervision of engineering works.

- Training of construction workers is inadequate and many practices are unsafe.  

An example of this type of innovation necessary to correct some of these shortfalls is the Dademo Model in PNG, where engineering is seen to be part of the capacity building process that does deliver social outcomes, not simply technical services a part from society.

Cultural change is taking place across the emergency services, and humanitarian engineering can be a key part of this change. Emergency Services are recognising the need to partner, be smarter, work

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36 McLeod, A, CEO Melbourne Committee, Presentation to Engineers Australia Melbourne 18 Oct 2011.
37 Commonwealth of Australia National Strategy for Disaster Resilience Building our nation’s resilience to disasters.
38 Singh, P, President of Fiji Institute of Engineers Presentation Sydney 20 Oct 2011.
together broadly and integrate more widely with the community. This culture change puts the community at the heart of delivering the response to an emergency and the recovery. Some specifics being examined are; the social distance between participants (the level of familiarity), the level of imposition, and the power distance derived from differences in status. This change is important to engineers.

Collaboration requires effort, and it also requires a change of mindset. In particular, it requires a willingness to examine services from a perspective which does not place one’s own institution at the centre. Shared Value is the concept that must be engaged to bring organisations together. The military are often required to provide direct assistance, and work closely with the national or state authority and the humanitarian community. There is a case for strengthening the connections between Australian industry and Australian Government responses to emergencies. The commercial sector brings expertise, capabilities and capacities that are not available in the public sector. Military logistic support increasingly depends on commercial suppliers of goods and services. The capacity of aid agencies to supply, reconstruct and rehabilitate, comes from industry and contracted civilian experts. Thus, Australia’s military, police and humanitarian responses to overseas emergencies, have to be connected to and draw on Australian industry and a range of civilian experts such as engineers.

In order to stimulate change, humanitarian engineering must deliver service and build platforms that others won’t. It must seek out and define: “What constitutes Success for Engineers in the support of Humanitarian activities?” and continuously examine ways for managing engineering resources to deliver improved humanitarian outcomes.

**Embrace a Principled Approach**

A principles based approach will provide a basis for strategies and actions to be developed, which address current obstacles and gaps in the humanitarian engineering framework. The aim is to bind the uncoordinated existing elements of humanitarian engineering with a coherent strategic framework. The four principles are:

- Promote Shared Engineering Knowledge
- Encourage and Leverage Peer to Peer Professional relationships
- Employ a Collaborative and Flexible Approach
- Enable Proactive Engagement.

**Promote Shared Engineering Knowledge** - The best information addressing the most pressing need at the correct time

Engineering decisions in response to disasters must be made quickly, often with limited information, and this principle addresses the need to improve the quality of information available to engineers. Effective information management relies on the understanding of the complex multi-dimensional information requirements of each department, across both cultural and technical boundaries. Information to support international activities comes from a disparate range of sources. Shared knowledge is built on information interoperability; transferring and using information in a uniform and efficient way across multiple organisations and information technology systems, while still managing security risks. The adoption of agreed standards for managing and sharing information...
reinforces a culture of collaboration and allows for more consistent alignment of messaging. Shared knowledge provides an opportunity for a feedback loop in the organisational learning loop, and if knowledge is combined with authority, it will allow for ongoing improvement.

**Encourage and Leverage Peer to Peer Professional relationships** - Trusted bonds between professionals from all cultures ensuring best results

All nations have valued engineering expertise and this principle acknowledges that to accomplish humanitarian engineering tasks, teams need to develop integrated approaches within established authorities (but differing countries), with professional trust and interoperability. Organisational and cultural diversity promotes the best use of individual and organisation’s distinct set of professional, technical and cultural disciplines, values and perceptions. This principle reaches beyond cultural and national boundaries, as the professional ‘peer to peer equality’ is built on the concepts of preparedness and community resilience. Through application of this principle humanitarian engineering can maximise ‘existing advantage’ between nations within existing organisations and domains of engineering.

**Employ a Collaborative and Flexible Approach** in which engineers work together to achieve a shared goal.

A collaborative approach must be underpinned by a shared understanding across agencies and a clear articulation by the leadership group of common strategic objectives. Success in this approach depends upon the ability of all to plan collaboratively, resource appropriately and respond quickly through an integrated, whole-of-community approach to a dynamic situation. Flexibility in each humanitarian situation is important, as each situation will occur within a unique socio-political context; a 'one-size-fits-all' approach is neither possible nor desirable.

**Enable Proactive Engagement** by developing networks and contacts between engineering individuals and agencies across all levels

A collaborative approach must be reinforced through the development of institutional familiarity, trust and transparency between engineers and through frequent personal contact and human networks.

**Inspired Leadership**

Strong and senior leadership within the engineering profession is required to inspire engineers to be part of a changing culture which values humanitarian engineering work. Current leaders have a difficult decision to make when embracing a culture of collaboration across an engaged network dedicated to humanitarian actions as it challenges the traditional notions of engineering and humanitarianism. Within the current paradigms of industry and government humanitarian engineering does not deliver results directly connected to mainstream projects and work. It is convenient to be a leader of results within your domain than to attempt wider change. Conventional wisdom of leadership encourages leaders to exercise management practices focussed on direct and tangible results, and the rest is simply fluff. Indeed if that attitude of leadership does prevail then
humanitarian engineering remains rooted to the ‘good idea’ pile and the cynical exercising of ‘feel
good’ sentiment.

Principles as an underlying framework for humanitarian engineering are part of a visionary
statement which leaders can take forward. The early identification and establishment of a
leadership group to coordinate and monitor the development of humanitarian engineering is critical.
The cultural change needed to foster effective humanitarian engineering requires strong leadership,
and adequate buy-in from the most senior levels of engineering organisations. Public demonstration
of support and consistent messaging is necessary to support the leadership team.

There remains an example of inspiration for Australians in General Sir John Monash. General Sir
John Monash is considered by many to be Australia’s greatest military commander was a Reservist,
(citizen soldier) and a civil engineer. Possibly Monash’s greatest battle was the battle of Le Hamel, in
which a joint US–Australian force fought under Australian command. The battle was fought on 4 July
1918 and was one of the key battles in stemming the German offensive of 1918.

Monash was first and foremost an engineer, with a particular enthusiasm and talent for engineering
management. He was a man who, in civilian life, made substantial contributions to advancing the
technology of reinforced pre-stressed concrete at the turn of the twentieth century. His engineering
management skills combined with visionary leadership were tested many times as Head of the
Victorian State Electricity Commission. In later life, Monash served as the Chancellor of the
University of Melbourne. During a speech to students he made a statement that summed up, not
only his personal philosophy, but the philosophy that drives many who have been involved in post-
conflict and post-disaster recovery:

"Adopt as your fundamental creed that you will equip yourself for life, not solely for your
own benefit but for the benefit of the whole community" 39

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39 Monash, J. Melbourne 1925 Speech to University of Melbourne
Conclusion

Engineers Australia celebrated the Year of Humanitarian Engineering in 2011 and one of the key components of the year was an exploration of the role of engineers in acute emergencies. The humanitarian imperative is complex and demanding, and it is not enough to lock engineering away in a complacent model of the past. The engineering profession must move on from conventional models of support and be agile. This change requires adaption and the broad framework of humanitarian engineering offers that opportunity.

Humanitarian engineering is the delivery of engineering services which benefit a distressed or disadvantaged community. It embraces a view that engineering is not only about select advancement for a few who can afford new technology; rather it enables the widest human social contribution by engineers possible. Further, the narrow view of pure humanitarianism does not encourage wide participation of the engineering profession. As a concept humanitarian engineering seeks to break down barriers in humanitarian endeavours and allow engineering professionals to contribute greater skills to communities in distress.

At the end Humanitarian engineering is about engineers changing themselves to make greater contributions. The evolution of the profession throughout the late 20th Century and the beginning of this century has seen distance evolve between the community and the engineer. Outsourcing in the western world now sees most engineering organisations in the commercial arena. For humanitarian engineering to succeed it must be commercially viable for engineers to contribute to contribute to disaster recovery. This twining together of commercial and humanitarian interest is vexed, until it is understood that charity does not work, and that new models of engagement with the disadvantaged are required if engineers are able to make the best contributions to recovery from acute emergencies.

True change requires courage and leadership to foster a new approach, which includes building a collaborative network embracing the stovepipes of excellence existing in government, non-government and industry. The alternative is to remain rooted to conventional wisdom, and accept that the role of engineering in acute emergencies does not deserve change.

About the Author:

Neil Greet was a leading coordinator in the Engineers Australia 2011 Year of Humanitarian Engineering, and runs his own consultancy Collaborative Outcomes. He has served operationally Australian Defence Force in Timor Leste and Iraq. Domestically, he has worked in remote indigenous communities and assisted the Victorian Government, following the 2009 Bushfire Disaster. He was the inaugural Commander of the 6th Engineer Support Regiment, and in 2007 conceived and implemented the ‘Reconstruction During Conflict - A Whole of Government Approach’ seminar jointly sponsored by Defence and Engineers Australia. Neil is a Civil Engineer and holds Masters Degrees in Science and Defence Studies.

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Key Stakeholders

Addendum 1 to “Humanitarian Engineering in Acute Emergencies” A Report for Engineers Australia: Developing a Concept of Shared Value for Engineers Delivering Humanitarian Outcomes in Disasters, Conflicts and Complex Emergencies

The United Nations Office for the Coordination of Humanitarian Affairs

The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) is the part of the United Nations Secretariat responsible for bringing together humanitarian actors to ensure a coherent response to emergencies. OCHA’s mission is to:

- Mobilize and coordinate effective and principled humanitarian action in partnership with national and international actors in order to alleviate human suffering in disasters and emergencies.
- Advocate the rights of people in need.
- Promote preparedness and prevention.
- Facilitate sustainable solutions.

UN OCHA delivers coordination of humanitarian action through the cluster approach. Clusters are groups of humanitarian organizations (UN and non-UN) working in the main sectors of humanitarian action, e.g. shelter and health. Clusters provide a clear point of contact and are accountable for adequate and appropriate humanitarian assistance. Clusters create partnerships between international humanitarian actors, national and local authorities, and civil society.

Non Government Organisations

The term Non Government Organisation (NGO) was coined by the United Nations. By its very nature it is difficult to define, but it is not government and it is not organisations deriving for profit. NGOs can be philanthropic, secular, non-secular, charity, not for profit, and personal interest groups, ranging from small groups of individuals with an identified purpose to large global organisations. NGOs have grown with the pluralism of Western society, and mushroomed since the end of World War II. Critically NGOs have offered a pathway for donors to contribute to humanitarian need by avoiding the national interests of Government, but Governments also fund many NGOs. NGO is not a collective organisation but a descriptor of a group of wide ranging organisations with many interests.

The Australian Council for International Development (ACFID) was founded nearly fifty years ago, uniting Australian Non Government Organisations (NGOs) concerned with global poverty and delivering overseas aid and development. The Council’s Vision is a world where:

- gross inequality within societies and between nations is reversed; and extreme poverty is eradicated.
• human development is ecologically and socially sustainable for the benefit of current and future generations.
• governments lead their societies in striving to protect and realise all people’s human rights.

Engineers are involved in many NGOs providing critical technical assistance and advice. Two key Australian NGOs most closely associated with engineering are, the Registered Experts for Disaster Relief Australia (REDR (Australia), and Engineers without Borders (EWB).

RedR (Australia)

RedR (Australia) was established in 1992 by Mr Jeff Dobell, who saw the potential for the valuable contribution engineers can make in responding to disasters and alleviating poverty. Founding President of RedR (Australia), the late Professor Fred Hollows AC, challenged Australian engineers to apply their ingenuity and resources to the alleviation of suffering, wherever it occurred. RedR (Australia) provides emergency assistance to communities devastated by conflict or major natural disasters by selecting, training and providing competent and effective personnel to humanitarian relief programs worldwide. RedR (Australia) maintains a Standby Register of qualified personnel. The skills, knowledge and expertise of RedR (Australia) Register members are crucial to ongoing humanitarian efforts around the world.

EWB (Australia)

EWB Australia was founded in 2003 when a small group of engineers from Melbourne were inspired to do something a little different with their engineering. Engineers Without Borders works with disadvantaged communities to improve their quality of life through education and the implementation of sustainable engineering projects. Through the process of helping people in need the members of EWB become more socially aware and responsible, improving themselves, inspiring others to action and furthering the ultimate goal of sustainable development. EWB works in partnership with developing communities both within Australia and overseas, assisting them to gain access to the knowledge, resources and appropriate technologies they need to improve their livelihoods.

Government

Henry Dunant’s vision for the Red Cross was for humanitarian care to be undertaken by “zealous, devoted and thoroughly qualified volunteers”.

Indeed the humanitarian principles see little place for the role of government, yet it is Government which set the agenda and define the values to which we as a society aspire. Government has authority and legitimacy (through democratic process) to undertaken humanitarian action. For Australia this is exercised across three executive levels of Federal, State and Local government, with Department and Agencies at each level undertaking the delivery of the executive directions. For humanitarian action in response to an international disaster it is the Australian Agency for International Development, Attorney Generals Department (Australian Emergency Management), Australian Federal Police, Department of Health and Ageing, the Department of Defence and the Australian States and Territories who provide resources.

Australian Agency for International Development (AusAID)
The purpose of Australia’s aid program is to help people overcome poverty. This also serves Australia’s national interests by promoting stability and prosperity both in our region and beyond. AusAID’s supports efforts in areas where Australia can make a difference and where resources can most effectively and efficiently be deployed. From it’s charter it is clear that AusAID has an exclusive mandate to provide support only to Overseas Development Aid (ODA) eligible countries. The recent creation of the Australian Civilian Corps (ACC) within AusAID, has introduced an important capability that envisages a range of non-military specialists deployed on a notice to move of approximately 28 days, to bridge the gap between immediate response to and long term recovery from disasters.

Military Engineers

The 2009 Defence White Paper requires; “an ADF that is ready to respond, when necessary, in a range of situations from combat operations to disaster relief”, and recent Australian Government commitments of the ADF have recognised that humanitarian and military operations are increasingly integrated.

**HMAS Kanimbla**, with a regular crew of approximately 240 men and women, two Sea King Helicopters and two landing craft carried a detachment of 150 engineers (1st Combat Engineer Regiment, based in Darwin) and key equipment to Banda Aceh. The engineers worked in support of the Indonesian Government authorities, restoring essential services in tsunami-affected areas. Together the engineer and medical teams focused on delivery of basic sanitation and shelter in selected camps, for those Acehnese worst affected by the tsunami. The ADF teams were part of a coordinated approach with Indonesian authorities and NGOs to improve overall conditions in some of the displaced persons camps.

The special relationship of the military to the community is a complex relationship which varies across countries and cultures. For instance, in the Asia Pacific region the military is the first responder to disasters not the last resort. In many cases ADF engineers provide a special bond to other military engineers which are extraordinarily useful in emergencies. But it is the bond between the ADF and the Australian society which is most important. Australians praise great humanitarians in uniform such as Sir Edward ‘Weary’ Dunlap and Simpson with his donkey, equally with soldiers of great valour. The role of military engineers in acute emergencies has a long distinguished history and remains a key tool for Government.

**Australian Emergency Management**

Under Australia’s constitutional arrangements State and Territory Governments have responsibility for emergency management within their jurisdiction and have the laws, funding mechanisms and organisational arrangements in place to deal with such emergencies. Local Governments have significant roles and responsibilities for disaster mitigation and management at the local level through arrangements that vary according to state and territory laws, practices and agreements. At the Commonwealth level Australian Emergency Management is coordinated by the Attorney General’s Department. Under cooperative arrangements with the states and territories, the Commonwealth Government provides:
support to the states and territories in developing their capacity for dealing with emergencies
• and disasters across all hazards
• national coordination functions
• assistance to states or territories when requested
• financial assistance in the form of cost sharing arrangements for response and recovery
• expenditure.

The Council of Australian Governments has released a “National Strategy For Disaster Resilience Building the resilience of our nation to disasters”. A resilient based approach to disaster management...envisages that individuals, households, businesses, governments and communities will grow to recognise and understand current and potential future risk, take action to reduce exposure and vulnerability, and be better able to respond, recover from and adapt to change from emergencies and disasters of all types.

Commercial Enterprises

Commercial Enterprises can also be known as Business or Industry which are engaged in the delivery of goods and services to society. Most engineering organisations are commercial organisations, and most engineers work in commercial organisations. Generally the method of agreement for engineering work is a contract and a fee for service is charged enabling profit.

Business and industry are increasingly involved as direct actors in disaster management. Traditionally business has exercised ‘corporate social responsibility’ through philanthropic donation to NGOs for direct action in disaster response or cash to support appeals. This action has normally been taken at the Board and senior management level and promoted throughout the business for support. These actions have provided a necessary injection of funding particularly to UN OCHA which is reliant of funding from appeals to undertake its role. With the devolution and outsourcing of Government functions to the commercial sector in Western nations over the last thirty years, to gain efficiency, many businesses are now directly involved as responders. This deliberate action by Governments has added to the ‘crowded space’ challenges experienced in international disasters. The WFP and many EAS nations have standing government contracts providing logistical and intimate support contracts with companies to deliver humanitarian aid. These contracts provide guaranteed support against the terms of the contract but must still be coordinated to meet the needs the affected state. Due to the nature of the contractual relationships and obligations on both parties, it is sometimes difficult to adjust to changing needs without paying a significant premium to guarantee supply. Businesses are keen to exercise ‘corporate social responsibility’ and if contracted will fulfil the terms of contract to assist countries in the time of need and often will forgo the competitive battle for profit to meet a common humanitarian goal.

Relationships with Industry and Academic Institutions are essential to research and development outcomes in disaster management. Business provides pathways to commercial technologies that may influence disaster operations such as improved communication systems for rapid deployment, or early warning of impending disaster. Academic institutions can combine under guidance to develop policy and guidelines that will assist in meting some of the organisational and political challenges of responding to disasters. These external to government organisations can provide much needed support that helps prepare for disasters in the future.
Engineers Australia Year of Humanitarian Engineering 2011

Addendum 2 to “Humanitarian Engineering in Acute Emergencies” A Report for Engineers Australia: Developing a Concept of Shared Value for Engineers Delivering Humanitarian Outcomes in Disasters, Conflicts and Complex Emergencies

Goal

The goal of the Year of Humanitarian Engineering was to promote the significance and importance of humanitarian engineering to both the engineering profession and wider community so that humanitarian engineering receives the necessary support in Australia and abroad – and continues to make a difference.

Objectives

There were three main objectives for the Year of Humanitarian Engineering:

- **Educate.** To educate both the community and profession about the role engineering and technology can play in disaster relief and humanitarian projects. This objective focused on why members of the engineering team should be involved in humanitarian engineering and what they need to know to have a positive impact.
- **Activate.** To activate meant recruiting members of the engineering team and engineering organisations in humanitarian endeavors. This objective focused on how members of the engineering team and engineering organisations should get involved in humanitarian engineering.
- **Celebrate.** To celebrate meant acknowledging the positive contribution that humanitarian engineering makes in the world and highlight the individuals and projects that epitomise the values and impact of humanitarian engineering.

Make It So Campaign

*Engineers Australia’s ‘Make it So’ campaign underpinned the promulgation of the Year of Humanitarian Engineering message. ‘Make it so’ began as a public awareness campaign in 2008, and has since become a major platform for Engineers Australia to continue to promote and celebrate engineering globally. The initial two-year public awareness campaign addressed a need to engage both the engineering profession and the Australian public in an ‘ideas’ generated discussion that would showcase how engineering teams can solve problems with creativity and innovation. In*
October 2011 the ‘Make it so’ campaign was announced the **winner of the Associations category** at the **Asia Pacific Sabre Awards**.

### Conduct

**Information Sharing Seminars.**

Engineers Australia provided the forum to showcase the humanitarian work being done in both Australia and overseas. Many deserving individuals provided inspiration for future generations of engineers to undertake challenging humanitarian engineering roles with personal stories.

### 2011 Humanitarian Engineering Conference

The three day conference was held at the Etihad Stadium in Melbourne from 30 November to 2 December 2011. It encapsulated many of the activities which took place during 2011 - the Year of Humanitarian Engineering, and included presentations, technical workshops, and interactive sessions. The conference streams were:

- Indigenous Australia and Reconciliation.
- Human Centred Design.
- Engineering Education.
- Corporate Social Responsibility and Engagement.
- Engineering, Risk and Disaster.
- Defining a Path.
- Progressing Humanitarian Engineering.
- Current Partnerships.
- Engineers Assisting in Disaster.

### National Workshops – Engineers in Acute Emergencies

The aim of the series of national workshops and seminars was to examine and develop where necessary improved integration of engineering efforts in the acute phases of disasters and complex emergencies. The workshops included facilitated lessons learned activities and a series of presentations focusing on the strategic means that bridge the disparate organisations and policies in acute emergencies. Presentations were made by subject matter experts from government and non-government agencies considering a variety of aspects of strategy and implementation, including the phases of humanitarian disaster response and recovery, and the priorities therein. The objectives of the workshops reflected the goals of celebrate, educate and activate. The specific objectives were:

- Celebrate and promote the positive work undertaken by Engineers in the acute phase of emergencies and conflict (for instance REDR work in international disasters).
- Educate and inform engineers on how strategy forms the bridge between policy and implementation in a multi-agency forum which includes Government and Non Government Agencies.
• Educate and inform on the relationships between Response, recovery, stabilisation, development and disaster risk reduction and examine the role that engineers play in each.
• Activate a network (for instance, how AusAID reaches out, the Australian Civilian Corps, Whole of Government and NGO integration) and ‘what opportunities?’ for EA members.

Six workshops across Australia, and a separate stream at the Year of Humanitarian Engineering conference examined the role of engineers in acute emergencies in 2011:

• Engineers Supporting Humanitarian Outcomes in the Acute Phase of Australian Domestic Disasters in Brisbane on 27 September 2011.
• Contribution of Military Engineers to Humanitarian Engineering in Hobart on 6 October 2011.
• Humanitarian Engineering A Pivotal Role in United Nations Response to Disaster and the Ongoing Demand to Building Community Resilience in Melbourne on 18 October 2011.
• Engineers Supporting Humanitarian Outcomes in the Acute Phase of International Disasters in Sydney on 20 October 2011.
• 2011 Humanitarian Forum in Darwin on 3 November 2011.
• Engineering, Risk and Disaster in Melbourne on 1 Dec 2011.
• Engineering Risk Analysis in Adelaide on 7 December 2011.

Engineers Supporting Humanitarian Outcomes in the Acute Phase of Australian Domestic Disasters - Brisbane 27 September 2011

The Brisbane Workshop provided a forum to explore the role engineers have in ‘Building the Recovery’ by examining different disasters, early involvement in planning, Industry requirements, State government needs and community expectations. In turn this led to exploring the mechanisms for integrating engineering into overall disaster management by exploring the needs of different organisations. The topics were:

• The Demands of an Emergency Response and the Importance of Building a Comprehensive Early Recovery Program.
• The Queensland Reconstruction Authority: The Set-Up and Delivery of Services to Enable Recovery in Queensland from the 2011 Disasters.
• Industry Involvement in Disasters based on the US experience and a Potential Role for Australian Engineering Industry in Recovery from Disaster.
• Strathewen Community Renewal Project.
• Integration in Early Recovery.

Mr Joe Buffone Acting Emergency Services Commissioner – Victoria spoke on the topic of “The Demands of an Emergency Response and the Importance of Building a Comprehensive Early Recovery Program”. He described the complexity of emergency management both environmentally and organisationally. The challenge of cascading effects is enormous. Further, he raised the issue that historically, the transition to recovery has been poorly managed. Smarter recovery is delivered by understanding the needs of the community, letting the community lead their own recovery and giving them information, responsiveness and results. Mr Buffone saw many opportunities to connect and build resilience. Resilience is the glue that binds it all together, and engineering
community needs to be a greater part of that connection. Cultural change is taking place across the emergency services, recognising the need to partner, be smarter, work together broadly and improves integration with the community and that includes the engineering community.

Mr Graeme Newton CEO, Queensland Reconstruction Authority presented on the topic of “The Queensland Reconstruction Authority: The Set-Up and Delivery of Services to Enable Recovery in Queensland from the 2011 Disasters.” Mr Newton described the scale of the emergency that occurred in Queensland during January and February of 2011. He initially focused on the funding and structural arrangements of the Queensland Recovery Authority which allowed speedy recovery in key local authorities. He emphasised that there was still a strict governance processes with Project Control, Federal Inspectorate and normal audit requirements. It broad terms it is similar to a large construction project. Mr Newton described future strategic projects, which see the method of partnering employed by the Queensland Recovery Authority as world leading. The active use of the website is critical to the operation of the Authority and consistent messaging.

Mr Lynn Feldmann of SKM spoke on the topic: “Industry Involvement in Disasters based on the US experience and a Potential Role for Australian Engineering Industry in Recovery From Disaster”. Mr Feldmann described the US methodology of negotiating a Master Services Arrangement with a defined suite of services defined by the Department of Homeland Security. He emphasised it was not about giving up political control but enables a better definition of the resource to assist recovery from disaster. He saw the potential in Australia for distrust to arise between Government and Industry as there is no understanding between the parties about what can be done until the disaster occurs. However, Mr Feldmann accepted that Australia was constitutionally different the US and that there may not be the desire to implement the US model in Australia.

Mr Steve Pascoe spoke about the “Strathewen Community Renewal Project”. Mr Pascoe survived the Black Saturday Bushfires on 7 February 2009, but lost his home in the community in Stathewen. He passionately described the personal connection between community and environment. Mr Pascoe then described community renewal and what that means to engineers. He emphasised that recovery from disaster is about people and engineers need to think of what humans need, not what is easiest, most practical, or looks best on paper. The Organisations responsible for recovery need to identify opportunities to ‘build back better’ and upgrade infrastructure and services, ultimately saving resources. Community recovery is very long term and planning needs to allow for this.

Brigadier Peter Jeffery spoke on Army Reserve supporting the State and Community: “A Tale of Two Floods and a Cyclone!” He was supported by Colonel Stuart Yeaman of the Queensland Recover Authority. Brigadier Jeffery as the Commander of 11 Brigade spoke on the employment of the Army Reserve supporting the Australian Defence Force response to the 2011 Queensland Flood and Cyclone Yasi disaster. The two speakers explored the role for Defence Engineers in the domestic disasters and explored the need for a speedy and organised early recovery. It was acknowledged that Defence also played a role in response such as search and rescue operations, but the presentations focused on how long Defence should remain engaged in early recovery.

Contribution of Military Engineers to Humanitarian Engineering - Hobart 6 October 2011

Mr Dechlan Ellis provided ‘The Andrew Burns Lecture: Contribution of Military Engineers to Humanitarian Engineering’ and also presented the same presentation to the Year of Humanitarian
Engineering Conference. Mr Ellis (SKM and Defence Reserves) shared personal experiences and lessons about the contribution of military engineers to humanitarian engineering. He spoke about the philosophical connection between humanitarian engineering and military role and used two Case Studies: Case Study 1 – Army Aboriginal Community Assistance Programme (AACAP) and Case Study 2 – Afghanistan. Mr Ellis emphasised the need for Humanitarian Engineering in dangerous environments and the difficult demands of Complex Emergencies. He highlighted the advantage that Industry aware Engineer Reservists bring to complex situations such as Afghanistan. In his case study of army engineers in Afghanistan he emphasised the fact that engineers connected with the community and the role in Capacity Building through the construction and development of a Trades School.

**Humanitarian Engineering A Pivotal Role in United Nations Response to Disaster and the Ongoing Demand to Building Community Resilience - Melbourne 18 October 2011**

The Melbourne Workshop examined the provision of engineering efforts in support of International responses to Disasters and Humanitarian crises. In particular the global system for response through the United Nations and the role engineers play as part of the Non-Government actions in the immediate response and early recovery to crisis. This emphasized the need for a greater understanding the role engineers play in building community resilience through disaster risk reduction, and how engineers can assist in building the resilience of communities at risk. The topics explored were:

- The United Nations Facing the Challenges of Disasters.
- REDR (Australia) - Engineers and Humanitarian Emergencies – How Can We Help.
- The International Red Cross and Red Crescent Movement.
- Community Vulnerability Models Informing Risk Mitigation; Building Resilience in Communities at Risk in the Asia Pacific Region.
- Save The Children - The Challenge for NGOs in delivering Disaster Risk Reduction Programs to Vulnerable Communities.
- The psychosocial demands and potential impact on engineers working in disaster response and how to support them undertaking humanitarian response work: before, during and after the event.

Mr Andrew MacLeod CEO Committee of Melbourne spoke “The United Nations Facing the Challenges of Disasters”. Mr Mcleod opened by speaking about his own personal experience particularly his role in the UN response to the 2006 Pakistan earthquake disaster. He described the strengths and weaknesses UN, and offered the view response and recovery to disaster can be better and there exists a challenge of “Islands of Excellence”. Mr Mcleod believes that is a there way convergence underway: 1. There is growing disillusionment with current system; 2. Growing professionalism in CSR programs of Industry; and 3. Growing desire to have impacts within normal work environment. He closed by challenging the need to change cultures and existing organisations.

Robert Crigan presented Case Study 1 “Engineers and Humanitarian Emergencies – How Can We Help”. Mr Crigan offered an inspiring presentation of what engineers can do through deployments with REDR (Australia). His presentations provided in depth lessons learned across 5 separate deployments (UNWFP in Liberia, UNWFP in Somalia, UNHCR in South Lebanon, Maldives Tsunami
Recovery, UNHCR in Ingushetia & Chechnya). He concluded that engineers have an awareness of community needs, that many Aid and Development practitioners cannot see and are not interested in. He reinforced the notion that ‘simple stuff’ is important and noted the hope that ‘build back better’ brings to communities coping with disaster.

Ms Sarah Davies of the Australian Red Cross presented Case Study 2 “The International Red Cross and Red Crescent Movement”. Ms Davies commenced by explaining the origins of the Red Cross which led to the establishment of neutral, impartial relief societies within each country and rules of law in war which led to the Geneva Conventions or International Humanitarian Law (IHL). She then described how Australian Red Cross sends technically skilled Aid Workers worldwide. Currently there are 55 in the field in 26 countries; 15 with International Committee of the Red Cross; 22 with International Federation of Red Cross; and 18 with Australian Red Cross. The professional profiles of Aid Workers in the Australian Red Cross are Disaster Management, Disaster Preparedness, Community Development, Livelihoods, Health, Food Security, Nutrition, Water & Sanitation, & Communications.

Mr Mark Edwards presented the “Community Vulnerability Models Informing Risk Mitigation; Building Resilience in Communities at Risk in the Asia Pacific Region”. Mr Edwards introduced the work of GeoScience Australia in Disaster Risk Management. In a construct of Hazard/Exposure/Vulnerability/Impact, he explained vulnerability is where science can make the most difference by structural examination, construction of models and provision of adaption options. As a Case Study he described the Australian Indonesian Disaster Risk Reduction Facility and their embryonic involvement in response to the 2009 Padang earthquake. Mr Edwards believes much needs to be done to match the rhetoric associated with Disaster Management and cited as an example that only 4% of people have built back better in Padang, because 4 to 10% of the cost of recovery is the extra cost to build back better, which is significant to any recovering community.

Mr Nick Ireland the Disaster Risk Reduction and Climate Change Adaptation Manager for Save the Children presented the topic “The Challenge for NGOs in delivering Disaster Risk Reduction Programs to Vulnerable Communities”. Mr Ireland commenced by emphasizing that natural disasters have increased from an average of 150 a year in the 1980s to over 400 today and 50% of those affected by disasters are children. He demonstrated that building inclusiveness is critical to the sector based approach of NGOs. The skills of listening, learning, discussing, developing, and consulting are highly prized by NGOs. Mr Ireland concluded by stating that the UN estimates for every $1 investing in preparing for a disaster, $7 of losses can be prevented, but then asked the question: How do you measure what didn’t happen?

Amanda Allan the Executive Director/ Director of Psychological Services of the Mandala Foundation examined “The psychosocial demands and potential impact on engineers working in disaster response and how to support them undertaking humanitarian response work: before, during and after the event.” Ms Allan emphasised that understanding the psychosocial aspects of disaster is critical for two key groups; those that are affected by the disaster and those that give assistance to the affected population. She concentrated on describing the nature of psychosocial demands, on those who are providing assistance and the need to manage the potential impact on individuals.
The Sydney Workshop provided a forum to investigate the integration of engineers into overall disaster management and what future role there is for engineers in the disasters external to Australia. The topics examined were:

- Developing a Versatile Rescue Engineering Capability – and How it was Applied in the Canterbury Earthquakes.
- Integrating the Engineering Effort into Disaster Management in South West Pacific.
- The Damage Situation of East Japan Great Earthquake of March 2011 and Approach on Disaster Mitigation.

Mr Dave Brunsdon who is Director Kestrel Group - Risk, Continuity and Emergency Management presented on “Developing a Versatile Rescue Engineering Capability – and How it was Applied in the Canterbury Earthquakes”. The presentation commenced with a comprehensive overview of NZ’s rescue engineering capability – the scope (Urban Search and Rescue, Building Safety Evaluation); how it has been developed, how it integrates with the capability of other countries, and how it has been utilised overseas. He then concentrated on the response to the Canterbury earthquakes and how NZ’s engineering capability was applied in these extraordinary circumstances. Mr Brunsdon then concluded that building a core rescue engineering capability is essential for public safety and that professional engineering should be embedded within emergency management arrangements. Engineers must put appropriate emphasis on the consequences of failure and maintain a focus of designing resilience into key facilities and infrastructure networks.

Mr Pratarp Singh who is the President of the Fiji Institution of Engineers, supported by Dr Andrew Cleland CEO of the Institutional of Professional Engineers New Zealand presented the topic “Integrating the Engineering Effort into Disaster Management in South West Pacific”. The presentation highlighted the unique demands of the South West Pacific and Dr Cleland highlighted the need for engineers to understand small systems in the South West Pacific. Mr Singh saw many areas for advancement of modern/unconventional engineering across the South West Pacific and the need for engineers to be more proactive. A key notion was engineers need to better understand disaster management and climate change and take leading role in the assessment of risks. To do so engineers need to have increased engagement with governments (Planning, Development & Budgeting/Finance), NGO’s, policy makers, donors, teaching institutions, development partners, banks/funding agencies, risk underwriters/insurance industry, developers, etc to improve preparation, response and recovery from disasters.

Professor Kazutoshi Kan Dr. of Shibaura Institute of Technology spoke on the topic of “The Damage Situation of East Japan Great Earthquake of March 2011 and Approach on Disaster Mitigation”. A massive 9.0 magnitude earthquake and tsunami hit Eastern Japan on 11 March 2011. The presentation showed the scope of the disaster and the nature of consequence, causing more damage. The suffering of the victims is unparalleled in Japanese history and required unique and long term action to correspond to the situation. There is a requirement to change the traditional
concept of complete protection by hard measure to the concept of how to reduce the human damage and how to reduce the damage risk. Professor Kan made many key recommendations and highlighted it is important now to understand disaster adaption as a systematic response.

Dr. Marlene Kanga, who is a member of the WFEO Committee for Disaster Risk Management presented the topic "World Federation of Engineering Organisations (WFEO) Committee for Disaster Risk Management – An International Forum for Engineering Response to Major Disasters”. The presentation commenced with the need to focus on natural disasters, and described generally the international systems for natural disaster risk management. This was followed by a detailed description of WFEO and the Committee for Disaster Risk Management (CDRM). Critically the presentation recommended that as Australia’s contribution to the CDRM that Engineers Australia develop a Proposal for Sub-Committee for capacity building in DRM. This Subcommittee will examine capacity building essential for developing countries, relationship between sustainable economic development and effective disaster risk management, and application of engineering for humanitarian outcomes.

2011 Humanitarian Forum - Darwin 3 November 2011

The Darwin Workshop provided a forum to explore the role engineers have in a variety of humanitarian outcomes. The topics were:

- Timor Leste – Transitioning to a Better Future.
- Supporting Humanitarian Outcomes in Partnership with Indigenous Australia.
- The Challenges of Reconstruction in Recovery.

Brad Abbot – Engineers Without Borders presented the Humanitarian Challenges for Engineers in Timor Leste. Mr Abbot described the operation of Engineers Without Borders and emphasized the mission of Engineers Without Borders is to work with disadvantaged communities to improve their quality of life through education and the implementation of sustainable engineering projects. He discussed how difficult partnering of this nature can be and provided as an example the 2009 National Working Group to strengthen national water/sanitation technical & engineering education, and how it suffered from financial, political and collaboration challenges. The success is the Engineers Without Borders / Dili Institute of Technology Partnership which aims to establish a civil engineering curriculum accreditation for national accreditation process in 2013.

Mr Salustiano Piedade of the Dili Institute of Technology presented on "Transition Challenges – Building a Better Future in Timor Leste”. Mr Piedade described the economic and social challenges of Timor Leste and demonstrated what this meant for indigenous engineering efforts. In Timor Leste there are strong, active foreign influences from state and non-state actors leading to competitive behavior and poor coordination between stakeholders with conflicting objectives and values. Critically the benefits of the oil industry have not yet been realised for social and economic advancement. He praised the partnering effort of Engineers Without Borders/Dili Institute of Technology, and saw opportunities in the transparent nature and limited bureaucracy of the partnership.

Dr Latisha Pettersen of Australia Indigenous Doctors Association presented “A View from Indigenous Australia”. Dr Pettersen described cultural diversity and introduced the concept of
‘strength through cultural knowledge’ which enables the coming together of the medical profession and indigenous peoples. She described a conceptual framework of interconnectedness between spiritual, cultural, social, psychological, and physical dimensions. This concept of interconnection is applicable to other professions such as engineering. Dr Pettersen closed with a powerful message that all Australians have a right to equitable health, social and economic outcomes.

Mr Allan McGill of Territory Alliance presented on “The Strategic Indigenous Housing and Infrastructure Program (SIHIP)”. Mr McGill opened by emphasising the scope of the challenge of the SIHIP program and compared it with overseas programs which seem to have more attention. SIHIP aims to improve conditions and increase prospects of employment. Mr McGill said the manner that Territory Alliance works closely with Indigenous communities sets it apart from other endeavors. SIHIP must meet community expectation as it shapes the legacy and reputation of all parties involved in the program. Tailoring final designs to met the community expectations is not a ‘cash cow’.

Captain Brad Willis of the Australian Defence Force presented on the topic of “The Army Aboriginal Community Assistance Program (AACAP)”. Captain Willis described the connection between Indigenous Australia and the Australian Defence Force through multiple programs. ACCAP was announced on 14 Nov 1996 by Senator John Herron who believed the Australian Defence force had much to offer to remote indigenous communities. The initial scope to improve housing conditions was rapidly increased to include other infrastructure needs and wider health and training roles. The military has gained enormous experience that benefited operations and learned to understand the client needs and culture.

Moira McCreesh of Oxfam presented on “The Challenges of Internally Displaced Persons (IDP) Camps in Timor Leste.” Ms McCreesh described the general challenges for Refugees and IDPs across the world and then concentrated on the particular situation in Timor Leste and drivers of conflict. In 2008 IDP Camps were closed as part of a program to return IDPs to home locations. Comprehensive planning was conducted to enable the closure of camps but Ms McCreesh pointed to some key lessons. Key is to start planning exit strategy at the start but be adaptable to the constant emergencies.

John McLaren of Disaster Aid Australia presented a short synopsis of “Shelter Box”. Shelter Box is an international disaster relief charity that delivers emergency shelter, warmth and dignity to people affected by disaster worldwide.

Mr Neil Greet presented “Early Recovery - Black Saturday Fires – 7 Feb 2009”. Mr Greet while serving in the Australian Defence Force participated in the early recovery from the ‘Black Saturday’ disaster as the Chief of Defence Force Liaison Officer. Recovery from disaster starts when the response starts and while response organisations started to stand down after mopping up actions during the first week, organisations such as the Department of Human Services had a massive ramp up in operational tempo. Comprehensive needs analysis, rapid impact assessments underpinned rapid planning for community actions and building new partnerships was critical initially. Mr Greet (with the permission of Mr Pascoe) described the direct effects on the community in Strathewen and demonstrated the difficult path of recovery where organisations attempt to meet the expectations of the community.
Rosemary Burkitt of Australia Red Cross presented “The Emergency Readiplan”. Ms Burkitt explained the Emergency Readiplan: Four steps to prepare your household, a booklet that assists families preparing emergencies.

Mr Troy Crilly of the Northern Territory Emergency Services presented “The Challenges of Resilience Against Natural Disasters in the Northern Territory.” Mr Crilly presented a synopsis of natural disasters experienced in the Northern Territory, and scoped the potential engineering effects of disaster. He concentrated on the theme of community resilience and what this means to engineers. The COAG Natural Disaster Resilience Statement emphasizes communication with community and organisations. The quality of the recovery effort rests on community resilience.

Engineers in Acute Emergencies Stream Year of Humanitarian Engineering Conference – 30 November to 2 December 2011

The Year of Humanitarian Engineering Conference covered all aspects of humanitarian engineering. This stream concentrated on the themes and concepts of the role engineers play in supporting humanitarian outcomes in acute emergencies. The topics were:

- Engineers in Disasters and Post Conflict
- Contribution of Military Engineers to Humanitarian Engineering
- What role is there for Industry in Disaster Response; Lessons from the United States
- Humanitarian Logistics and Engineers
- Building Capacity through Engineering
- The Australian Civilian Corps (ACC)
- Defence and Humanitarian Engineering

Mr Neil Greet a Coordinator for Year of Humanitarian Engineering presented “Engineers in Disasters and Post Conflict”. This presentation summarized the series of workshops conducted across the country and described in this paper. He presented 12 themes which summarized the outcomes.

Mr Dechlan Ellis provided ‘Contribution of Military Engineers to Humanitarian Engineering’ and also presented the same presentation as the Andrew Burns Lecture in Hobart. Mr Ellis (SKM and Defence Reserves) shared personal experiences and lessons about the contribution of military engineers to humanitarian engineering. He spoke about the philosophical connection between humanitarian engineering and military role and used two Case Studies: Case Study 1 – Army Aboriginal Community Assistance Programme (AACAP) and Case Study 2 – Afghanistan. Mr Ellis emphasised the need for Humanitarian Engineering in dangerous environments and the difficult demands of Complex Emergencies. He highlighted the advantage that Industry aware Engineer Reservists bring to complex situations such as Afghanistan. In his case study of army engineers in Afghanistan he emphasised the fact that engineers connected with the community and the role in Capacity Building through the construction and development of a Trades School.

Mr Joe Chapman of SKM spoke on the topic: “What role is there for Industry in Disaster Response; Lessons from the United States”. The US is experiencing an increasing number of destructive disasters. Following the Katrina disaster the United Sates made extraordinary changes to the systems of response and recovery through the Federal Emergency Management Agency (FEMA). The major areas of private sector support to FEMA are the public and individual assistance, hazard
mitigation technical assistance, long term recovery planning and flood mapping. Under the Public Assistance – Technical Assistance Contract, AECOM has deployed ≈ 5,000 staff across US and territories over 15 years. This provides support for state, local governments and private non-profit organizations requiring recovery services including; damage assessment, cost estimating, and eligibility determination. Mr Chapman concluded that “A Whole Community Approach to Emergency Management” by FEMA included comprehensive industry engagement.

Dr Elizabeth Barber of the University of New South Wales presented on “Humanitarian Logistics and Engineers”. Dr Barber described Engineering and Logistics as a dual approach across all phases of humanitarian action. Firstly there is engineering assistance to logistics through creation and maintenance of physical and communications infrastructure to enable logistics operations. Secondly, there are engineering impacts on logistics- for example transport design may affect the type and frequency of transport, and configuration of loads. Engineering and logistics resources are critical in the phases of recovery from disasters but are often poorly managed by transitioning organisations. Dr Barber highlighted that it is the engineers and logisticians that improve the health of disaster victims by enabling the necessary scale of public health initiatives following disaster. She concluded that there is a requirement for closer collaboration between engineers and logisticians, within engineering groups, the United Nations missions, global NGOs, various military forces, and other stakeholders.

Mr Andrew Balmaks Chairman of Noetic Group presented the topic “Building Capacity through Engineering”. Mr Balmaks offered the view that traditional notions of capacity building through aid programs have not worked, and evidenced the recent review into AusAID effectiveness. He described the Dademeo Model (Bob Dademeo is a retired Chief of PNG Defence Force). It is a plan to improve equality and the standards of education and health in Papua New Guinea through the improvement and development of infrastructure in accordance with PNG 2050 Vision. It is based on the use of engineers in a nation building role in a civil-military partnership.

Ms Cheryl Johnson of the Australian Agency for International Development (AusAID) spoke on the topic of “The Australian Civilian Corps (ACC)”. AusAID serves Australia’s interests by promoting stability and prosperity in our region and beyond, it grows trade and jobs and acts against radicalisation building peace. The fundamental purpose is to help people overcome poverty. Ms Johnson described the ACC as an innovative arm of AusAID, designed to send civilian specialists to support stabilisation and recovery efforts overseas. The ACC works closely with international partners – United Nations, United Kingdom, United States, Canada, and other European countries. Ms Johnson stated that there are a number of opportunities for engineers to contribute to stabilisation and recovery efforts.

Captain Clare O’Neill presented the topic “Defence and Humanitarian Engineering”. Captain O’Neill described the wider mission of Defence and in particular the Australian Defence Force (ADF). The ADF provides ships, aircraft and vehicles which can transport all agencies to the area of need, not just the military. Once on the ground the ADF can provide a responsive and protected means of support, and enhance the ability to coordinate activities through good command control and communications. It offers comprehensive but constrained medical care until hospitals are established, and can reinstate essential engineering services. These capabilities are maintained at a high state of readiness by the ADF. Captain O’Neill then described her personal experience
supporting the response to the Padang earthquake in 2009 and two tours to Afghanistan as part of the Reconstruction Task Force.

Engineering Risk Analysis - Adelaide 7 December 2011

Mr Jeff Howard of Engineers Australia presented the topic: “Understanding Insurance – The Importance of Engineering Risk Analysis”. Mr Howard opened by describing recent humanitarian disasters in Australia which have starkly highlighted the type and scale of threats that society faces. Engineers, government planning officials, and insurers have an equal share in contributing to assessing and preparing a risk management strategy that minimises harm to society resulting from natural disasters. He analysed the characterization of risk - the uncertainty of an outcome of an event, by engineers, government planning officials, and insurers, before briefly outlining the possible differences in their approach to risk management strategies. Alternative implementation options of risk management were offered concluded with the practical impacts of varying risk management strategies.

Presentations