Multidisciplinary Cross-Cultural University Outreach to Secular Scientists and Engineers (Why Engineers Make Good Apologists)

Dominic Halsmer
Professor and Chair, Oral Roberts University, Engineering, Physics, and Physical Science Department, Tulsa, OK 74171 dhalsmer@oru.edu

Abstract **- A healing evangelist named Oral Roberts was called by God to build a university where graduates would be prepared to enter into every person's world with healing for the totality of human need. A unique feature of the engineering program is the educational objective requiring graduates to be able to apply Christian principles of stewardship. This involves a readiness to provide excellent technical solutions, as well as answers to all those who want to know the reason for their hope. An innovative program prepares graduates for these opportunities by facilitating cross-cultural interaction with technically-oriented skeptics. Engineers are particularly well-suited to recognize and discuss evidence of engineering designs found in nature, which have recently been brought to light through the findings of modern science. This evidence provides a compelling argument for the existence of a master design engineer for the universe who desires eternal love relationships with those creatures who are willing to accept his designs!**

Index Terms - Christian engineering education, Design in nature, Engineering ethics, Philosophy of engineering, Spiritual engineering.

ON A MISSION FROM GOD

Since the fall of 2004, faculty and students in engineering and the sciences at Oral Roberts University have been reaching out to the Tulsa community in an effort to provide answers to skeptics of the Christian faith, especially with regard to science. This outreach is consistent with the university mission to raise up students to go into every person's world with healing for the totality of human need. The effort focuses on reaching a very important people group; the analytically-minded, who are generally familiar with modern science. Faculty and students interact with skeptics (primarily Chinese nationals in the USA for technical training) during dinners, apologetics-related presentations, and friendly sports competitions [1]. Presentations emphasize evidence from the sciences for a master design engineer for the universe. Cross cultural relationships develop which improve mutual understanding and facilitate acceptance of the Gospel.

This outreach activity has prompted reconsideration of how well the Engineering, Physics, and Physical Science Department at Oral Roberts University is accomplishing its mission. The logo and conceptual framework for the department can be seen in Figure 1, while the mission statement of the department is as follows:

"The Engineering, Physics, and Physical Science Department seeks to provide students with the knowledge, skills, and experiences that will prepare them to enter directly into professional practice as Christian engineers, or into advanced studies in engineering, or other professional areas. This training equips students in the application of science and mathematics for the improvement of the physical world, and enables graduates to enter the engineering and scientific communities, and contribute to the healing of the human condition. The department supports the overall university mission by the development of analytical thinking and problem solving in science and engineering, and promotes understanding and reconciliation between the fields of science and theology."

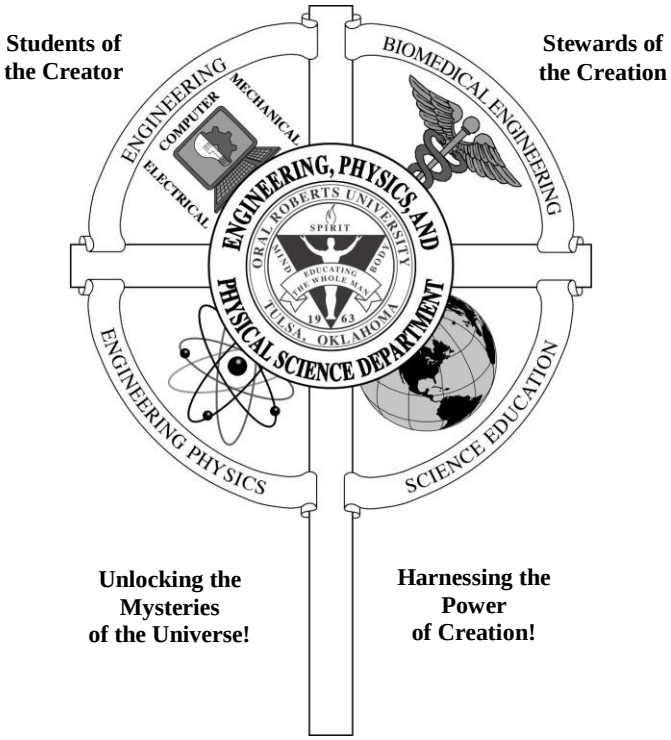

FIGURE 1
ENGINEERING, PHYSICS, AND PHYSICAL SCIENCE DEPARTMENT LOGO.

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PREPARED TO GIVE ANSWERS

First and foremost, it is the goal of the department to produce engineering and science graduates who are academically excellent, enabling them to make a positive impact in the technical field of their choice after graduation. This is a critically important step which ensures that our graduates have credibility in the industrial or academic communities where they serve. The technical expertise of our graduates affords them opportunities to contribute to the healing of the human condition in several different ways. They provide creative technical solutions in many diverse fields through the application of science and mathematics for the betterment of humanity.

However, as *Christian* engineers and scientists, they should *also* be prepared to give an answer to everyone who asks them to give the reason for the hope that they have. As exhorted in 1 Peter 3:15, this should be conducted with gentleness and respect. It is expected that this preparation will result in the improvement of the human spiritual condition, as those who are seeking answers to life's biggest questions are drawn toward the hopeful life of their Christian colleague. This preparation should also result in opportunities to promote understanding and reconciliation between the fields of science and theology. The important question which needs to be addressed is: "How should engineering and science graduates be prepared, in order that they might successfully handle such opportunities?"

REASONING WITH SPOC!

To begin answering this question, one must consider the group of people which predominantly populate the communities where the graduates will be working. It is expected that graduates will mainly be interacting with other engineers and scientists. This people group is significantly different from the normal population. According to Samuel C. Florman, who has written extensively on the engineer, people tend to think of engineers as practical, analytical, and non-emotional [2]. Think of Spoc on the original *Star Trek* television program to get an extreme view of this personality type. Florman also quotes results from five psychological studies of the engineering personality which seem to justify generalizations about this people group.

"These five studies yield a high consistency insofar as the character traits which engineers have in common are concerned. This is the more remarkable because these authors studied engineers in different fields and by different methods and techniques. It is therefore probable that unlike many other occupations where it is impossible to demonstrate any consistent trend as far as personality traits are concerned, the engineering profession – with the exception of research, administration, and sales specialties – is composed of a homogenous group of men with a fairly narrow range of temperamental variation [3]."

Engineers and scientists are interested in the pursuit, realization, and utilization of truth, especially truths that can be discovered through use of the scientific method. Hence, they tend to be very methodical and careful in their work, so that their results might be utterly dependable. The first and most critical canon of the Code of Ethics of the National Society of Professional Engineers (NSPE) is that "engineers, in the fulfillment of their professional duties, shall hold paramount the safety, health and welfare of the public [4]." Florman contends that "The resolve to be dependable is another essential element of the engineering view [5]." This view of their work, and the world in general, would tend to make anyone more skeptical of purported truths, even beyond what skepticism might have already existed before the start of such a career. Engineers and scientists have been trained to establish a high degree of certainty before embracing the veracity of engineering solutions or scientific findings.

It follows that engineers and scientists would require more than the average amount of evidence, and possibly from a broader range of sources, to be convinced of any particular proposition. They also lend more credence to evidence that is scientifically verifiable. Concerning Christian apologetics, this would explain why many engineers and scientists don't consider evidence or arguments from Scripture to be particularly compelling. However, this does not necessarily imply that they are uninterested in divine revelation. The special revelation of Scripture is only part of the manner in which God has revealed himself to humanity. Wouldn't evidence and arguments from the general revelation of nature be much more compelling to such a people group?

PROVIDING EVIDENCE FROM SCIENCE

The special revelation of Scripture does suggest that much can be known about God through an understanding of the universe. Paul's letter to the Romans speaks of God's invisible qualities, his eternal power and divine nature, being clearly seen and understood by everyone, from what has been made (Romans 1:20). According to Paul, this has been evident from the creation of the world, but the last hundred years has seen many scientific discoveries that effectively support Paul's assertion.

As an example, consider Einstein's extensively-tested General Theory of Relativity. This theory implies that all matter, energy, space, time, and the information content inherent therein, came into existence at a point in history. Such a beginning for the universe suggests a creator with the divine attribute of being transcendent of our dimensions of space and time. This would help to explain the apparently supernatural capabilities of such a creator, from our point of view in the four-dimensional created realm.

Thus, Christians graduating in engineering or science should be familiar with the scientific evidence for a creator. They should be able to help people see God's eternal power and divine nature in the created order of the universe. Lee Strobel's recent book, entitled *The Case for a Creator* [6], does an excellent job in this regard. Although it does not discuss much about the identity of the creator, this too can be inferred to some degree by evidence from nature. One of the powerful messages of the book of *Job* is that Job was able to

discern the existence of a personal redeemer to rescue him from his fallen human condition.

As skeptics consider the evidence for a creator, they may become more open to the idea that this creator would desire to communicate with the creation in a reliable manner, such as inspired writings. It may be helpful to point out consistencies between general and special revelations, such as the expansion of the universe. This recently-discovered characteristic of our universe is mentioned several times in Scripture by multiple authors. They consistently claim that God is responsible for stretching out the heavens like a tent. It is interesting to note that scientists are currently puzzled by the mysterious force, known as "dark energy", which is allegedly accelerating the expansion of the universe.

What about when science and theology appear to contradict one another? These occurrences are not surprising, and in fact, should be expected. If science is defined as man's interpretation of the facts about nature, and theology is defined as man's interpretation of the facts about God, then a comparison of the two will undoubtedly produce some contradictions since man's interpretations tend to be flawed. It makes sense, however, that there would be no contradictions between the facts concerning nature and the facts concerning God, since God has authored both revelations [7].

HUMANS AND OTHER DESIGNS IN NATURE

Florman also states that most engineers tend to be pragmatists rather than ideologues [8]. They are interested in what works. When dialoging with an engineer, it may be helpful for an apologist to point out that eternal separation from the Creator is not a very pragmatic option. Humans reach their full potential while in close intimate relationship with their Creator. To ignore that all-important relationship just doesn't work for human beings. They are not designed to operate outside of that relationship. Humans were designed to be in close relationship with God. It is their purpose.

Engineers are very familiar with the concept of design for a purpose. This suggests a new category of powerful evidence to be considered by engineers and scientists: that of engineering designs found in nature. From studies of the very large, i.e. astronomy, to studies of the very small, i.e. biochemistry, the universe is replete with examples of design for a specific purpose. Consider the tiny bacterial flagellum, a highly efficient molecular motor which serves as the propulsion system for many bacteria. It is made up of the same kind of parts that human engineers use to make larger motors. These kinds of molecular designs can have a profound effect on engineers who view them for the first time, as Lee Strobel recounts in the following story.

'Drawings of the flagellum are, indeed, very impressive, since they look uncannily like a machine that human beings would construct. I remember a scientist telling me about his father, an accomplished engineer who was highly skeptical about claims of intelligent design. The dad could never understand why his son was so convinced that the world had been designed by an intelligent agent. One day the scientist put a drawing of the bacterial flagellum in front of him. Fascinated, the engineer studied it silently for a while, then looked up and said to his son with a sense of wonder: "Oh, now I get what you've been saying." [9]'

GOD DOES SPIRITUAL ENGINEERING!

However, God is not only involved in engineering the universe in a material sense. More importantly, he is engaged in "spiritual engineering" for our benefit, as described in 2 Samuel 14:14: "Like water spilled on the ground, which cannot be recovered, so we must die. But God does not take away life; instead, he *devises* ways so that a banished person may not remain estranged from him." God is an engineer, both in his awesome creation of this beautiful universe, and in his design of our redemption, through the obedient sacrifice of Jesus, the Messiah, the Son of God, who was to come into the world. Part of this design involves the calling of *spiritual* engineers and scientists to participate with God in spiritual engineering, providing gentle and respectful, yet thoughtful and prayerful, answers to questions raised by skeptics, especially in the area of science.

God has placed in humanity a curiosity for the world and how it works, as well as the ability to discover scientific truth. He's also placed evidence for his existence and his nature within his creation to be found by those truth-seekers who are willing to search for him. Proverbs 25:2 (NIV) reflects this strategy which God has put in place to woo us back to himself: "It is the glory of God to conceal a matter; to search out a matter is the glory of kings.", or in The Message version: "God delights in concealing things; scientists delight in discovering things." The following modern proverb relates this idea to engineering: "Amusement park engineers design wild, spinning rides so that people can lose their senses for a few moments. God has designed this wonderful, spinning ride we call earth in the hopes that we come to our senses for all eternity." Engineers and scientists may find evidences and arguments from nature to be particularly compelling. Good stewardship of the creation includes being prepared to share this knowledge with those who hunger and thirst for a restored relationship with their creator.

Adam and Eve (and all their progeny) were banished from the presence of God after they chose to disobey, but God has made available a magnificent means of reconciliation which is intimately tied up with his creation of the material world. In the greatest of mysteries, God became a part of his creation, and engaged in a daring rescue mission, which revealed the divine depth of his love for us. The universe itself has been designed to draw us back to our creator, and to help us accept and return his love. As proclaimed by the writer of the Psalms,

> "The heavens declare the glory of God;
> the skies proclaim the work of his hands.
> Day after day they pour forth speech;
> night after night they display knowledge.
> There is no speech or language
> where their voice is not heard.
> Their voice goes out into all the earth,
> their words to the end of the world. [10]"

REVERSE ENGINEERING THE CREATION

Those who honestly study aspects of the cosmos can't help but discover the information that the psalmist so beautifully describes. Our minds are inherently inquisitive. Children naturally take things apart to see how they work. This kind of behavior is actually associated with another engineering-related field known as reverse engineering. Reverse engineering is simply the process of extracting knowledge or design information from anything that has been engineered.

As an example, consider the development of the Tu-4 long range bomber by the Soviet Union toward the end of World War Two. The United States Air Force got a big surprise when the Tu-4 was unveiled at a 1947 air show, since the plane appeared to be nearly identical to the United States B-29 Superfortress. With the release of newly declassified documents in 2001, the Smithsonian Institution's National Air and Space Museum revealed that the Soviets had, in fact, copied the Superfortress virtually part for part; all 105,000 of them. They were able to do this by completely dismantling and studying one of three B-29s that were forced to make an emergency landing in southeastern Russia after a mission over Japan in 1944. Unfortunately for the Soviets, the Tu-4 inherited the same problems as the B-29: notoriously unreliable engines, which tended to catch fire just as readily as the American version [11].

A significant amount of our latest and greatest technologies have arisen through reverse engineering of the biological systems that we find so prevalent in our world. This relatively new field, which is known as biomimetics, is thoroughly surveyed in a brand new book, edited by Yoseph Bar-Cohen of Jet Propulsion Laboratories, called *Biomimetics: Biologically Inspired Technology* [12]. Currently, concepts in reverse engineering have been found to be extremely useful in deciphering computer software and hardware systems, as described in *Reversing: Secrets of Reverse Engineering* [13] by Eldad Eilam. Here we see a fascinating parallel between the organization of computer instructions and the chemistry of life. Physicist Paul Davies contends that life involves more than just "self-organization" [14]. According to Davies, "Life is in fact *specified* – i.e., genetically directed – organization. Living things are instructed by the genetic software encoded in their DNA (or RNA). [15]" Like design specifications which define how an engineered product will meet performance requirements, complex information is specified at the fundamental level of life to provide what is needed for growth to maturity and the fulfillment of purpose.

DESIGNED FOR DISCOVERY

For centuries now, scientists and engineers have reveled in the fact that our world is a wonderland of discovery, and that our minds are well equipped to unravel the mysteries of the cosmos. We tend to take this situation for granted, but Albert Einstein understood that, aside from the wisdom of a creator, there is no compelling reason why things should have worked out this way. He described the situation well when he said, "The most incomprehensible thing about the world is that it is comprehensible!".

Astronomer Guillermo Gonzalez and Philosopher Jay W. Richards have compiled a detailed description of the uniqueness of planet Earth in this regard. In *The Privileged Planet: How Our Place in the Cosmos is Designed for Discovery*, "They demonstrate that our planet is exquisitely fit not only to support life, but also to give us the best view of the universe, as if Earth were designed both for life and for scientific discovery. [16]" Our planet is not the only element of creation that exhibits this characteristic. The fields of science and engineering flourish at all levels and in many different venues. Our curiosity for how things work appears to be insatiable, and yet we are continually satisfied with an endless supply of riddles from nature that seem to be designed especially for us to enjoy solving.

From the very beginning, we were made in God's image and given authority to subdue and rule over creation. 'So God created man in his own image, in the image of God he created him; male and female he created them. God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground." [17]'. Bearing the image of God, we were also given the creativity and ingenuity to devise solutions to problems that would enhance the quality of life and lift the human spirit.

When Henry Ford realized the great potential of an affordable automobile, he said, "I will build a motor car for the great multitude…so low in price that no man…will be unable to own one – and enjoy with his family the blessing of pleasure in God's great open spaces." [18]. Of course, along with this God-given authority and inventiveness comes the responsibility of good stewardship. Did Henry Ford also realize the enormous potential for injury and death resulting from automobile accidents that would quickly increase to alarming levels? And yet, few would argue that the automobile should never have been built.

STEWARDSHIP AND RESPONSIBILITY

Engineers recognize the high priority of ensuring safety in their designs. As mentioned earlier in discussing dependability, the first of the fundamental canons of the Code of Ethics of the NSPE is that engineers hold paramount the safety, health and welfare of the public. Although the entire NSPE Code of Ethics is somewhat lengthy, the Engineer's Creed, which was adopted by the NSPE in 1954, provides a more concise statement of the commitments of professional engineers:

"As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I pledge:

To give the utmost of performance;

To participate in none but honest enterprise;

To live and work according to the laws of man and the highest standards of professional conduct;

To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with need for Divine Guidance, I make this pledge. [19]"

Engineers are concerned with more than just safety. They have committed to dedicate their God-given (and hard-earned) abilities to the advancement and betterment of human welfare! Spiritual engineers not only recognize the obvious significance of the last line of the Engineer's Creed, but also recognize the underlying implications of the first line, in light of the spiritual estrangement inherent in the human condition. Such engineers seek to engage in enterprises that contribute to the improvement of all aspects of human welfare, including the spiritual condition.

Spiritual engineers understand that stewardship of creation means more than just taking good care of the environment and making good use of natural resources. It recognizes that everything belongs to the Lord, and hence we must seek his purposes for how everything is to be used for his glory. This includes personal stewardship over the time, energy, gifts, and information that have been entrusted to us. In general, engineers are gifted with the wisdom and ability to combine information and technical skills with available resources to develop products, processes, and systems that benefit humanity. Spiritual engineers look to do this in a way which lifts people's spirits, and encourages them to soar to the great heights for which they were created.

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