

# ENGINEERING, BEST QUOTES ON

We need to stop looking to politicians to make our world better. Politicians don't make the world a better place. Everything that's ever made the world a better place has come from inventors, engineers, scientists, teachers, artists, builders, philosophers, healers, and people that choose love over hate.

—Don Freeman

The scientist explains that which exists; The engineer creates that which never was.

—Theodore von Karman

When you want to know how things really work, study them when they're coming apart.

—William Gibson

There is nothing in machinery, there is nothing in embankments and railways and iron bridges and engineering devices to oblige them to be ugly. Ugliness is the measure of imperfection.

—H.G. Wells

Aviation is the branch of engineering that is least forgiving of mistakes.

—Freeman Dyson

The story of civilization is, in a sense, the story of engineering—that long and arduous struggle to make the forces of nature work for man's good.

—L. Sprague de Camp

Failure is central to engineering. Every single calculation that an engineer makes is a failure calculation. Successful engineering is all about understanding how things break or fail.

—Henry Petroski

Science can amuse and fascinate us all, but it is engineering that changes the world.

—Isaac Asimov

Beware of overconfidence; especially in matters of structure.

—Cass Gilbert

Architects and engineers are among the most fortunate of men since they build their own monuments with public consent, public approval and often public money.

—John Prebble

In science if you know what you are doing you should not be doing it.

In engineering if you do not know what you are doing you should not be doing it.

—Richard Hamming

We tend to hear much more about the splendors returned than the ships that brought them or the shipwrights. It has always been that way. Even those history books enamored of the voyages of Christopher Columbus do not tell much about the builders of the *Nina* the *Pinta* and the *Santa Maria* or about the principle of the caravel. These spacecraft—their designers, builders, navigators, and controllers are examples of what science and engineering set free for well-defined peaceful purposes can accomplish. Those scientists and engineers should be role models for an America seeking excellence and international competitiveness. They should be on our stamps.

—Carl Sagan

Leonardo Da Vinci combined art and science and aesthetics and engineering; that kind of unity is needed once again.

—Ben Shneiderman

Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road.

—Stewart Brand

The texts of man's achievements are not written exclusively in words. They are written, as well, in architecture, paintings, sculpture, drawing, photography, and in urban, graphic, landscape, and industrial design.

—J. Carter Brown

The engineer is concerned to travel from the abstract to the concrete. He begins with an idea and ends with an object. He journeys from theory to practice. The scientist's job is the precise opposite. He explores nature with his telescopes or microscopes, or much more sophisticated techniques, and feeds into a computer what he finds or sees in an attempt to define mathematically its significance and relationships. He travels from the real to the symbolic, from the concrete to the abstract. The scientist and the engineer are the mirror image of each other.

—Gordon Lindsay Glegg

You've never heard of four Ph.D.'s doing a drive-by or of four engineers holding up a liquor store.

--Jaime Oaxaca

Engineering is the professional art of applying science to the optimum conversion of natural resources to the benefit of man.

—Ralph J. Smith

In the R & D business, we kind of lump people into two categories: inventors and engineers. The inventor is the kite kind of person. They have a zillion ideas and they come up with great first prototypes. But generally an inventor...is not a tidy person. He sees the big picture and...[is] constantly lashing something together that doesn't really work. And then the engineers are the strings, the craftsmen [who pick out a good idea] and make it really practical. So, one is about a good idea, the other is about...making it practical.

--Unknown Scientist

It is not the beauty of a building you should look at; its the construction of the foundation that will stand the test of time.

—David Allan Coe

Thomas Edison had a unique way of hiring engineers. He'd give the applicant a light bulb and ask, 'How much water will it hold?'

There were two ways to find the answer. The first choice was to use gauges to measure all the angles of the bulb. Then with the measurements in hand, the engineer would calculate the surface area. This approach could take as long as twenty minutes.

The second choice was to fill the bulb with water and then pour the contents into a measuring cup. Total elapsed time: about a minute.

Engineers who took the first route, and performed their measurements by book, were thanked politely for their time and sent on their way. If you took the second route, you heard Edison say, 'You're hired.'

—David Armstrong

Albert Einstein was good at math, but it took ages for him to understand the sort of tensor calculus that all engineering students today acquire.

—David Bodanis

The humanities are the flower that blossoms on top of the 'stem.' (Science, Technology, Engineering, Math.)

--John Lithgow

Asian countries produce eight times as many engineering bachelors as the United States, and the number of U.S. students graduating at the masters and PhD levels in these areas is declining.

—Mark Kennedy

Imagination has brought mankind through the dark ages to its present state of civilization. Imagination led Columbus to discover America. Imagination led Franklin to discover electricity. Imagination has given us the steam engine, the telephone, the talking-machine, the automobile, for these things had to be dreamed of before they became realities. So I believe that dreams—daydreams, you know, with our eyes wide open and your brain machinery whizzing—are likely to lead to the betterment of the world. The imaginative child will become the imaginative man or woman most apt to invent, and therefore to foster, civilization.

—L. Frank Baum

Hoover Dam, showpiece of the Boulder Canyon project, the several million tons of concrete that made the Southwest plausible, the *fait accompli* that was to convey, in the innocent time of its construction, the notion that mankind's brightest promise lay in American engineering.

—Joan Didion

There was no room for dust devils in the laws of physics, as least in the rigid form in which they were usually taught. There is a kind of unspoken collusion going on in mainstream science education: you get your competent but bored, insecure and hence stodgy teacher talking to an audience divided between engineering students, who are going to be responsible for making bridges that won't fall down or airplanes that won't suddenly plunge vertically into the ground at six hundred miles an hour, and who by definition get sweaty palms and vindictive attitudes when their teacher suddenly veers off track and begins raving about wild and completely nonintuitive phenomena; and physics students, who derive much of their self-esteem from knowing that they are smarter and morally purer than the engineering students, and who by definition don't want to hear about anything that makes no fucking sense. This collusion results in the professor saying: (something along the lines of) dust is heavier than air, therefore it falls until it hits the ground. That's all there is to know about dust. The engineers love it because they like their issues dead and crucified like butterflies under glass. The physicists love it because they want to think they understand everything. No one asks difficult questions. And outside the windows, the dust devils continue to gambol across the campus.

—Neal Stephenson

The Wright brothers flew right through the smoke screen of impossibility.

—Charles Kettering

The people who were building it [the internet] were a bunch of engineers—pretty much a homogenous bunch of geeks, and all we wanted was to get it to work. The general public has a rather broad range of characteristics; some people do not have other people's interests at heart, and so they run scams and generate malware and do all kinds of things that are harmful. I'm unhappy that the internet is host to that. But it's like every infrastructure. It's like the road system we depend heavily on but people get drunk and they drive and they destroy property or kill themselves or other people. And we don't look to get rid of cars. So we just have to learn to make the system more secure—make you and me safer in our use of the net.

—Vinton Cerf

So here we have pi squared, which an engineer would call 10.

—Frank King

The building which was fitted accurately to answer its end would turn out to be beautiful, though beauty had not been intended.

--Georg Möller

Architecture begins where engineering ends.

--Walter Gropius

A pile of rocks ceases to be a rock when somebody contemplates it with the idea of a cathedral in mind.

--Antoine de  
Saint-Exupery

Architecture is a science arising out of many other sciences, and adorned with much and varied learning; by the help of which a judgment is formed of those works which are the result of other arts.

—Marcus V. Pollio

Engineering is the application of science for human benefit.

—J.M. Prausnitz

The engineer requires the imagination to visualize the needs of society and to appreciate what is possible as well as the technological and broad social age understanding to bring his vision to reality.

—Sir Eric Ashby

Science is about knowing; engineering is about doing.

—Henry Petroski

Engineering stimulates the mind. Kids get bored easily. They have got to get out and get their hands dirty: make things, dismantle things, fix things. When the schools can offer that, you'll have an engineer for life.

—Bruce Dickinson

Manufacturing is more than just putting parts together. It's coming up with ideas, testing principles and perfecting the engineering, as well as final assembly.

—James Dyson

There's a snobbery at work in architecture. The subject is too often treated as a fine art, delicately wrapped in mumbo-jumbo. In reality, it's an all-embracing discipline taking in science, art, maths, engineering, climate, nature, politics, economics.

—Norman Foster

Build a better mousetrap, and the world will beat a path to your door.

—Ralph Waldo Emerson

Engineering, medicine, business, architecture and painting are concerned not with the necessary but with the contingent - not with how things are but with how they might be - in short, with design.

—Herbert Simon

When I was working in my first job engineering construction, what I liked the most was working with architects and making buildings that had this creative side coming from the architect and that were making them a big success.

—Bernard Arnault

There's nothing I believe in more strongly than getting young people interested in science and engineering, for a better tomorrow, for all humankind.

—Bill Nye

My childhood dream was to study mechanical engineering. After reading *The Mysterious Island*—which I read 25 times as a boy—I thought that was the best thing a person could do. The engineer in the book knows mechanics and physics, and he creates a whole way of life on the island out of nothing. I wanted to be like that.

—Dan Shechtman

The engineering is secondary to the vision.

—Cynthia Ozick

A fly with a brain the size of a salt grain has the behavioral repertoire nearly as complex as a much larger animal such as a mouse. That's a super-interesting problem from an engineering perspective.

—Michael Dickinson

I hated science in high school. Technology? Engineering? Math? Why would I ever need this? Little did I realize that music was also about science, technology, engineering and mathematics, all rolled into one.

—Mickey Hart

Today, over half of China's undergraduate degrees are in math, science technology and engineering, yet only 16 percent of America's undergraduates pursue these schools.

—Cathy McMorris  
Rodgers

The heel is engineering in itself. This little thing that supports the human weight has to have a precise balance.

—Christian Louboutin

I employ case studies of failure into my courses, emphasizing that they teach us much more than studies of success. It is not that success stories cannot serve as models of good design or as exemplars of creative engineering. They can do that, but they cannot teach us how close to failure they are.

—Henry Petroski

I kind of think of engineering like the chefs at a restaurant. Nobody's going to deny chefs are integrally important, but there's also so many other people who contribute to a great meal.

—Ben Silbermann

Our vision is to rediscover the spirit of the Renaissance, create a new discipline where engineering for cultural heritage is actually a symbol of blending art and science together.

—Maurizio Seracini

Asian countries produce eight times as many engineering bachelors as the United States, and the number of U.S. students graduating at the masters and PhD levels in these areas is declining.

—Mark Kennedy

Our engineering departments build freeways which destroy a city or a landscape, in the process.

—Arthur Erickson

At the fourth grade level, girls at the same percentages of boys say they're interested in careers in engineering or math or astrophysics, but by eighth grade that has dropped precipitously.

—Chelsea Clinton

During the nineteenth century, the rapid emergence and proliferation of new manufacturing methods and building technologies led to the establishment of polytechnic schools that concentrated on the practicalities of engineering and construction rather than the niceties of stylistic correctness or adherence to established precedent.

—Martin Filler

What we usually consider as impossible are simply engineering problems... there's no law of physics preventing them.

—Michio Kaku

A report released by the *Partnership for a New American Economy* and the *Partnership for New York City* predicts that by 2018, there will be 800,000 science, technology, engineering, and mathematics (STEM) jobs in the United States that require a master's degree or higher—and only around 550,000 American-graduates with this training.

—Marvin Ammori

We are more dependent on science and engineering than at any other time in history. However, there is plenty of evidence that far too many people are scientifically illiterate, often having been put off science at school.

—Robert Winston

Engineering or technology is all about using the power of science to make life better for people, to reduce cost, to improve comfort, to improve productivity, etc.

—N. R. Narayana  
Murthy

But remember this, Japanese boy... airplanes are not tools for war. They are not for making money. Airplanes are beautiful dreams. Engineers turn dreams into reality.

—Hayao Miyazaki

The form a city assumes as it evolves over time owes more to large-scale works of civil engineering—what we now call infrastructure—than almost any other factor save topography.

—Martin Filler

It is pure mythology that women cannot perform as well as men in science, engineering and mathematics. In my experience, the opposite is true: Women are often more adept and patient at untangling complex problems, multitasking, seeing the possibilities in new solutions and winning team support for collaborative action.

—Weili Dai

We know that to compete for the jobs of the 21st century and thrive in a global economy, we need a growing, skilled and educated workforce, particularly in the areas of science, technology, engineering and math. Americans with bachelor's degrees have half the unemployment rate of those with a high school degree.

—Mark Pocan

With engineering, I view this year's failure as next year's opportunity to try it again. Failures are not something to be avoided. You want to have them happen as quickly as you can so you can make progress rapidly.

—Gordon Moore

All we know about the new economic world tells us that nations which train engineers will prevail over those which train lawyers. No nation has ever sued its way to greatness.

—Richard Lamm

There are hundreds of miracles within a single machine. Americans calmly explain these with mathematical formulas. Our difficulty is to learn, theirs to appreciate. We Latins, even the most intelligent of us, still count on our fingers and toes. But once we do learn, we shall surpass the Americano, because we understand the spiritual significance of a machine. We see the beauty of combining gas, grease and steel into a powerful, exact movement. We appreciate the material destiny of the universe.

—Warren Eyster

One man's 'magic' is another man's engineering.

—Robert A. Heinlein

I love doing it. Every building is like a person. Single and unrepeatable.

—Ayn Rand

To provide simple scientific solutions to complex design problems is the job of an Engineer.

—Bhupesh B. Patil

I was originally supposed to become an engineer but the thought of having to expend my creative energy on things that make practical everyday life even more refined, with a loathsome capital gain as the goal, was unbearable to me.

—Albert Einstein

The way you learn anything is that something fails, and you figure out how not to have it fail again.

—Robert S. Arrighi

I have been branded with folly and madness for attempting what the world calls impossibilities, and even from the great engineer, the late James Watt, who said ... that I deserved hanging for bringing into use the high-pressure engine. This has so far been my reward from the public; but should this be all, I shall be satisfied by the great secret pleasure and laudable pride that I feel in my own breast from having been the instrument of bringing forward new principles and new arrangements of boundless value to my country, and however much I may be straitened in pecuniary circumstances, the great honour of being a useful subject can never be taken from me, which far exceeds riches.

—Richard Trevithick

Indeed, 'brute force' solutions are often characteristic of advanced cultures, not primitive ones. The Romans and their predecessors spent a long time figuring out how to build arches... and virtually all our buildings today use post-and-lintel construction, precisely what the arch was devised to replace. We have better materials and more money, and given that, arches are usually not worth the extra complexity.

—Henry Spencer

The reason for the difference between the architectural and engineering 'climate', so to speak, is very complex. It is partly a matter of terminology, partly a matter of historical accident, and the consequent training of architects and engineers, and mostly a matter of what is commonly supposed to be the difference in content or context—architecture being concerned with producing works of art; engineering with utility structures.

—Yanni Alexander  
Loukissas

Aldus Barnes, a structural engineer by training and member of the *Advanced Geometry Unit* (AGU) at Arup, has formed many successful collaborations and earned a prominent place for himself in architecture by adopting the language and skills of architects. ‘Talk in terms of texture and density, instead of torsion and shear. That way they don’t think you are just another nerd,’ Barnes advises the young members of his team.

—Yanni Alexander  
Loukissas

First rule of engineering; beware prototypes. Along with, avoid anything made by an engineer who doesn’t have all his own fingers.

—Simon R. Green

Programmers are isolated. They sit in their cubicle; they don’t think about the larger picture. To my mind, a programmer is not an engineer, because an engineer is somebody who starts with a social problem that an organization or a society has and says, ‘OK, here’s this problem that we have- how can we solve it?’ The engineer comes up with a clever, cost-effective solution to address that problem, builds it, tests it to make sure it solves the problem. That’s engineering.

—Philip Greenspun

Engineering, too, owes its most useful materials to the achievements of chemists in identifying, separating, and transforming materials: structural steel for the framework of bridges and buildings, portland cement for roadways and aqueducts, pure copper for the electrical industries, aluminum alloys for automobiles and airplanes, porcelain for spark plugs and electrical insulators. The triumphs of engineering skill rest on a chemical foundation.

—Horace G. Deming

Aeroplanes are not designed by science, but by art in spite of some pretence and humbug to the contrary. I do not mean to suggest that engineering can do without science, on the contrary, it stands on scientific foundations, but there is a big gap between scientific research and the engineering product which has to be bridged by the art of the engineer.

—John D. North

This one went unusually smoothly. When I finished it, I remarked to a friend that I felt like an engineer who had designed a machine and then sat back and realized it did everything I’d set out to do.

Which made him say, quite emphatically, ‘No engineer has ever felt this.’

—Robert J. Bennett

Engineering is the art of directing the great sources of power in nature for the use and convenience of man.

—Thomas Tredgold

Engineering is not merely knowing and being knowledgeable, like a walking encyclopedia; engineering is not merely analysis; engineering is not merely the possession of the capacity to get elegant solutions to non-existent engineering problems; engineering is practicing the art of the organizing forces of technological change ... Engineers operate at the interface between science and society.

—Gordon Stanley Brown

Engineering is quite different from science. Scientists try to understand nature. Engineers try to make things that do not exist in nature. Engineers stress invention. To embody an invention the engineer must put his idea in concrete terms, and design something that people can use. That something can be a device, a gadget, a material, a method, a computing program, an innovative experiment, a new solution to a problem, or an improvement on what is existing. Since a design has to be concrete, it must have its geometry, dimensions, and characteristic numbers. Almost all engineers working on new designs find that they do not have all the needed information. Most often, they are limited by insufficient scientific knowledge. Thus they study mathematics, physics, chemistry, biology and mechanics. Often they have to add to the sciences relevant to their profession. Thus engineering sciences are born.

—Yuan-Cheng ('Bert')  
Fung

Engineering is the science of economy, of conserving the energy, kinetic and potential, provided and stored up by nature for the use of man. It is the business of engineering to utilize this energy to the best advantage, so that there may be the least possible waste.

—Willard A. Smith

Engineering or Technology is the making of things that did not previously exist, whereas science is the discovering of things that have long existed.

—David Billington

Engineers use knowledge primarily to design, produce, and operate artifacts. ... Scientists, by contrast, use knowledge primarily to generate more knowledge.

—Walter Vincenti

Every technological success is hailed as a great scientific achievement; every technological disaster is deemed an engineering failure.

—Unknown

Engineering without imagination sinks to a trade.

—Herbert Hoover

It is both a sad and a happy fact of engineering history that disasters have been powerful instruments of change. Designers learn from failure. Industrial society did not invent grand works of engineering, and it was not the first to know design failure. What it did do was develop powerful techniques for learning from the experience of past disasters. It is extremely rare today for an apartment house in North America, Europe, or Japan to fall down. Ancient Rome had large apartment buildings too, but while its public baths, bridges and aqueducts have lasted for two thousand years, its big residential blocks collapsed with appalling regularity. Not one is left in modern Rome, even as ruin.

—Edward Tenner

It seems to be saying perpetually; 'I am the end of the nineteenth century; I am glad they built me of iron; let me rust.' ... It is like a passing fool in a crowd of the University, a buffoon in the hall; for all the things in Paris has made, it alone has neither wits nor soul.

[About the Eiffel Tower.]

—Hilaire Belloc

No one wants to learn by mistakes, but we cannot learn enough from successes to go beyond the state of the art

—Henry Petroski

The dollar is the final term in almost every equation which arises in the practice of engineering in any or all of its branches, except qualifiedly as to military and naval engineering, where in some cases cost may be ignored.

—Henry R. Towne

The essence of engineering consists not so much in the mere construction of the spectacular layouts or developments, but in the invention required—the analysis of the problem, the design, the solution by the mind which directs it all.

—William Hood

The Golden Gate Bridge is a giant moving math problem.

—John van der Zee

The most important object of Civil Engineering is to improve the means of production and of traffic in states, both for external and internal trade. It is applied in the construction and management of roads, bridges, railroads, aqueducts, canals, river navigation, docks and storehouses, for the convenience of internal intercourse and exchange; and in the construction of ports, harbours, moles, breakwaters and lighthouses; and in the navigation by artificial power for the purposes of commerce. It is applied to the protection of property where natural powers are the sources of injury, as by embankments for the defence of tracts of country from the encroachments of the sea, or the overflowing of rivers; it also directs the means of applying streams and rivers to use, either as powers to work machines, or as supplies for the use of cities and towns, or for irrigation; as well as the means of removing noxious accumulations, as by the drainage of towns and districts to ... secure the public health.

—Thomas Tredgold  
(1828)

The scientist discovers a new type of material or energy and the engineer discovers a new use for it.

—Gordon Lindsay Glegg

The story of civilization is, in a sense, the story of engineering—that long and arduous struggle to make the forces of nature work for man’s good.

—Lyon Sprague DeCamp

Three engineering students were discussing who designed the human body. One said, ‘It was a mechanical engineer. Just look at all the joints.’ The second said, ‘No, it was an electrical engineer. The nervous systems many thousands of electrical connections.’ The last said, ‘Obviously, it was a civil engineer. Who else would run a toxic waste pipeline through a major recreation area?’

—Unknown

What is the difference between Mechanical Engineers and Civil Engineers?  
Mechanical Engineers build weapons and Civil Engineers build targets.

—Unknown

[An engineer’s] invention causes things to come into existence from ideas, makes world conform to thought; whereas science, by deriving ideas from observation, makes thought conform to existence.

—Carl Mitcham

[Engineering] is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to a plan on paper. Then it moves to realization in stone or metal or energy. Then it brings homes to men or women. Then it elevates the standards of living and adds to the comforts of life. That is the engineer's high privilege.

—Herbert Hoover

Engineers ... are not mere technicians and should not approve or lend their name to any project that does not promise to be beneficent to man and the advancement of civilization.

—John Fowler

Engineers ... are not superhuman. They make mistakes in their assumptions, in their calculations, in their conclusions. That they make mistakes is forgivable; that they catch them is imperative. Thus it is the essence of modern engineering not only to be able to check one's own work but also to have one's work checked and to be able to check the work of others.

—Henry Petroski

There can be little doubt that in many ways the story of bridge building is the story of civilization. By it we can readily measure an important part of a people's progress.

—Franklin D Roosevelt

We shape our buildings, thereafter they shape us.

—Winston Churchill

Engineering problems are under-defined, there are many solutions, good, bad and indifferent. The art is to arrive at a good solution. This is a creative activity, involving imagination, intuition and deliberate choice.

—Ove Arup

The ideal engineer is a composite ... He is not a scientist, he is not a mathematician, he is not a sociologist or a writer; but he may use the knowledge and techniques of any or all of these disciplines in solving engineering problems.

—N. W. Dougherty

The sight of such a monument is like continual and stationary music which one hears for one's good as one approaches it.

—Anne Louise Germaine  
de Staël

The engineer is the key figure in the material progress of the world. It is his engineering that makes a reality of the potential value of science by translating scientific knowledge into tools, resources, energy and labor to bring them into the service of man ... To make contributions of this kind the engineer requires the imagination to visualize the needs of society and to appreciate what is possible as well as the technological and broad social age understanding to bring his vision to reality.

—Sir Eric Ashby

A key characteristic of the engineering culture is that the individual engineer's commitment is to technical challenge rather than to a given company. There is no intrinsic loyalty to an employer as such. An employer is good only for providing the sandbox in which to play. If there is no challenge or if resources fail to be provided, the engineer will seek employment elsewhere. In the engineering culture, people, organization, and bureaucracy are constraints to be overcome. In the ideal organization everything is automated so that people cannot screw it up. There is a joke that says it all. A plant is being managed by one man and one dog. It is the job of the man to feed the dog, and it is the job of the dog to keep the man from touching the equipment. Or, as two Boeing engineers were overheard to say during a landing at Seattle, 'What a waste it is to have those people in the cockpit when the plane could land itself perfectly well.' Just as there is no loyalty to an employer, there is no loyalty to the customer. As we will see later, if trade-offs had to be made between building the next generation of 'fun' computers and meeting the needs of 'dumb' customers who wanted turnkey products, the engineers at DEC always opted for technological advancement and paid attention only to those customers who provided a technical challenge.

—Edgar H. Schein

Bridges are America's cathedrals.

—Unknown

An arch never sleeps.

—J. Fergusson

Cheops' Law: Nothing ever gets built on schedule or within budget.

—Robert A. Heinlein

When they first built the University of California at Irvine they just put the buildings in. They did not put any sidewalks, they just planted grass. The next year, they came back and put the sidewalks where the trails were in the grass.

—Larry Wall

A good scientist is a person with original ideas. A good engineer is a person who makes a design that works with as few original ideas as possible. There are no prima donnas in engineering.

—Freeman Dyson

It is not the beauty of a building you should look at; its the construction of the foundation that will stand the test of time.

—David Allan Coe

Construction is the art of making a meaningful whole out of many parts. Buildings are witnesses to the human ability to construct concrete things. I believe that the real core of all architectural work lies in the act of construction. At the point in time concrete materials are assembled and erected, the architecture we have been looking for becomes part of the real world.

—Peter Zumthor

It does not much matter that an individual loses two or three hundred pounds in buying a bad picture, but it is to be regretted that a nation should lose two or three hundred thousand in raising a ridiculous building.

—John Ruskin

A city is not an accident but the result of coherent visions and aims.

—Leon Krier

Form follows function.

—Louis Sullivan

Cities are the greatest creations of humanity.

—Daniel Libeskind

Concrete you can mold, you can press it into—after all, you haven't any straight lines in your body. Why should we have straight lines in our architecture? You'd be surprised when you go into a room that has no straight line—how marvelous it is that you can feel the walls talking back to you, as it were.

—Philip Johnson

The Romans were not inventors of the supporting arch, but its extended use in vaults and intersecting barrel shapes and domes is theirs.

—Harry Seidler

To me, a building—if it's beautiful—is the love of one man, he's made it out of his love for space, materials, things like that.

—Martha Graham

Infrastructure is much more important than architecture.

—Rem Koolhaas

Bridges are perhaps the most invisible form of public architecture.

—Bruce Jackson

A building has integrity just like a man. And just as seldom.

—Ayn Rand

The best engineer a few decades ago was someone who could create the most beautiful beam or structure; today it's to do a structure you cannot see or understand how it's done. It disappears and you can talk only about color, symbols, and light. It's an aesthetic of miracle.

—Jean Nouvel

A world which sees art and engineering as divided is not seeing the world as a whole.

—Professor Sir Edmund  
Happold

I am particularly fond of concrete, symbol of the construction progress of a whole century, submissive and strong as an elephant, monumental like stone, humble like brick.

—Carlos Villanueva

I think buildings should imitate ecological systems.

—Ken Yeang

If you think you can't make the world a better place with your work, at least make sure you don't make it worse.

—Herman Hertzberger

Engineering is not a science. Science studies particular events to find general laws. Engineering design makes use of the laws to solve particular practical problems. In this it is more closely related to art or craft.

—Ove Arup

Practice safe design: Use a concept.

—Petrula Vrontikis

Great buildings that move the spirit have always been rare. In every case they are unique, poetic, products of the heart.

—Arthur Erickson

Most buildings are drawings filled in by engineers.

— Thomas Heatherwick

There was an engineer who had an exceptional gift for fixing all things mechanical. After serving his company loyally for over 30 years, he happily retired. Several years later the company contacted him regarding a seemingly impossible problem they were having with one of their multi-million dollar machines.

They had tried everything and everyone else to get the machine to work but to no avail. In desperation, they called on the retired engineer who had solved so many of their problems in the past.

The engineer reluctantly took the challenge. He spent a day studying the huge machine. At the end of the day, he marked a small 'x' in chalk on a particular component of the machine and stated, 'This is where your problem is'.

The part was replaced and the machine worked perfectly again.

The company received a bill for \$50,000 from the engineer for his service. They demanded an itemized accounting of his charges.

The engineer responded briefly:

One chalk mark \$1

Knowing where to put it \$49,999

It was paid in full and the engineer retired again in peace.

—Unknown

Normal people ... believe that if it ain't broke, don't fix it.

Engineers believe that if it ain't broke, it doesn't have enough features yet.

— Scott Adams

For decades engineers have stood accused that their buildings do not have any cultural value.

—Fritz Todt

A good engineer thinks in reverse and asks himself about the stylistic consequences of the components and systems he proposes.

—Helmut Jahn

In 2012, only 14% of women entering university for the first time elected to pursue a science-related field of study, contrasted with 39% of men entering university in the same year.

—Ximena Rojo

Less than 5% of girls, on average, contemplate pursuing a STEM career....  
And in their professional lives, women often face obstacles such as harassment.

—Ximena Rojo

Don't hire a chemical engineer to brew you a cup of coffee.

--A. Margolese

When doctors listen to nurses, patients recover more quickly; if mining engineers pay more attention to their men than to their machinery, the pits are more efficient. As in athletics and nuclear research, it is neither books nor seminars from which managers learn much, but from here-and-now exchanges about the operational job in hand.

--Reg Revans

Inventions reached their limit long ago, and I see no hope for further development.

—Julius Frontinus  
(1st century A.D.)

One has to look out for engineers—they begin with sewing machines and end up with the atomic bomb.

--Marcel Pagnol

Some reporters credit their career choice to a thirst for justice and liberty and a desire to comfort the afflicted and afflict the comfortable. I credit mine to engineering camp, where I spent a week between my junior and senior years in high school. I didn't mind the engineering, but engineering camp made me realize I really didn't envision spending the rest of my life with engineers. Sharing work stories with newspaper reporters seems so much more entertaining.

--Burt Constable

When the weight of the paperwork equals the weight of the equipment, the project is complete.

--Engineers' Maxim

The great growling engine of change—technology.

—Alvin Toffler

A recent study from *CareerCast.com*, a new job site, evaluates 200 professions to determine the best and worst according to five criteria inherent to every job: income, employment outlook, physical demands, and stress. Mathematicians fared best with a median income of \$94,160, strong growth potential, favorable working conditions and excellent job prospects. Most of the positions in the top ten also utilize applied math and statistics skills in their work: actuary, statistician, biologist, software engineer, computer-systems analyst, historian, sociologist, industrial engineer and accountant.

—*CareerCast.com*

When Henry Ford wanted safety-glass for one of his new models, he went to his tried and tested engineers for help. All 130 of them knew too many reasons why safety-glass could not be produced. Finally, a young engineer, who knew no reason why it couldn't be done, set to work and developed safety-glass.

--Unknown

By 2018 there will be more than two million open jobs in STEM (science, technology, engineering, math) professions, but only 19 percent of current college degrees are in STEM fields. Even worse, 75 percent of students that do well in science and math decide to not pursue STEM in college. If we want to remain a global leader, we have to develop more interest in these topics. One way to do that is to show students that coding ties into nearly everything we do. And to do that, we need to incorporate programming into the curriculum.

—Ellen Ullman

The electrical engineer has an enormous advantage over other engineers; everything lends itself to exact calculation, and a completed machine or any of its parts may be submitted to the most searching electrical and magnetic tests, since these tests, unlike those applied by other engineers, do not destroy the body tested.

—John Perry

When we look back beyond one hundred years over the long trails of history, we see immediately why the age we live in differs from all other ages in human annals. ... It remained stationary in India and in China for thousands of years. But now it is moving very fast. ... A priest from Thebes would probably have felt more at home at the council of Trent, two thousand years after Thebes had vanished, than Sir Isaac Newton at a modern undergraduate physical society, or George Stephenson in the Institute of Electrical Engineers. The changes have have been so sudden and so gigantic, that no period in history can be compared with the last century. The past no longer enables us even dimly to measure the future.

—Winston Churchill

Engineering, too, owes its most useful materials to the achievements of chemists in identifying, separating, and transforming materials: structural steel for the framework of bridges and buildings, Portland cement for roadways and aqueducts, pure copper for the electrical industries, aluminum alloys for automobiles and airplanes, porcelain for spark plugs and electrical insulators. The triumphs of engineering skill rest on a chemical foundation.

—Horace G. Deming

While electric railroading is perhaps the most important branch of electrical engineering, at least as regards commercial importance, considering the amount of capital invested therein, nevertheless it is a remarkable fact that while most other branches of electrical engineering had been developed to a very high degree of perfection, even a few years ago theoretical investigation of electric railroading was still conspicuous by its almost entire absence.

All the work was done by some kind of empirical experimenting, that is, some kind of motor was fitted up with some gearing or some sort of railway car, and then run, and if the motor burned out frequently it was replaced with a larger motor, and if it did not burn out, a trailer was put on the car, and perhaps a second trailer, until the increase of the expense account in burn-outs of the motors balanced the increased carrying capacity of the train.

—Charles Proteus  
Steinmetz (1902)

I hope climate science becomes the big thing. And then what I want is electrical engineers to solve the world's energy problems, energy distribution problems. I want mechanical engineers to make better transportation systems. I want chemical engineers to develop better solar panels, and so on.

—Bill Nye

Engineering stimulates the mind. Kids get bored easily. They have got to get out and get their hands dirty: make things, dismantle things, fix things. When the schools can offer that, you'll have an engineer for life.

—Bruce Dickinson

Invention is the most important product of man's creative brain. The ultimate purpose is the complete mastery of mind over the material world, the harnessing of human nature to human needs.

—Nikola Tesla

Scientists study the world as it is; engineers create the world that has never been.

—Theodore von Karman

The optimist claims the glass is half full; the pessimist claims it is half empty.  
An engineer observes that the glass is twice as big as it needs to be.

--Bob Lewis

Electronic calculators can solve problems which the man who made them cannot solve; but no government-subsidized commission of engineers and physicists could create a worm.

—Joseph Wood Krutch

I'm a mechanic because your honor roll student that got an engineering degree can't design it right the first time.

—Unknown

Engineering: Any engagement in a systematic practice of design to achieve solutions to particular human problems.

—*National Research Council*

Technologies result when engineers apply an understanding of the natural world and of human behavior to design to satisfy human needs and wants.

—*National Research Council*

Science: Burning wood produces heat, water, and carbon dioxide. Heat denatures proteins in food.

Engineering: Building a fireplace and chimney makes it easier to cook with fire without filling the room with smoke.

— Michael Dickman

Engineering: The act of creating, adapting, molding, processing, manufacturing,.. news things that Mother Nature has not produced in a natural way (i.e. Aircraft, Buildings, Machinery, Rockets, Clocks...). Output—artificial gadgets. But note that its not exclusive of Human activity (i.e. The beavers building dams)

—Juan Gerardo Muros

ENGINEERING is about making things work. It is about using resources available to you or creating resources to build or design something that serves to fulfill a predetermined purpose. *Resource* not only means materials, tools, energy, etc., but also includes scientific knowledge. Engineering is utility driven.

—Shiv Shankar Sangaru

Engineering is not an exact science, but an inventive specialisation making use of facts grounded on science, technology and arts to solve practical problems while taking the welfare of society in mind (e.g. human safety, security, reduced cost of doing business, etc).

—Nashon Adero

Americans making the investment in education are having to pile up debt with the hope their incomes improve along with it. Earnings can vary significantly based on the program. Engineers often benefit the most from their degrees and teachers the least.

—Agnel Philip

Programming today is a race between software engineers striving to build bigger and better idiot-proof programs, and the Universe trying to produce bigger and better idiots. So far, the Universe is winning.

—Rich Cook

One day the station will reenter the Earth's atmosphere and crash into the ocean, and I hope to be there to see it. We will never have a space station like this again, and I will always be grateful for the part I've played in its life. In a world of compromise and uncertainty, this space station is a triumph of engineering and cooperation. Putting it into orbit—making it work and keeping it working—is the hardest thing that human beings have ever done, and it stands as proof that when we set our minds to something hard, when we work together, we can do anything. I know we can solve our problems here on Earth.

—Astronaut Scott Kelly

Everybody should be ashamed who uses the wonders of science and engineering without thinking and having mentally realized not more of it than a cow realizes of the botany of the plants which it eats with pleasure.

--Albert Einstein

The structural engineers who employ math and science to make the architectural form a reality are 'invisibles'—hidden behind the walls and ceilings—unknown professionals to most of society. When an individual asks me the difference between an architect and structural engineer, the elevator speech goes like this: 'Architects create the form and the experience, and engineers make it stand up!'

—Carol A. Post

Computers are to design as microwaves are to cooking.

—Milton Glaser

There was a beauty to an elegantly designed circuit board that rivaled anything found in nature.

--Kit Rocha

Unobtainium is a joke among engineers. Unobtainium refers to a material that could make faster-than-light space travel possible. It's also any substance that would solve a huge and persistent engineering problem—but does not yet exist. And probably never will. The term has been in use since at least the 1950s. It might sound familiar now because it had a role in James Cameron's *Avatar*, from 2009. In that film, unobtainium (with a variant spelling) is a valuable and scarce mineral; the race to mine it leads to colonization and the film's central conflict.

—Margaret Weitekamp

Standing before costly objects of technological beauty, we may be tempted to reject the possibility of awe, for fear that we could grow stupid through admiration. We may feel at risk of becoming overimpressed by architecture and engineering, of being dumbstruck by the Bombardier trains that progress driverlessly between satellites or by the General Electric GE90 engines that hang lightly off the composite wings of a Boeing 777 bound for Seoul. And yet to refuse to be awed at all might in the end be merely another kind of foolishness.

—Alain de Botton

The occasional visit of success provides just the excitement an engineer needs to face work the following day.

—Koichi Tanaka

It is no longer just engineers who dominate our technology leadership, because it is no longer the case that computers are so mysterious that only engineers can understand what they are capable of. There is an industry-wide shift toward more 'product thinking' in leadership—leaders who understand the social and cultural contexts in which our technologies are deployed.

Products must appeal to human beings, and a rigorously cultivated humanistic sensibility is a valued asset for this challenge. That is perhaps why a technology leader of the highest status—Steve Jobs—recently credited an appreciation for the liberal arts as key to his company's tremendous success with their various i-gadgets.

--Damon Horowitz

The ideal engineer is one with a comprehensive liberal arts education. Industry and academic partners have told us that the ideal engineer participates in teams effectively, communicates respectfully, clearly and concisely, and executes compassionately and realistically.

—Frank Harwath

Any impatient student of mathematics or science or engineering who is irked by having algebraic symbolism thrust upon him should try to get along without it for a week.

—Eric Temple Bell

The emphasis on verbal communication, writing, leadership, and engagement with other disciplines will help...students become more well-rounded engineers.

—Sun-Il Kim

In the 1890s, [Thomas] Edison developed rock-crushing machinery for retrieving iron ore. That business failed, but the machinery proved well suited to producing cement, a key ingredient of concrete. In 1907, a time when New York City was rife with overcrowded tenements, Edison announced plans for low-cost, healthful concrete houses, and he later patented a method for building them. In a single pour into an iron mold...concrete would form the walls and roof— and the stairs, floors, even bathtubs. Edison offered the use of that patent free, and an investor built prototypes in New Jersey, some of which still stand. But this business also failed: the molds were costly, the houses weren't very attractive, and potential buyers were put off by the stigma of a home labeled 'the salvation of the unwashed masses.'

—Paul Lalonde

Sometimes I think we get the idea that engineering is esoteric. But look at Stonehenge. That's a functioning observatory and a calendar from 5,000 years ago. Or the Mayan calendars—they're fantastic and have been around for such a long time. The technology people have been able to come up with from virtually nothing is amazing.

—Frank Harwath

Heavier-than-air flying machines are impossible.

—Lord Kelvin (1895)

Engineering is the professional and systematic application of science to the efficient utilization of natural resources to produce wealth.

—T. J. Hoover

To inspire more students of color to pursue STEM, we have to redefine what excellent STEM instruction and curriculum look like. Instead of lectures and labs that are disconnected from everyday reality, students need to ‘remix the content they’ve internalized’ to create solutions for real people. This remixing involves developing an understanding of what problems can and cannot be solved with technology, learning how to source the necessary tools and work on a team, and discerning scope and scale. New models of learning need to be co-created by educators with the students and communities they serve. It’s nuanced, time-intensive work, and requires that more people engage in better conversations.

—Wisdom Amouzou

The funniest part about my graduation will be my parents finding out I’m not an Engineering major anymore.

—Internet Meme

According to the *Bureau of Labor Statistics*, employment opportunities in food, agriculture, renewable natural resources and environment occupations are expected to grow more than 5 percent between 2015 and 2020. Demand is highest for plant and food scientists, sustainable biomaterials specialists, water resources scientists and engineers, precision agriculture specialists, and farm-animal veterinarians.

—Madhu  
Krishnamurthy  
(2018)

In World War II, the need for computation exploded. Over 200 women were hired at the University of Pennsylvania’s Moore School of Electrical Engineering, creating artillery-trajectory tables for the Army. By 1944...about half of all computers were women. One contractor of the Applied Mathematics Panel used the term ‘kilogirl’ to refer to 1,000 hours of female calculation work. Another astronomer spoke of ‘girl-years’ of work.

—Clive Thompson

Women...were among the original coders of...digital brains, because in the early days programming...was seen as dull work. The earliest programmers for the Eniac—the military-funded first programmable general-purpose computer—were entirely women, plucked from the ranks of the Army’s human computers. And though they wound up inventing brilliant coding techniques, they received none of the glory: When the Army showed off the Eniac to the press, running lighting-fast ballistics-crunching algorithms, it didn’t introduce the women who’d written the code.

—Clive Thompson

Climate change is the greatest challenge of our generation and it is up to us—the young engineers, technologists and entrepreneurs to build solutions.

—Madhav Datt

I recently called an old Engineering buddy of mine and asked what he was working on these days. He replied, ‘Aqua-thermal treatment of ceramics, aluminum and steel under a constrained environment.’ I was impressed until, upon further inquiry, I learned that he was washing dishes with hot water under his wife’s supervision.

—Internet Meme

The decisions engineers make in solving design problems are not morally neutral . . . It is not a morally neutral decision to emphasize cost over efficiency, for instance, or ease of manufacture over safety . . . Different design solutions embody different sets of harms and goods. Those different solutions, when instantiated into artifacts, are going to have different sets of effects, and engineers have an obligation, at a minimum to minimize the harmful effects.

—Wade L. Robison

The 21st-century city is the child of catastrophe. The comforts and infrastructure we take for granted were born of age-old afflictions: fire, flood, pestilence. Our tall buildings, our subways, our subterranean conduits, our systems for bringing water in and taking it away, our building codes and public health regulations—all were forged in the aftermath of urban disasters by civic leaders and citizen visionaries.

—Derek Thompson

Natural and man-made disasters have shaped our greatest cities, and our ideas about human progress, for millennia. Once Rome’s ancient aqueducts were no longer functional—damaged first by invaders and then ravaged by time—the city’s population dwindled to a few tens of thousands, reviving only during the Renaissance, when engineers restored the flow of water. The Lisbon earthquake of 1755 proved so devastating that it caused Enlightenment philosophers such as Jean-Jacques Rousseau to question the very merits of urban civilization and call for a return to the natural world. But it also led to the birth of earthquake engineering, which has evolved to make San Francisco, Tokyo, and countless other cities more resilient.

—Derek Thompson

If I had an hour to solve a problem, I’d spend 55 minutes thinking about the problem and five minutes thinking about solutions.

—Albert Einstein

I like engineers. They build things that are useful and sometimes beautiful—a brick sewer, a suspension bridge—and take little credit. They do not wear black and designer glasses like architects. They do not crow.

—Rose George

The visionary architect William Le Baron Jenney masterminded the construction of what is considered history's first skyscraper, the 138-foot-tall Home Insurance Building, which opened in 1885....It is impossible to know just how much cities everywhere have benefited from Chicago's successful experiments in steel-skeleton construction. By enabling developers to add great amounts of floor space without needing additional ground area, the skyscraper has encouraged density. Finding ways to safely fit more people into cities has led to a faster pace of innovation, greater retail experimentation, and more opportunities for middle- and low-income families to live near business hubs. People in dense areas also own fewer cars and burn hundreds of gallons less gasoline each year than people in nonurban areas. Ecologically and economically, and in terms of equity and opportunity, the skyscraper, forged in the architectural milieu of post-fire Chicago, is one of the most triumphant inventions in urban history.

—Derek Thompson

Engineers make bridges.  
Artists make paintings.  
Scientists make rockets.  
But teachers make them all.

—Internet Meme

A group of managers were given the assignment of measuring the height of a flagpole. They went out to the flagpole with ladders and tape measures, but they continually fell off the ladders and dropped the tape measures and the whole thing was just a fiasco.

Finally an engineer came along and saw what they were trying to do. He then walked over, pulled the flagpole out of the ground, laid it flat, measured it from end to end, gave the measurement to one of the managers, and walked away.

After the engineer was gone, one manager turned to another and laughed. 'Isn't that just like an engineer! We're looking for the height, and he gives us the length!'

—Tony Jeary and John  
Davis

Design is not just what it looks like and feels like. Design is how it works.

—Steve Jobs

Got a 2.4 GPA my first semester in college. Thought maybe I wasn't cut out for engineering. Today I've landed two spacecraft on Mars, and designing one for the moon. STEM is hard for everyone. Grades ultimately aren't what matters. Curiosity and persistence matter.

—Ben Cichy

Many installations depend on the technology to plan their energy models and determine locations for placement of solar panels and wind farms. We couldn't get information on parameters—power lines, transformers, communication lines, wind potential, land use and structures on our projects without GIS [Geographic Information Systems] technology. It's necessary for everyone to do their jobs well.

— John Trudell

In highly specialized technical fields, soft-skills are critical to the career path. A survey the American Enterprise Institute conducted last year found that nearly half of workers in science, technology, engineering and math fields thought that good writing and communication skills were extremely important and around 70% said the same regarding critical thinking skills. At the same time, less than 40% of these workers said that high level math, analytical or computer skills were extremely important.

—Brent Orrell

This [California] landscape is bejeweled with engineering feats: the California Aqueduct; the Golden Gate Bridge; and the ribbon of Pacific Coast Highway that stretches south of Monterey, clings to the cliffs of Big Sur, and descends the kelp-strewn Central Coast, where William Hearst built his Xanadu on a hillside where his zebras still graze. No dreamscape better inspires dreamers.

—Conor Friedersdorf

Certain majors...bring a faster return on investment than others....There are bachelor degree programs that allow most graduates to recoup the money spent on their diploma in five years or less....Seven engineering majors dominate the list, including petroleum, aerospace and industrial engineering. The remaining majors are also in science, math and health care; nursing, dental support services, construction management and quality control/safety technicians.

Other fields, such as drama and dance, showed no return on investment most of the time....That doesn't mean those careers don't offer creative fulfillment or societal value, but it could indicate unstable employment or limited economic return.

—Michael Itzkowitz

In our big cities there is nothing at all not made by ourselves except the air. We are our own context and live by picking each other's brains.

—L. M. Boston

Truss 6, a supporting structure that hung over the choir [in Notre Dame cathedral]. Estimated to have been built in 1180, the truss was one of the oldest features of the cathedral that took nearly two centuries to build starting in 1163.

—Douglas Starr

Archaeological experiments often take the form of replicating ancient structures or artefacts using materials, tools and techniques that were possibly used by past people....We collaborate with other researchers in Geology and Engineering...to better characterise the mechanical properties of archaeological materials. This includes applying techniques such as petrographic analysis, scanning electron microscopy, X-ray fluorescence/diffraction, and hardness testing to understand how different physical characteristics may have influenced the technological decisions and strategies of ancient people.

—*University of  
Wollongong,  
Australia*

European Out-of-Office:

I'm away camping for the summer. Please email back in September.

American Out-of-Office:

I have left the office for two hours to undergo kidney surgery but you can reach me on my cell any time.

—Samuel Pollen

The bumpy sections of sidewalks are designed to help people who are visually impaired. 'Tactile paving' uses varying bump or dot patterns to warn pedestrians with limited or no vision that they are approaching specific hazards, like stairs, stoplights, crosswalks, or the edge of a subway platform.

—<https://www.mentalfloss.com>

Treadmills started out as torture devices. In 1818, a civil engineer invented the 'tread-wheel' as a way to reform convicts. Prisoners would spend grueling 8-hour shifts climbing the paddle wheel like a StairMaster, which turned gears that pumped water or crushed grain—leading to the eventual name 'treadmill.'

—<https://en.wikipedia.org>

France installed the world's first solar road. The kilometer-long road in Tourouvre-au-Perche has 30,000 square feet of solar panels, is strong enough you can drive a big rig over it, and is designed to generate enough energy to power the street lighting for 3,400 village residents.

—Kim Willsher

To the Women in my Engineering Classes;

While it is my intention in every other interaction I share with you to treat you as my peer, let me deviate from that to say that you and I are in fact unequal. Sure, we are in the same school program, and you are quite possibly getting the same GPA as I, but does that make us equal? I did not, for example, grow up in a world that discouraged me from focusing on hard science. Nor did I live in a society that told me not to get dirty, or said I was bossy for exhibiting leadership skills. In grade school I never had to fear being rejected by my peers because of my interests. I was not bombarded by images and slogans telling me that my true worth was in how I look, and that I should abstain from certain activities because I might be thought too masculine. I was not overlooked by teachers who assumed that the reason I did not understand a tough math or science concept was, after all, because of my gender. I have had no difficulty whatsoever with a boys club mentality, and I will not face added scrutiny or remarks of my being the 'diversity hire.' When I experience success the assumption of others will be that I earned it. So, you and I cannot be equal. You have already conquered far more to be in this field than I will ever face.

—Jared Mauldin  
(Senior in  
Mechanical  
Engineering)

[On Katherine Johnson] As a computer, she calculated the trajectory for Alan Shepard, the first American in space. Even after NASA began using electronic computers, John Glenn requested that she personally recheck the calculations made by the new electronic computers before his flight aboard Friendship 7—the mission on which he became the first American to orbit the Earth. She continued to work at NASA until 1986 combining her math talent with electronic computer skills. Her calculations proved as critical to the success of the Apollo Moon landing program and the start of the Space Shuttle program, as they did to those first steps on the country's journey into space.

—Yvette Smith

To invent, you need a good imagination and a pile of junk.

—Thomas Edison

Man, with the wonderful and terrible powers that science has put in his hands, stands in greater need than ever before of an ethic to guide his steps. The environmental warnings we see around us are warnings not only to our engineering skills, but to our spirits.

—Shirley Temple Black

Computer science and engineering education [should] offer more than technical skills and ‘coding for all,’ and it wouldn’t be limited to students in only those fields. Instead, English majors might explore the connection between surveillance systems and immigration. Drama students could act out how social media platforms and search engines can reinforce racism and sexism. And even young children would be able to understand, analyze, and thoughtfully question the technologies that profoundly shape their lives.

New technology has created many social benefits—think advances in healthcare and expanded access to education. But the same technology that makes it possible to unlock an iPhone also has dark consequences, such as law enforcement’s misidentification of innocent individuals. As schools around the nation increasingly incorporate computer science and engineering education into their curriculum, educators [should] prioritize an often overlooked aspect of technology: its intersections with ethics, culture, and power.

—David Johnson

How to write ‘I changed a lightbulb’ on your resume: ‘Single-handedly managed the successful upgrade and deployment of a new environmental illumination system with zero cost overruns and no safety incidents.’

—Internet Meme

The basic ‘Three E’s’ of traffic safety—education, engineering and enforcement.

--C. F. Butcher

Concern for man himself and his safety must always form the chief interest of all technical endeavours.

—Albert Einstein

To solve engineering problems, you use your brain. Solving classroom problems uses your whole being.

—Ryan Fuller, Former  
Aerospace  
Engineer

Without a single degree, the Romans built us roads that have lasted an eternity.

—*theChive*

Our civil engineering is best better than most countries. Have been abroad to England/South Africa/Philippines and was struck by how different a.k.a. organized many things we take for granted are in the US from municipal utilities to driving code/structure to building arrangement to household fixtures and the list goes on. It's remarkable how polished they are here. Or worst is still far better than many most likely. Hats off to the men and women involved in that work.

—*theChive*

If the BlackBerry's rise was due in large part to his success in scientific thinking as an engineer, its demise was in many ways the result of his failure in rethinking as a CEO.

—Adam M. Grant

Disagreeable people tend to be more critical, skeptical, and challenging—and they're more likely than their peers to become engineers and lawyers. They're not just comfortable with conflict; it energizes them. If you're highly disagreeable, you might be happier in an argument than in a friendly conversation.

—Adam M. Grant

When we look at the engineers with the highest productivity, the evidence shows that they're givers....The California engineers with the best objective scores for quantity and quality of results are those who consistently give more to their colleagues than they get.

—Adam M. Grant

In North American universities, more than half of STEM professors spend at least 80 percent of their time lecturing, just over a quarter incorporate bits of interactivity, and fewer than a fifth use truly student-centered methods that involve active learning.

—Adam M. Grant (2013)

Of all engineers, the most productive were those who gave often, and gave more than they received. These were the true Givers, and they had the highest productivity, and the highest status. They were revered by their peers. By giving often, engineers built up more trust, and attracted more valuable help across their work groups—Not just from the people they helped.

—Adam Grant

By some estimates, the United States needs at least 50,000 new semiconductor engineers over the next five years to staff all of the new factories and research labs that companies have said they plan to build with subsidies from the Chips and Science Act, a number far exceeding current graduation rates nationwide, according to Purdue [University]. Additionally, legions of engineers in other specialties will be needed to deliver on other White House priorities, including the retooling of auto manufacturing for electric vehicles and the production of technology aimed at reducing U.S. dependence on fossil fuels.

—Jeanne Whalen (2022)

Engineers in the United States have long enjoyed unemployment rates below those of other college grads—rates that are now hovering near all-time lows amid soaring demand for their skills.

—Jeanne Whalen (2022)

Japan is the highest-tech nation on earth, according to a trade-data analysis from Ulrich Schetter, a researcher at *Harvard University's Growth Lab*. South Korea comes in second after a meteoric rise up the ranks, and Germany is now third, having slid from the dominant technical position it held in the 1960s and '70s. The United States slipped to 12th, just behind France and Britain and just ahead of Singapore and Slovenia—raising the prospect that the world's top political and military power could fall behind China, where technology is advancing steadily.

—Andrew Van Dam  
(2022)

Australian company Tarmac Linemarking, in collaboration with OmniGrip and Vic Roads, completed a 'trial run' of new photoluminescent linemarkings....The 'smarter path' line markings use the natural science of photoluminescence—similar to the process used in glow-in-the-dark childrens' stickers, toys or watches. When it's dark, the coating emits light it has absorbed and stored through the day, so that the lines and pavement markings can be better seen.

—<https://www.schoolandcollegelistings.com>

The seeds farmers plant are carefully crafted by years of state-of-the-art research to maximize yield and efficiency. Gene sequencing and molecular markers help track the best traits when breeding new crops. Chemical mutagens and radiation speed up evolution by introducing new mutations. And genetic engineering enables scientists to move genes between species or turn off genes for undesirable characteristics. Organic farms are not necessarily any less high-tech. Except of genetic engineering, all the above technologies improve yields on many USDA-certified organic farms.

—Jenna Gallegos

*Northwestern* engineers have developed the smallest-ever-remote-controlled-walking robo—and it’s shaped like a crab. And just a half-millimeter wide, these tiny crabs can bend, twist, walk, turn and even jump. Although the research is exploratory, the engineers believe microrobots could eventually perform practical tasks inside tight spaces.

—*Northwestern  
Magazine  
(Fall 2022)*

The Girls Who Code curriculum is designed to help show young women that the field of coding is much more diverse and is involved with more industries than they may realize. In addition to tech-specific jobs, coding can be the starting point for other career sectors. ‘It’ll focus on female engineers, it’ll focus on female jobs that maybe you wouldn’t necessarily think would fall under the computer science realm, but do,’ [Dr. Karee] McAndrew says. ‘So it gives girls that view to say like, ‘Oh, wow, they look at all these great females and what they’re doing and how successful they are. And they followed the path of computer science or science to end up in the position that they are.’

—Erik Ofgang

As educators, we face tremendous pressures to pack technical materials into our [engineering] courses. So why should we include history in our lesson plans?... History provides a compelling perspective on the process of scientific discovery. We have known through research that historical references can help students clear up common misconceptions about scientific topics, ranging from planetary motion to evolution. Looking at the story of science over centuries enables students to understand that research and discovery are continuous processes. They can then see that the laws and the equations that they use to solve problems were discovered through long and sometimes painful processes. The findings they arrive at today, in other words, are the fruits of the hard work of real people who lived in real societies and had complex lives, just like the rest of us.

—Muhammad H. Zaman

A sense of history teaches students the all-important value of failure in science. It also highlights the persistence of the scientists who continued to push against the odds. Recent research suggests that by discussing the struggles and failures of scientists, teachers are able to motivate students. Indeed, the discussion of struggles, obstacles, failures and persistence can lead to significant academic improvement of students.

—Muhammad H. Zaman

A fundamental goal of modern engineering education is to create socially conscious engineering practitioners who have a strong sense of ethics. Following an engineering education, individuals could go on to develop medical technology for resource-constrained settings, or work on stem cells or genetic engineering. The importance of ethics in any of these areas cannot be underestimated.

—Muhammad H. Zaman

Cities in Greece struggle to build subway systems because they keep digging up ancient ruins.

—theChive

Our mythology of science and technology treats the moment of discovery or invention as a sacred scene. In school, students memorize the dates of major inventions, along with the names of the people who made them—Edison, lightbulb, 1879; Wright Brothers, airplane, 1903. The discoverers—Franklin, Bell, Curie, Tesla— get best selling biographies, and millions of people know their name. This is the eureka theory of history....But in the past few years, I've come to think that this approach to history is wrong. Inventions do matter greatly to progress, of course. But too often, when we isolate these famous eureka moments, we leave out the most important chapters of the story—the ones that follow the initial lightning bolt of discovery....When a good idea is born, or when the first prototype of an invention is created, we should celebrate its potential to change the world. But progress is as much about implementation as it is about invention. The way individuals and institutions take an idea from one to 1 billion is the story of how all of the world really changes.

—Derek Thompson

The U.S. has more Nobel Prizes for science than the U.K., Germany, France, Japan, Canada, and Austria combined. But if there were a Nobel Prize for the deployment and widespread adoption of technology—even the technology that we invented, even technology that's not so new anymore—our legacy wouldn't be so sterling. Americans invented the first nuclear reactor, the solar cell, and the microchip, but today, we're well behind a variety of European and Asian countries in deploying and improving these technologies. We were home to some of the world's first subway systems, but our average cost per mile for tunnel projects today is the highest in the world. The U.S. did more than any other nation to advanced the production of the mRNA vaccines against COVID-19, but also leads the developed world in vaccine refusal.

—Derek Thompson

Implementation, not mere invention, determines the pace of progress—a lesson the U.S. has failed to heed for the past several generations....Even the majestic breakthroughs are typically incomplete, expensive, and unreliable. ‘Most major interventions initially don’t work very well, the economic historian Joel Mokyr told me. ‘They have to be tweaked, the way the steam engine was tinkered with my many engineers over decades. They have to be embodied by infrastructure, the way nuclear fission can’t produce much energy until it’s inside a nuclear reactor. And they have to be built at scale, to bring down the price and make a big difference to people.’

—Derek Thompson

One regrettable feature of history is that it sometimes takes a catastrophe to fast-forward progress. The U.S. directly advanced airplane technology during World War I; radar, penicillin manufacturing, and nuclear technology during World War II; the Internet and GPS during the Cold War; mRNA technology during the pandemic. A crisis is a focusing mechanism.

—Derek Thompson

We’re living through the birth of a new species of skyscraper that not even architects and engineers saw coming. After 9/11, experts concluded that skyscrapers were finished. Tall buildings that were in the works got scaled down or canceled on the assumption that soaring towers were too risky to be built or occupied. ‘There were all sorts of symposiums and public statements that we’re never going to build tall again,’ one former architect told the Guardian in 2021. ‘All we’ve done in the past 20 years since is build even taller.’

—Bianca Bosker

There are skyscrapers, and then there are supertalls, often defined as buildings more than 300 meters in height, but better known as the cloud-puncturing, sci-fi towers that look like digital renderings....In 2019 alone, developers added more supertalls than had existed prior to the year 2000; there are now a couple hundred worldwide, including Dubai’s 163-story Burj Khalifa (a hypodermic needle aimed at space), Tianjin’s 97-floor CTF Finance Center (reminiscent of a drill bit boring the clouds), and... Manhattan’s 84-floor Steinway Tower (a luxury condominium resembling the love child of a Dustbuster and a Mach3 razor).

—Bianca Bosker

There is no doubt that super-tall, slender buildings are the most technologically advanced constructions in the world.

—Civil Engineering and  
Architecture (2021)

Building engineers, like judgy modeling agents, have varying definitions of superslim, but they usually agree that such buildings must have a height-to-width ratio of at least 10 to 1. To put that in perspective, the Empire State Building (one of the world's first supertalls, completed in 1931) is about three times taller than it is wide —'pudgy,' as one engineer described it to me. Steinway Tower is 24 times taller than it is wide—nearly as slim as a No. 2 pencil, and the skinniest supertall in the world....These superslim buildings—and supertalls generally—have relied on engineering breakthroughs to combat the perilous physics that go with height.

—Bianca Bosker

Over the past few decades, new combinations of materials like microsilica and fly ash (a residue that results from burning coal) have made concrete steroidally strong—10 times as strong as the stuff down on the sidewalk.

—Bill Baker

The Roman Pantheon, built in 118 A.D. by the emperor Hadrian, is still the largest unreinforced concrete dome in the world.

—*theChive*

I am writing my PhD thesis in theoretical physics and every time I have to decide between using  $>$  and  $<$  I think to myself 'the crocodile wants to eat the bigger number.'

—*theChive* Contributor

The majestic structures of ancient Rome have survived for millennia—a testament to the ingenuity of Roman engineers, who perfected the use of concrete.... Roman concrete, in many cases, has proven to be longer-lasting than its modern equivalent, which can deteriorate within decades....white chunks in the concrete, referred to as lime clasts, gave the concrete the ability to heal cracks that formed over time. The white chunks previously had been overlooked as evidence of sloppy mixing or poor-quality raw material.

'For me, it was really difficult to believe that ancient Roman (engineers) would not do a good job because they really made careful effort when choosing and processing materials,' said...Admir Masic, an associate professor of civil and environmental engineering at the Massachusetts Institute of Technology. 'Scholars wrote down precise recipes and imposed them on construction sites (across the Roman Empire).'

—Katie Hunt



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