National Academy of Engineering
2101 Constitution Ave., NW
Washington, DC 20418

Date: February 22, 2000
Contacts: Charles E. Blue, American Association of Engineering Societies
(202) 296-2237 x16; e-mail <cblue@aaes.org>; cell phone (888) 285-8865 x57834
Donald Lehr, National Engineers Week
(212) 967-8200; e-mail <74731.2172@compuserve.com>; cell phone (917) 304-4058
Robin Gibbin, National Academy of Engineering
(202) 334-1562; e-mail <rgibbin@nae.edu>

[EMBARGOED: NOT FOR PUBLIC RELEASE BEFORE 1:00 P.M. EST TUESDAY, FEB. 22]

National Academy of Engineering Reveals Top Engineering Impacts of the 20th Century: Electrification Cited as Most Important

WASHINGTON – One hundred years ago, life was a constant struggle against disease, pollution, deforestation, treacherous working conditions, and enormous cultural divides unbreachable with current communications technologies. By the end of the 20th century, the world had become a healthier, safer, and more productive place, primarily because of engineering achievements.

Speaking on behalf of the National Academy of Engineering (NAE), astronaut/engineer Neil Armstrong today announced the 20 engineering achievements that have had the greatest impact on quality of life in the 20th century. The announcement was made during National Engineers Week 2000 at a National Press Club luncheon. [1]

The achievements – nominated by 29 professional engineering societies – were selected and ranked by a distinguished panel of the nation's top engineers. Convened by the NAE, this committee – chaired by H. Guyford Stever, former director of the National Science Foundation (1972-76) and Science Advisor to the President (1973-76) – worked in anonymity to ensure the unbiased nature of its deliberations.

"As we look at engineering breakthroughs selected by the National Academy of Engineering, we can see that if any one of them were removed, our world would be a very different – and much less hospitable place," said Armstrong. Armstrong's announcement of the top 20 list, which includes **space exploration** as the 12th most important achievement, covers an incredibly broad spectrum of human endeavor – from the vast networks of **electrification** in the world (No. 1), to the development of **high-performance materials** (No. 20) such as steel alloys, polymers, synthetic fibers, composites and ceramics. In between are advancements that have revolutionized the way people live (**safe water supply and treatment**, No. 4, and **health technologies**, No. 16); work (**computers**, No. 8, and **telephones**, No. 9); play (**radio and television**, No. 6); and travel (**automobile**, No.2, **airplane**, No.3, and **interstate highways,** No.11).

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[1] National Engineers Week 2000 is held February 20-26. National Engineers Week always falls around the birth date of George Washington, who was a surveyor and is often cited as America's first engineer.

In his statement delivered to the National Press Club, Armstrong said that he was delighted to announce the list of the greatest achievements to underscore his commitment to advancing the understanding of the critical importance of engineering. "Almost every part of our lives underwent profound changes during the past 100 years thanks to the efforts of engineers, changes impossible to imagine a century ago. People living in the early 1900s would be amazed at the advancements wrought by engineers," he said, adding, "as someone who has experienced firsthand one of engineering's most incredible advancements – space exploration – I have no doubt that the next 100 years will be even more amazing."

The NAE notes that the top achievement, electrification, powers almost every pursuit and enterprise in modern society. It has literally lighted the world and impacted countless areas of daily life, including food production and processing, air conditioning and heating, refrigeration, entertainment, transportation, communication, health care, and computers.

Many of the top 20 achievements, given the immediacy of their impact on the public, seem obvious choices, such as automobiles, at No. 2, and the airplane, at No. 3. These achievements, along with space exploration, the nation's interstate highway system at No. 11, and **petroleum and gas technologies** at No. 17, made travel and mobility-related achievements the single largest segment of engineering to be recognized.

Other achievements are less obvious, but nonetheless introduced changes of staggering proportions. The No. 4 achievement, for example, the availability of safe and abundant water, literally changed the way Americans lived and died during the last century. In the early 1900s, waterborne diseases like typhoid fever and cholera killed tens-of-thousands of people annually, and dysentery and diarrhea, the most common waterborne diseases, were the third largest cause of death. By the 1940s, however, water treatment and distribution systems devised by engineers had almost totally eliminated these diseases in America and other developed nations. They also brought water to vast tracts of land that would otherwise have been uninhabitable.

Number 10, **air conditioning and refrigeration technologies,** underscores how seemingly commonplace technologies can have a staggering impact on the economy of cities and worker productivity. Air conditioning and refrigeration allowed people to live and work effectively in sweltering climates, had a profound impact on the distribution and preservation of our food supply, and provided stable environments for the sensitive components that underlie today’s information-technology economy.

Referring to achievements that may escape notice by most of the general public, Wm. A. Wulf, president of the National Academy of Engineering, said, "Engineering is all around us, so people often take it for granted, like air and water. Ask yourself, what do I touch that is not engineered? Engineering develops and delivers consumer goods, builds the networks of highways, air and rail travel, and the Internet, mass produces antibiotics, creates artificial heart valves, builds lasers, and offers such wonders as imaging technology and conveniences like microwave ovens and compact discs. In short, engineers make our quality of life possible."

SELECTION PROCESS

The process for choosing the greatest achievements began in the fall of 1999, when the National Academy of Engineering, an autonomous non-profit organization of outstanding engineers founded under the congressional charter that established the National Academy of

Sciences, invited discipline-specific professional engineering societies to nominate up to ten achievements. A list of 105 selections was given to a committee of academy members representing the various disciplines. The panel convened on December 9 and 10, 1999, and selected and ranked the top 20 achievements. The overarching criterion used was that those advancements had made the greatest contribution to the quality of life in the past 100 years. Even though some of the achievements, such as the telephone and the automobile, were invented in the 1800s, they were included because their impact on society was felt on the 20th century.

THE ACHIEVEMENTS

Here is the complete list of achievements as announced today by Mr. Armstrong:

1) Electrification – the vast networks of electricity that power the developed world.
2) Automobile – revolutionary manufacturing practices made the automobile the world's major mode of transportation by making cars more reliable and affordable to the masses.
3) Airplane – flying made the world accessible, spurring globalization on a grand scale.
4) Safe and Abundant Water – preventing the spread of disease, increasing life expectancy.
5) Electronics – vacuum tubes and, later, transistors that underlie nearly all modern life.
6) Radio and Television – dramatically changed the way the world received information and entertainment.
7) Agricultural Mechanization – leading to a vastly larger, safer, less costly food supply.
8) Computers – the heart of the numerous operations and systems that impact our lives.
9) Telephone – changing the way the world communicates personally and in business.
10) Air Conditioning and Refrigeration – beyond convenience, it extends the shelf life of food and medicines, protects electronics, and plays an important role in health care delivery.
11) Interstate Highways – 44,000 miles of U.S. highway allowing goods distribution and personal access.
12) Space Exploration – going to outer space vastly expanded humanity's horizons and introduced 60,000 new products on Earth.
13) Internet – a global communications and information system of unparalleled access.
14) Imaging Technologies – revolutionized medical diagnostics.
15) Household Appliances – eliminated strenuous, laborious tasks, especially for women.
16) Health Technologies – mass production of antibiotics and artificial implants led to vast health improvements.
17) Petroleum and Gas Technologies – the fuels that energized the 20th century.
18) Laser and Fiber Optics – applications are wide and varied, including almost simultaneous worldwide communications, non-invasive surgery, and point-of-sale scanners.
19) Nuclear Technologies – from splitting the atom, we gained a new source of electric power.
20) High Performance Materials – higher quality, lighter, stronger, and more adaptable.

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Editors Notes

Additional information and visuals are available at http://www.greatachievements.org.

Greatest Engineering Achievements of the 20th Century is a collaborative project led by the National Academy of Engineering, with the American Association of Engineering Societies, National Engineers Week, and 29 engineering societies.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers.

Since its founding in 1951 by the National Society of Professional Engineers, National Engineers Week, a consortium of more than 100 engineering, scientific, education societies, and major corporations, has helped increase public awareness and appreciation of technology and the engineering profession. National Engineers Week 2000 co-chairs are the American Consulting Engineers Council (ACEC), a national organization of private engineering firms, and CH2M HILL, a global engineering company specializing in water and wastewater, environmental management, transportation, telecommunications, industrial facilities, and related infrastructure.

American Association of Engineering Societies is a federation of engineering societies dedicated to advancing the knowledge, understanding, and practice of engineering whose membership represents more than one million engineers in the United States.