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Grand Challenges for Engineering in the New Millennium

The grand challenge problems in the new millennium are significantly different from prior grand challenges – science and engineering provides a foundation to address these challenges – how will the engineering professional societies provide leadership to address these challenges?

Perspective

- The concept of grand challenges has addressed specific needs and energized the technical community and the public on many occasions – e.g. the 1961 call to put a man on the moon and return safely, the war on cancer set out in 1971, the Human Genome Project
- There are active discussions on many new grand(er) challenges – recent NRC reports on environmental science, biology, sustainability, energy challenges; the UN Millennium Development goals that address poverty and hunger in the world; other challenges include disaster resilience, terrorism, health.
- These are more than technical challenges to satisfy our curiosity with by-product benefits – they present fundamental technical challenges that care for people and are the foundation of a healthy society. The current NAE study will further focus these challenges and identify others.
- I believe our professional societies must serve the needs of the engineering community and society. Thus the professional societies have a grand challenge to be dynamic leaders, to be servants that enable solutions to these problems.
- The characteristics of the challenges have changed - our service to meet these new grand challenges will not be realized by specialized institutions that exist apart from the larger community – we need to create a cooperative future

Characteristics of the Challenges

- The Manhattan Project, placing a man on the moon, and other past technical challenges - these challenges were effectively carried out by segments of the science and engineering technical community – decisions were made, federal budgets were allocated, scientists and engineers in universities and industry moved to address the challenges
- The characteristics of many of the truly grand challenges now being presented are different. These challenges do have similar characteristics to prior challenges – they are complex, large-scale, multi-disciplinary problems that capture the imagination. These Grand(er) Challenges we are facing are more societal based

and less easy to frame in a technical systems context. I suggest there are dimensions to these challenges that result in significant differences.

- The boundaries are different - these challenges require an expanded multi-disciplinary concept that includes the public and professions outside science and engineering;
- These grand challenges are not isolated activities – e.g. energy relates to sustainability relates to health relates to poverty relates to terrorism
- These challenges are larger in scope and scale
- The financial requirements will not be limited to government funding
- An expanded ‘team’ is required that includes international participation
- New organization and communication concepts for working together will be required

The Professional Society Response

- AIChE is currently addressing three important initiatives: relevance (who are our customers, what do they value), energy, and international development – I see these as central to our path forward – and each feeds our need to dare to be more effective at meeting our current goals and looking beyond to a vision for how we can be a leader in implementing the new grand challenges that have been identified
- How do we organize to facilitate finding innovative solutions to these complex problems; e.g. effective communication among scientists, engineers, social scientists, policy makers, lawyers, physicians, architects, ...
- We will need to address these new challenges while continuing to meet traditional services to members – e.g. meetings, publications, career guidance, continuing education
- We are many different voices, we each bring different gifts, we each have personal priorities and needs – I believe we bring skills and understanding that are essential to solving these grand challenges – How will we meet this challenge?

The Grand Challenge for the engineering community is to overcome barriers to facilitate the integration and appreciation of engineering expertise into the solutions of these more socially based Grand(er) Challenges we now face