Testimony of
Paul R. Gudonis,
President of *FIRST*

Before the
Subcommittee on Healthy Families and Communities
"Renewing the Spirit of National And Community Service"

Committee on Education and Labor

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Good morning and thank you, Chairwoman McCarthy, Ranking Member Platts, and members of the Subcommittee.

My name is Paul Gudonis, and I am President of *FIRST*, a nonprofit organization whose 60,000 volunteers share a common vision: To inspire young people to dream of becoming science and technology heroes. *FIRST*, which stands for, For Inspiration and Recognition of Science and Technology, was founded 18 years ago by inventor Dean Kamen to address the cultural problem we face to excite our young people about the world of science, engineering and technology.

Many of America's future challenges – finding new sources of energy, fighting disease, cleaning the environment, and responding to threats to our national security – will require new technologies as well as political will and community engagement. *FIRST* works to interest today's students in becoming tomorrow's innovators.

FIRST accomplishes this objective by engaging over 130,000 students annually in robotics competitions – a sport of the mind, which emphasizes innovation, teamwork, co-opetition (competing while collaborating) and Gracious Professionalism. We offer a set of programs for students in grades K-12: Junior *FIRST* LEGO League for the youngest students; *FIRST* LEGO League for middle school children; and the *FIRST* Robotics Competition and junior varsity *FIRST* Vex Challenge for high school students. Starting in the fall of each school year, teams of 10 students in grade school sign up for the *FIRST* LEGO League while high school teams of 25 students join the *FIRST* Robotics Competition. They work side-by-side with professional engineers and scientists from over 2000 companies and institutions: large corporations such as GM, GE, IBM, Xerox, and Boeing; technology companies such as Google, Cisco, and Microsoft; leading universities including MIT and Georgia Tech; and government agencies such as NASA.

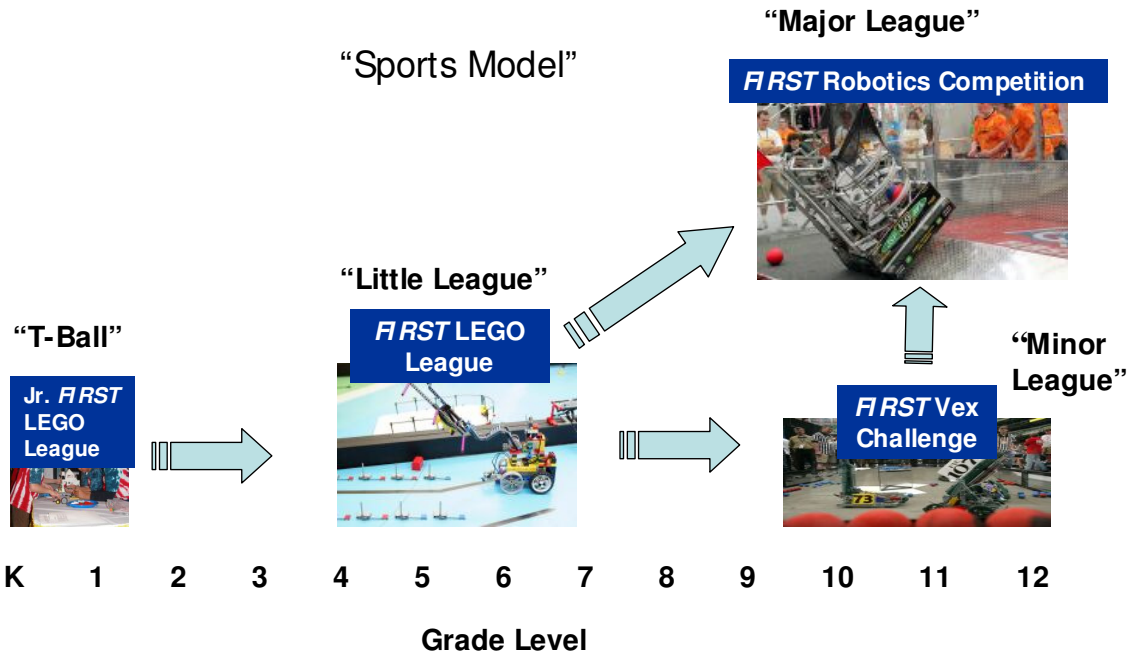
The idea behind *FIRST* is a simple one: Young people love the competition and spectacle of sport, and they look up to adult role models. The role models in *FIRST* are our nation's best and brightest, whose day jobs may be designing the newest aircraft at Lockheed-Martin or developing the latest wireless technology at Motorola. By volunteering on a *FIRST* team, they mentor these students and open up new opportunities for them in science and engineering. And as for spectacle, I just returned from the *FIRST* Championship, the Super Bowl of Smarts, which was attended by 20,000 people in the Georgia Dome, site of the 1996 Summer Olympics and that other Super Bowl a few years ago. Millions watched the coverage on CNN and on the Internet.

The challenge for *FIRST* is not just in forming new teams and attracting even more volunteers. We also face a major cultural problem here in the United States. The media lionize sports stars and Hollywood idols and inundate our youth with messages that lead them to believe that their best opportunity in life is to spend hours bouncing a ball to earn a shoe contract, or to sing their way to fame. A culture gets what it celebrates, and unfortunately, we are not celebrating the hard work and ingenuity that created this nation's high standard of living and leading, competitive economy. We take for granted that we have electricity, clean water, transportation systems, computers and telecommunications, and a longer lifespan due to our advances in medical technology.

Addressing this problem is what convinced Dean Kamen to start *FIRST*. As a National Medal of Technology recipient, holder of over 450 patents, and inventor of numerous medical devices, he launched FIRST in 1989 with the support of a group of concerned CEO's from some of America's major companies. FIRST is established as a 501 (c) 3 nonprofit organization headquartered in Manchester, New Hampshire. The board of directors is composed of individuals who have experience as senior executives of major corporations involved in medical technology, information systems, automobile manufacturing, aerospace, education, and other fields. The Chairman of the Board is John Abele, founder and retired chairman of Boston Scientific. The organization has an operating budget of $22 million annually and fulltime staff of 70 people, twenty of whom are deployed in field locations across the United States.

FIRST PROGRAMS

At the heart of *FIRST* is an interlinked continuum of programs providing life-changing experiences for young people ages six to eighteen. *FIRST* programs provide ever increasing challenges in the field of science, technology and engineering with the goal of engaging children in their early school years and then advancing them to the flagship program the "*FIRST* Robotics Competition" for high school students. The *FIRST* continuum is depicted below:



FIRST LEGO League (FLL) is designed for students 9-14, and Junior *FIRST* LEGO League is for kids 6-9. Each September, FLL teams of up to 10 children take on a new Challenge based on current real-world problems facing scientists and engineers globally. FLL has two key parts. In the robot game, teams design, build, test and program autonomous robots that must perform a series of tasks or missions. In the research project, teams conduct research and create technological or engineering solutions and must present their findings to a panel of judges at tournaments. Teams participate in one-day events during a three-month tournament season.

The *FIRST* Vex Challenge (FVC) is designed for small teams of high school aged students who work with one or two dedicated mentors to design, build, and test a robot using an off-the-shelf kit. Teams, which typically meet once or twice a week, maintain an engineering notebook through the season to document the

engineering process and their journey from initial concept to final design. In challenges that change each year, robots operate autonomously and under operator control.

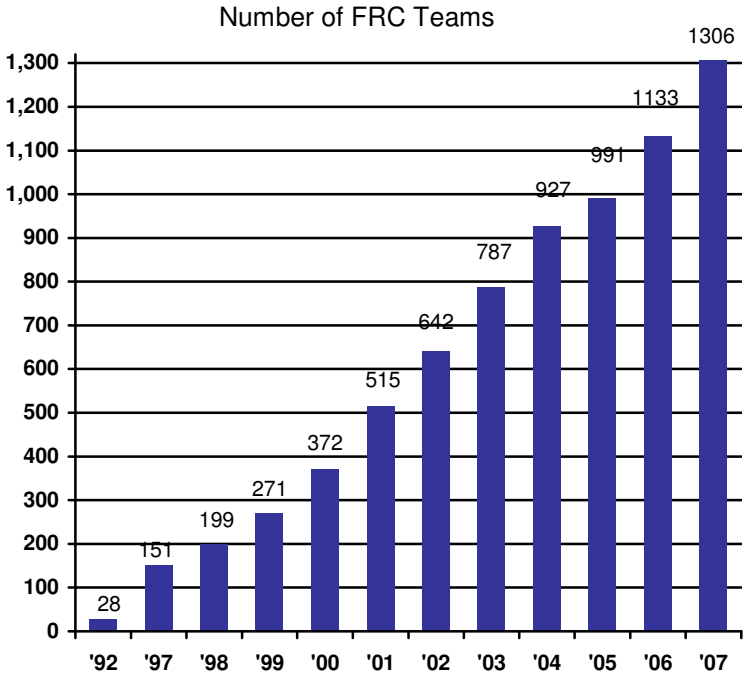
In the *FIRST* Robotics Competition (FRC), teams of high school students have a thorough experience of the process of innovation and engineering during an extremely intense 6-week “design/build” season starting in early January. Teams receive a common "Kit of Parts" in a large crate. There are no instructions, just a set of rules for the year’s game. Students work with mentors – engineers, technologists, business people, and innovators – to create a team and robot that competes and collaborates in alliances during three-day events in March. During the season, many teams work daily for 2-4 hours or more. According to many, “FRC is a ‘real-life’ engineering experience. We never have enough time, information, or money, but we do have a hard deadline and we know there are 1,300 other teams working just as hard as we are.”

Youth can participate in *FIRST* LEGO League, *FIRST* Vex Challenge and *FIRST* Robotics Competition from kindergarten through high school. Adults, including many *FIRST* alumni, become team mentors or volunteers of many types. The experience of *FIRST* participants is further enhanced by *FIRST*’s unique, powerful collaboration with industry, academia, government, and non-profits.

While our mission is to inspire young people through these after-school activities, there is a lot of learning going on. Students use mathematics in designing their robots (algebra, geometry, trigonometry, and calculus); they apply principles of physics and chemistry and learn to experiment while building these machines. To encourage sound engineering practices, teams are required to document their work in an Engineering Notebook. To compete for awards, they must develop skills in language arts, writing their award submissions and honing their public speaking abilities. Operating a *FIRST* team is much like running a small business enterprise, and teams have to develop a marketing and public relations plan, raise the necessary funds (salesmanship), and keep track of their finances. They also develop skills in computer programming by creating a website for their teams and using professional Computer Aided Design and 3D animation software as part of their design process.

PROGRAM GROWTH

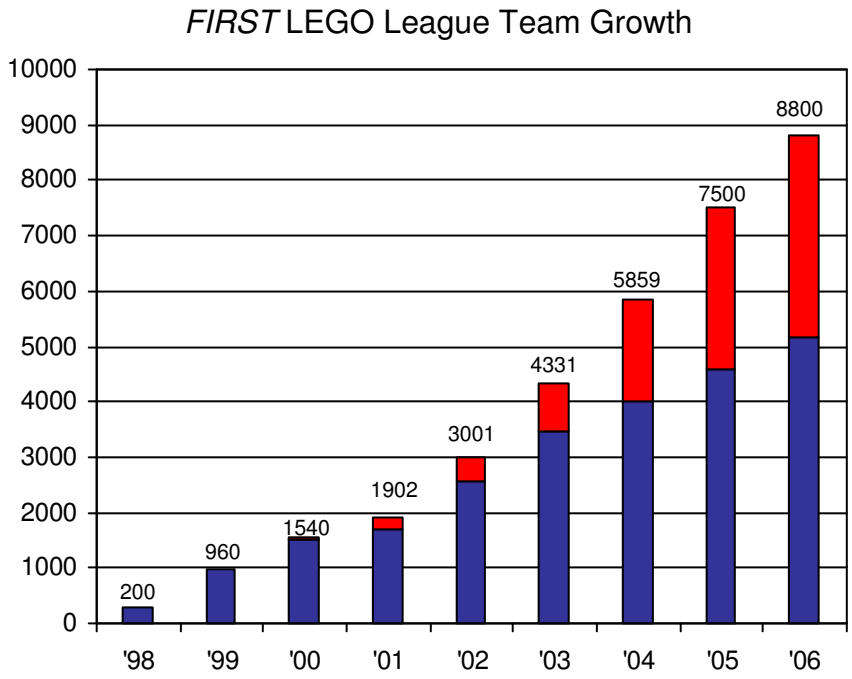
The *FIRST* Robotics Competition (FRC) has grown from 28 teams of high school students in its inaugural year of 1992 to 1306 in the current season. In the upcoming year, we will be holding a record 41 regional tournaments in the United States, Canada, Brazil, and Israel as qualifying events for the *FIRST* Championship that will be held in Atlanta, Georgia in April 2008.



Locations of FRC Regional Tournaments

Each year, a panel of volunteers from industry and academia design a new research challenge for the FIRST LEGO League teams. In 2003, the game was Mission Mars, based upon NASA's Spirit and Opportunity robotic exploration of the planet Mars. In 2004, the teams researched human disabilities in the No Limits challenge. In 2005, the children studied the seas in Ocean Odyssey, and in this past season, they learned about nanotechnology as they studied bucky balls, carbon nanotubes, and other molecular structures. For 2007, they will be tackling the world of alternative energy in Power Puzzle, a very relevant topic to our nation's environment and energy security.

The *FIRST* LEGO League has grown to over 8800 teams in the United States and 45 countries through the relationship *FIRST* has with the LEGO Company, which manufacturers the Mindstorms robotics kits used in this program.



VOLUNTEERS

FIRST is possible because of the commitment of 60,000 volunteers who serve as team mentors, technical advisors. judges, referees, fundraisers, tournament organizers, and in various support capacities. They are professional engineers and scientists, teachers, parents, university students and faculty, *FIRST* alumni, and retirees. They share a common vision of what adult role models can do to inspire the young people who participate on a *FIRST* team. Like pro sports figures or Hollywood icons, these volunteers are the real "rock stars of *FIRST*."

Over 2000 corporate sponsors encourage their technical employees to volunteer for *FIRST*. These companies recognize that they have a role to play in ensuring the nation's competitive leadership by developing the next generation of technical talent. These employers are facing a shortage of trained scientists and engineers, especially as "baby boomers" approach their retirement age. As Mr. Al Canton, Executive Director of General Motors' Proving Grounds and Test Operations put it, "We believe getting kids involved in science and technology is good for everyone, and it certainly feeds our pipeline for future engineers."

Mr. Galen Ho, President-Information and Electronic Warfare Systems for BAE Systems North America concurs. He states, "*FIRST* is a wise investment for BAE Systems because it energizes tomorrow's scientists, engineers, and leaders. That's good for the individual student, the community, and the nation." Likewise, Mr. Steve Sanghi, CEO of Microchip Technology in Arizona explained that "*FIRST* isn't just about building robots, it's about developing life skills. The kids learn skills in relationships, teamwork, finance, fundraising, budgeting, and project management. The partnership between academia, the community, and industry… will build our future employees and future citizens."

The *FIRST* staff recruits, trains, and supports the many volunteers who donate their time and talents to *FIRST* teams. *FIRST* provides handbooks and coaches' guides, conducts online and in-person workshops, and publishes information via our website to enable these volunteers to serve effectively. *FIRST* also screens volunteers for certain positions and collaborates with schools and other organizations to make sure that volunteers are appropriate for these activities.

The Corporation for National and Community Service administers funding for approximately 20 volunteers who serve as *FIRST* Senior Mentors, reaching out in their communities to recruit additional teams and connect them with volunteer mentors from local corporations. In addition, a dozen AmeriCorps VISTA volunteers assist in their geographic areas to support new *FIRST* teams, thus engaging more schools and communities in the *FIRST* experience. These resources are highly effective for *FIRST* by multiplying their impact—a single volunteer in this role attracts 100 mentors and supporters to the program.

Other volunteer organizations also combine their resources with *FIRST* to reach more students and communities. Through local partnerships with Boys and Girls Clubs, Girl Scouts, IEEE, Girls Inc., and the Society of Women Engineers (SWE) among others, *FIRST* is able to establish and mentor additional teams and bring the excitement of participating in *FIRST* to more young people.

While the number of *FIRST* volunteers grows each year with the growth of the various programs and expansion into new cities and states, we have a very high retention rate among these dedicated individuals. Some *FIRST* Robotics Competition teams have been in existence in their communities for over a dozen years, and while the students have graduated and moved on, the engineering mentors often remain committed to these teams, constantly inspiring a new cohort of students that are coming through the program.

SPONSORSHIP

Conducting these programs requires funding in addition to the significant volunteer manpower involved in making *FIRST* happen. Teams are encouraged to raise the money to pay for robotics kits, extra parts, uniforms, and travel by asking major corporations, local businesses, and individuals to support their participation in *FIRST*. Corporate sponsors are the largest source of funding for teams, often sponsoring multiple teams through their business units across the country. For example, GM provides funding and 275 engineering mentors for 55 FRC teams, supports over 100 *FIRST* LEGO League teams, and sponsors several regional tournaments. GE supports twenty-five FRC teams and other FIRST programs, and Motorola sponsors FRC and FLL teams, in conjunction with their Girl Scouts of the USA initiative.

In addition to providing cash contributions, many companies donate materials for the robotics kits. We are able to keep down the cost of participating in *FIRST* thanks to the generous contribution of motors, gears, pneumatics, batteries, and many other components by industry suppliers. Software maker Autodesk provides professional-grade design software to all of the FRC teams. Federal Express has donated free shipping of the kits of parts and finished robots for many years; this past season, that amounted to over 100 tons of free shipping.

Universities also sponsor *FIRST* events. In some cases, they will contribute to the cost of a regional tournament, provide students and facilities for one of the robotics teams, or subsidize the cost of the basketball arena to be used as a competition venue.

SCHOLARSHIPS

These universities also support *FIRST*'s goal of increasing student interest in science and engineering careers by enabling their college education. Over 75 colleges and universities offer 430 scholarships totaling $8 million in value to *FIRST* graduates. These scholarships are available to *FIRST* team members who are accepted by the college or university and meet any other financial aid criteria established by the institution. From what the universities tell us, they love *FIRST* program veterans because they make excellent science and engineering students because of their hands-on experiences and adoption of *FIRST* values.

IMPACT

Does *FIRST* accomplish its mission? Based on research conducted by Brandeis University, *FIRST* participants are 50% more likely to attend college, twice as likely go on to major in science or engineering, and three times as likely as a comparison group to major specifically in engineering. Upon entering college, they are nine times as likely to have an internship with a company and they expect to pursue a career in engineering at four times the rate of a comparison group of matched peers. For women and minorities, the results are equally dramatic: Young women go on to studies in science and engineering at three times the average, and minority members of *FIRST* teams enter these fields at 150% the rate of non-participants. Executive Summaries of these studies are included in Appendices A and B.

There are many individual stories as well. A young man in Brooklyn wrote to me about how, before joining a *FIRST* team, he belonged to another type of team, one you grow up with on the streets, but can't talk about. He wasn't very interested in school, smoked two bags of marijuana a day, and had been arrested for robbery, possession, and selling. Since he joined the *FIRST* Robotics team, mentored by some wonderful technologists, he has stayed in school, has a "legal salary job" for the *FIRST* time in his life, and is looking forward to college.

A team composed primarily of minorities in Phoenix attends a school where only 10 percent of the students continue their education beyond high school. All six graduating *FIRST* team members this past year earned full scholarships to Arizona State University. Being on a *FIRST* team has opened up a new world of opportunity for them – and created a group of motivated, smart individuals who will be pursuing careers in science and technology.

The mentors pass on their passion for science and technology, and, as importantly, a set of values that includes community service, *FIRST* students are twice as likely to become volunteers and believe that they should be leaders in their communities. During the off season, *FIRST* high schools teams mentor

younger students with their LEGO robotics kits; they are helping to rebuild homes devastated by Hurricane Katrina, and they are using their talents to develop science programs to share the fun with other young people.

FIRST's highest award is the Chairman's Award, and it is not for the fastest or highest-scoring robot. Rather, the judges select the team that best reaches out to their community, recruiting and mentoring rookie teams and performing service projects that exhibit the values of *FIRST.*

INCREASING THE IMPACT OF *FIRST*

Thanks to the energy and commitment of these wonderful volunteers, we've grown dramatically, yet only 5% of US high schools have a *FIRST* team. Some states have even fewer; New Hampshire leads the nation with 38% of its high schools boasting a *FIRST* team. In Rhode Island, every high school now has an opportunity to compete in the FIRST Vex Challenge program. As Governor Jennifer Granholm of Michigan stated during her visit to the Detroit *FIRST* Robotics Competition regional tournament last year, "Just as every high school has a football team, it should have a *FIRST* team." That's how we'll change the culture of our country.

We have the volunteers, and I can find more among our nation's technology companies and the large corps of retired engineers who want to share their skills with young people. The biggest obstacles to starting more *FIRST* teams and engaging more students is finding additional sponsors and convincing teachers to take on the extra load of coaching a *FIRST* Robotics team. Teachers are already overworked and underpaid, and we know from experience that offering them a stipend would be a big boost to the program for a variety of reasons.

Teachers who coach football and basketball teams or organize the school play often receive extra pay for their time. We should do the same for the teachers who will spend their nights and weekends inspiring the next generation of innovators, medical researchers, and technology entrepreneurs that have made this nation the leader that it is.

FIRST will work with states and local communities to address this issue, and continue to seek out additional sponsors and supporters of *FIRST* teams. Our board of directors has reaffirmed its commitment to the vision of *FIRST* by endorsing a plan of continued growth in program participation – engaging more students, schools, communities, sponsors, and volunteers. Given the challenges and opportunities facing our nation today, we recognize the importance of "stepping up the pace" and inspiring more young people to gain the education and skills necessary for an increasingly technological economy.

Thank you for the opportunity to tell you about the volunteers of *FIRST*, the important work they are doing, the impact they are having, and the results they are achieving.

Paul R. Gudonis
President
FIRST
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