

## Grand Challenges for the Giant Screen

Randy Atkins

Senior Program Officer, Media/Public Relations

National Academy of Engineering, Washington DC, USA

atkins@nae.edu

*So I urge the giant screen industry to focus more on issues that will determine the world's future and less on dinosaur reenactments. The Grand Challenges, our world's giant topics, also deserve to be displayed on a giant screen. But, as we think about the engineering challenges of the future and how to apply the latest film-making technologies to communicate about them, we should never lose sight of the fact that the mode of communication is not a substitute for great storytelling.*

### Introduction

Technological illiteracy is a major threat to the future of the United States. Even as our world is transformed by engineering achievements and U.S. citizens become more dependent on the conveniences modern technology provides, most of us are in the dark about how any of it – from cars to computers, I-phones to Internet – works. Most of us don't care. We are in ignorant bliss and the media – both news and entertainment – are a big part of the problem.

The world faces significant challenges, most of which engineers will be called upon to help address. The problems are fairly well documented, because the media thrives on scaring us with doomsday scenarios. The potential solutions are not well known, however, nor does the public know about the heroes trying to solve these challenges. They are engineers – a profession most people still think drive trains, mix music (for, say, IMAX films), or change light bulbs in our offices.

The public does not understand the contributions engineers have already made. Engineers have transformed scientific discoveries in ways that dramatically improve and extend lives. Here are twenty examples, from National Academy of Engineering's *Greatest Achievements of the Twentieth Century*<sup>1</sup>: electrification, the automobile, the airplane, water supply and distribution, electronics, radio and television, agricultural mechanization, computers, the telephone, air conditioning and refrigeration, highways, spacecraft, the Internet, imaging, household appliances, health technologies, petroleum/petrochemical technologies, laser and fiber optics, nuclear technologies, and high-performance materials.

These engineering achievements changed our lives. The giant screen industry should strive to better tell the stories behind those breakthroughs, or what those engineers are working on for this century. The key word is *stories*. There are compelling stories, and characters, behind the technologies that are molding our lives. Giant screen films would be more successful if they spent more time on the story, not just the audio-visual experience. Frankly, there may be too many giant

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<sup>1</sup> From <http://www.greatachievements.org/>.

screen films on natural science – dinosaurs, sea monsters, and such – to the exclusion of interesting engineering subjects.

### **Communicating engineering in popular culture**

Part of the problem, including in this symposium, is a focus on “*science* communication.” Too often, in fact, we use the term “science” as a catch-all when we’re really talking about “engineering.” Science is a critical to engineering’s many success stories, but it is different from engineering. The distinction is important for the public to understand as we seek to address the challenges of the century ahead. The role of engineers needs to be common knowledge. It needs to be a part of popular culture.

Science is the quest to understand how nature works. Engineering is the quest of humans – engineers – to use scientific knowledge, within nature’s constraints, for meeting people’s needs and wants. The public doesn’t understand those concepts, just as they don’t understand modern technologies that are central to our daily lives.

Technological literacy used to be important at the consumer level, for example in being able to understand whether to buy a product and which one. However, today we only see the outside package, and are seldom given the opportunity to understand the modern technology behind products. They may as well be magic. Consumers do not build modern devices or repair them when they break. We are not easily given the chance, or the incentive to understand, unless it is through school or media. Few in the media are up to the challenge of engagingly explaining how the modern engineered world works. There are real, untapped opportunities here for creative people.

Beyond their daily lives, the public isn’t prepared to help guide and support the policies that will ensure we meet society’s wants and needs for the century ahead. In a democratic society, we are asked to make choices that depend upon technological issues, from oil drilling to stem cells to surveillance cameras. Modern media, such as giant screen films, could help. Former Vice President Al Gore already made a film (though not in giant screen format), *An Inconvenient Truth*, on one such topic. But, typically, it focused mainly on problems and not the solutions. Engineering is about solutions. Well-produced and well-researched films could help citizens understand issues and obstacles, guiding informed opinions on how to address many of the world’s challenges. There is an important opening for creative people in the giant screen industry – explaining today’s technologies and creating enthusiasm to support the development of tomorrow’s technologies.

To be more successful, the giant screen industry should not just rely on the power of size and awe. Producers should focus more heavily on telling stories that resonate, and include strong characters. Engineering provides this opportunity, because it is more than applying science to solve problems. The engineering process toward achieving a successful technology involves complex combination of science, ethics, politics, law, and sometimes life-risking work.

And, of course, technology isn't always good. The engineering process includes unintended consequences. Modern advances can sometimes be used for nefarious purposes. Some may benefit from certain technologies more than, or even to the detriment of, others. But all of this can make great storytelling.

Feature films haven't traditionally been kind to engineers or scientists (the mad scientist is much more common than the heroic engineer). The giant screen industry should pick up where Hollywood has failed. Create some engineering heroes (without super powers). There is a wonderful synergy between the giant screen format and engineering stories because they offer dramatic visuals – the audacity of giant construction projects, innovative techniques for probing distant worlds in space, tools for exploring the mechanics of Earth, bioengineering that can reveal the inner workings of own bodies. The challenge is to do more than provide “eye candy.” Since engineering is about the human endeavor, telling compelling and important stories should be easy.

A giant screen experience can, indeed, help. In today's world, where more and more people have big screens home, it can take a giant screen to draw audiences into theaters. Further, the giant screen can provide much more detail, and that's potentially important when explaining complex engineering. Giant screen films can also bring about positive change by powerfully motivating viewers to get involved. These mammoth films are unique because the screen is so large that you feel enveloped by it. You feel pulled in to what's on the screen, as if you are practically there and part of the process. The giant screen allows you to get away with explaining complex issues, because the audience is more easily drawn in.

We need to convince, and incentivize, creative film producers and storytellers to use the giant screen format for tackling important issues. Scientists, engineers, and film makers should meet for regular brainstorming sessions. The discussions should include story ideas as well as how to ensure scientific and technical accuracy. Accuracy might even be used as a novel way to attract viewers. Perhaps the giant screen industry could publicize its films as being vetted by an expert National Academy (National Academy of Sciences, National Academy of Engineering, Institute of Medicine) committee for accuracy.

There have been workshops designed to tackle such issues by attempting to turn scientists and engineers into scriptwriters. While I like the general idea and goals, I doubt it will ever actually result in a blockbuster film production. I am proposing something similar, but fundamentally different. Instead of trying to teach one professional how to do another professional's job, let's facilitate collaboration. We should organize an ongoing series of meetings that brings scriptwriters and producers together with scientists, engineers, and medical experts to brainstorm ideas. Just as important, such meetings would simply allow people from widely different cultures to better understand each other.

Ideas to start the discussion could come from the National Academy of Engineering's recently announced *Grand Challenges for Engineering in the 21<sup>st</sup>*

*Century*<sup>2</sup>. The findings are the product of an international committee of some of our generation's leading technological thinkers. The group, chaired by former U.S. Secretary of Defense William J. Perry, included such technology pioneers as Google co-founder Larry Page, genome decipherer J. Craig Ventor, Nobel Prize winner Mario Molina, former National Institutes of Health head Bernadine Healy, and prolific inventors Dean Kamen and Ray Kurzweil, among others<sup>3</sup>.

The topics proposed by the committee illustrate that the century ahead presents challenges that would have at least as much impact as the *Great Achievements of the 20<sup>th</sup> Century*. Since I would like to encourage – even challenge – the giant screen industry to make these *Grand Challenges* the subject of a series of films, I will briefly outline them (specific challenges in bold) below.

### **Challenging the giant screen industry**

Foremost among the challenges giant screen producers should address are those that must be met to ensure the future itself. The Earth's growing population is using resources at a rate that cannot be sustained forever. There is a dramatic race to develop new sources of energy. At the same time, engineers are working on preventing and reversing the degradation of the environment. Addressing vulnerabilities to health from disease and preventing terrorist attacks will require much engineering ingenuity. And, beyond reacting to threats, pursuit of the joy of living will always be a priority of engineering innovators. All of these pursuits should be documented.

Among the "holy grails" of powering our future are to **make solar energy economical** (The Sun's rays bathe Earth's surface with more energy each hour than the planet's population consumes each year) and **provide energy from fusion** (producing the Sun's power source here on Earth to generate a virtually limitless supply of clean energy). The engineering quest to capture power from these sources could include dramatic visuals of solar arrays, huge atomic containment machines, and more.

Success with solar or fusion energy, however, will not quickly replace fossil fuels and their environmental impacts. The threat of global warming makes the capture of carbon dioxide emissions an urgent priority. The ability to **develop carbon sequestration methods** on the large scale required, securing it away in places – like the deep ocean – where it won't get back into the atmosphere, is a huge undertaking that could most effectively be portrayed on a huge screen.

A less well-known environmental challenge is to **manage the nitrogen cycle**. Nitrogen is the most common element in the atmosphere. The cycle by which it is taken up by plants, into the food chain, and back to the atmosphere has been drastically altered by industrial processes and fertilizers used for agriculture. The results include smog, acid rain, polluted water, and greenhouse gases. Engineering

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<sup>2</sup> See <http://www.engineeringchallenges.org/>.

<sup>3</sup> Details can be found at the project website, <http://www.engineeringchallenges.org>.

breakthroughs must be found to re-balance the system in a hungry world. This is an untold story.

The ability to **provide access to clean water** is an ever increasing concern and is already urgent in many parts of the world. Innovative new technologies will be needed for both personal and large-scale water needs. People in the U.S., however, don't feel the urgency.

The above challenges certainly relate to human health but, more a more direct one is the challenge to **engineer better medicines**. While modern medicine has tackled many diseases, many more remain resistant to effective treatment, and biomedical engineering is pursuing the goal of personalized medicine. While each of us is unique, today's treatments are mostly one-size-fits-all. Scientists and engineers probing deeper into the biology of our bodies may soon come up with medical technologies specific to you. What could be more personally relevant and engaging?

Simulation will become a more and more important medical tool. The biggest such challenge may be to **reverse-engineer the brain**. Such an achievement would surely offer advanced treatments for neurological diseases, new approaches in the quest for artificial intelligence, and a window to a better understanding mysteries like consciousness. It's a window film-makers might consider shooting through.

Fooling our brains into thinking we are in certain environments, to **enhance virtual reality**, has applications ranging from military exercises to medical training to long-distance meetings that provide face-to-face interaction without travel. This may also be the next step in the giant screen experience!

Increasingly sophisticated computing technologies methods will also allow us to **advance health informatics**. In addition to better and more efficient handling of health records, potential applications include automated diagnoses, analysis of treatment options, and tracking of disease. They can be dramatic, life-and-death issues.

Threats to our well-being come from many sources. Engineering solutions are badly needed to prevent and warn about dangers from natural sources and to counter the violence of terrorists. Chief among concerns may be to **prevent nuclear terror**. And as our world becomes more and more dependent on the Internet, a significant challenge will be to **secure cyberspace** from malefactors. Engineering technologies to detect and prevent these threats early is of vital concern, but we have become complacent as 09/11/01 recedes further into history.

Of course, reacting to threats is only part of engineers' challenges. Engineers have always contributed to the joy of living. The quest to **restore and improve urban infrastructure** offers the opportunity to show how engineers confront environmental and logistical obstacles while enhancing the aesthetic and practical appeal of the cities where most of the world's population lives.

Engineers are working to improve the ways we gain knowledge, but **advancing personalized learning**. Studying the fascinating process by which we learn, engineers are working to tailor instructional methods to individual minds for maximum benefit. It's not something feature films can easily do today, but it's a topic to explore.

Technology is also contributing to the discovery of mass knowledge, as they **engineer the tools of scientific discovery**. More and more intricate and powerful devices will be needed as we probe deeper into the unknown realms from the far reaches of space to the inner-working of atoms. These topics are often covered in giant screen films, but the engineers' roles usually aren't.

## **Conclusions**

That is certainly not an exhaustive list of the challenges engineers will face in the 21<sup>st</sup> century. But they are key ones, and may provide a useful guide of both visual and important stories as giant screen producers choose topics.

Engagingly portraying these vital issues for the public, and humanizing those working to address them, is of crucial importance – both for the U.S. and the world. We should document this century's technological progress in ways that draw in the public and involve them in the process. It's not too strong a statement to say that our very survival may depend upon how engineers address the Grand Challenges of Engineering, and public understanding will be a key to making that happen.

Finding practical solutions to problems like poverty, health, and energy will, in large part, require the ingenuity of skilled engineers. Their work has brought the modern conveniences much of the world enjoys. Their future challenges include bringing the fruits of progress to the rest and teaching those people how to sustain progress themselves. Like the successful engineering challenge of the "moon shots," it can be done, with political will and public support.

We need the artists of film to dramatically make these points in a way that resonates with the public. The giant screen medium can add to and amplify the power of the content. Film producers should use this advantage to step up to the challenge of engagingly discussing specific ways of meeting future goals for humanity. Currently no media truly draws people in to a substantive dialog on the important issues. Our entertainment is shallow.

The NAE *Grand Challenges for Engineering* project should start a serious national dialog about the engineering challenges, including any potential negative consequences. This country must rekindle the enthusiasm for science and engineering that made the U.S. a world leader. Engineers changed the way we live during in the 20<sup>th</sup> Century. That shouldn't be taken for granted, and must be extended to others with whom we share this shrinking world, as we look toward the century ahead.

While there are many global challenges for engineering, realizing them may depend less on engineers than on political leaders. That's why it's important to build public

backing, which translates into political action. Giant screen films can be a part of that process.

So I urge the giant screen industry to focus more on issues that will determine the world's future and less on dinosaur reenactments. The *Grand Challenges*, our world's giant topics, also deserve to be displayed on a giant screen. But, as we think about the engineering challenges of the future and how to apply the latest film-making technologies to communicate about them, we should never lose sight of the fact that the mode of communication is not a substitute for great storytelling.