A group of children, including a girl with a red headband and a boy with glasses, are looking intently at a tablet computer. The background is slightly blurred, showing other people in a crowd.

How will competitions change engineering education?

Nancy Clark Brown

Engineering Deans Institute, 17 April 2012

Competitions in Engineering Education

How competitions are leveraged in Engineering Education today:

- Special topics courses adjacent to core curriculum
- Collaboration or partnership courses
- Publicity, engineering reputation and recognition
- Student motivation and engagement
- Recruitment



Iowa State University, Team Prismo Car

The Value of Competitions in Engineering Education

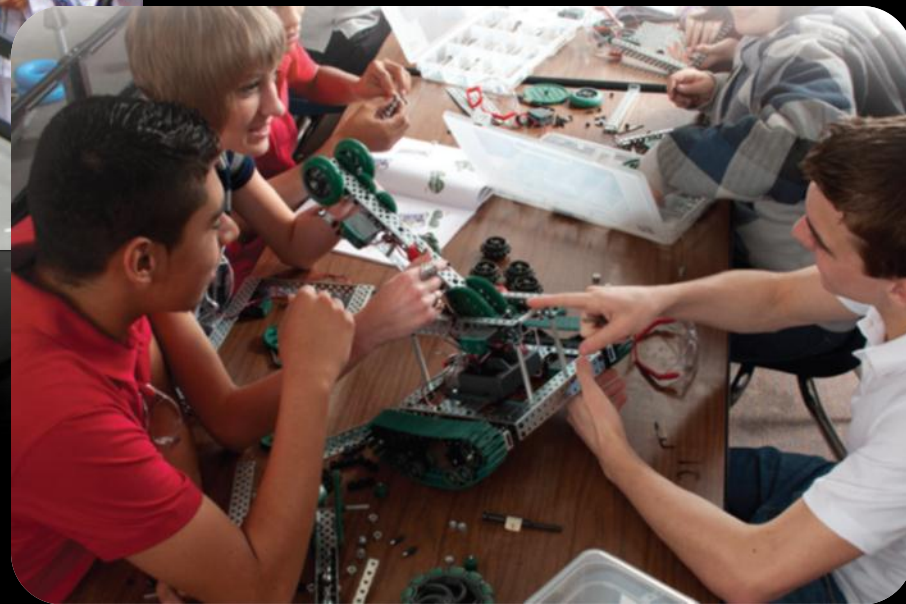


University of Maryland's entry in the U.S. Department of Energy Solar Decathlon 2011, Washington D.C., Sept. 30, 2011.

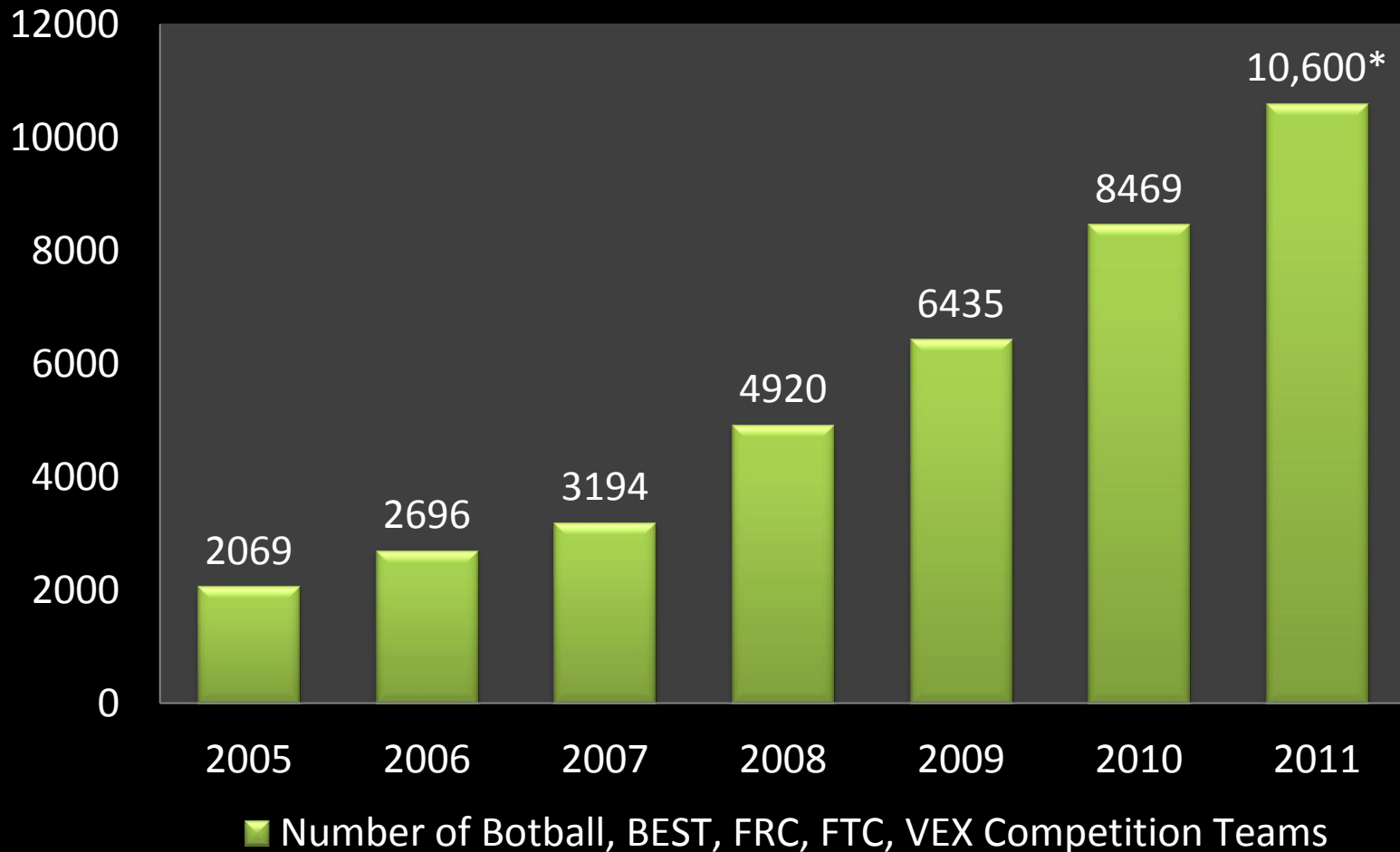
Photo Credit: Jim Tetro, U.S. Department of Energy Solar Decathlon

- Often simulates real world experience, processes or methods
- Develops 21st century skills
- Collaborative, multidisciplinary
- Exposes students to business, entrepreneurial methods

How will competitions shape engineering education in the future?



Robotics Competition Teams



Shell Eco Marathon 2012

45% of the 124 cars from the United States are high school teams

CHANGE IS INEVITABLE

- WITH ANY DESIGN, NOTHING COMES OUT EXACTLY AS ENVISIONED SKETCHED, DIGITALLY PROTOTYPED ETC.
- TIME, BUDGET, AND THE PHYSICAL TOLERANCES OF THE MATERIALS USED ARE JUST A FEW OF THE FACTORS THAT AFFECT THE FINAL OUTCOME
- FURTHER CHANGES ARE MADE WHEN A PARTICULAR PRODUCT IS PREPARED FOR MASS PRODUCTION
- FOR THIS PROJECT, TIME IS THE BIGGEST FACTOR FACING THE FABRICATORS

THEY ARE ONLY USED FOR CONCEPT VISUALIZATION PURPOSES

- THE DIGITAL WHEELS ARE LOOSELY BASED ON THE SET ON THE ORIGINAL CAR
- THE CAR IS CURRENTLY APPEARING AT VARIOUS TRADE SHOWS AND WILL MAKE AN APPEARANCE IN AUTODESK'S GALLERY IN SAN FRANCISCO, CA



MAJOR CHANGES

HEAD AND TAILLIGHTS -- GENERIC LIGHTS ARE USED IN PLACE

MAJOR CHANGES



Example: Team Antipodes

ANTIPODES

One Robot to Rule Them All...

Home

▼ Resources

FTC Budgeting Tool

DIY Planetary Rover Simulator

Essential Tools for the FTC Garage

Autodesk Inventor Parabolic Bouncing Ball Animation

▼ 2011 FTC Robotics

The Challenge

Tournaments

Events

Robot Design

Engineering Log

Tasmanian Exchange

▼ 2010 FTC Robotics

The Challenge

Tournaments

FTC Driving Challenge

2011 Maker Faire

Videos

Robot Design

[Resources >](#)

FTC Budgeting Tool

Robot Complexity	\$/Pkg	In Pkg	Packages			Budget	Cost			Budget
			Simple	Medium	Complex		Simple	Medium	Complex	
LEGO Education										
NXT Brick	149.95	1	1	1	1		149.95	149.95	149.95	-
NXT Rechargeable Battery (DC)	59.95	1	2	2	2		119.90	119.90	119.90	-
NXT Motor	19.95	1	2	3	5		39.90	59.85	99.75	-
Touch Sensor	19.95	1	1	2	3		19.95	39.90	59.85	-
Light Sensor	19.95	1	0	0	1		-	-	19.95	-
Ultrasonic Sensor	33.95	1	0	0	0		-	-	-	-
NXT Connector Cables	10.00	3	2	3	3		20.00	30.00	30.00	-
NXT Cables (Short & Long)	6.50	4	2	2	3		13.00	13.00	19.50	-
Hi Technic										
Infrared Seeker (v2)	49.95	1	0	1	1		-	49.95	49.95	-
Gyroscope	54.95	1	0	1	1		-	54.95	54.95	-
EOPD Sensor	54.95	1	0	0	1		-	-	54.95	-
Accelerometer	54.95	1	0	0	1		-	-	54.95	-

Above: Portion of the spreadsheet tool to help FTC teams budget and order. LEGO Education pricing as of March 2012. Physical tools are not included in budgeting because they tend to be owned by organizations outside of the

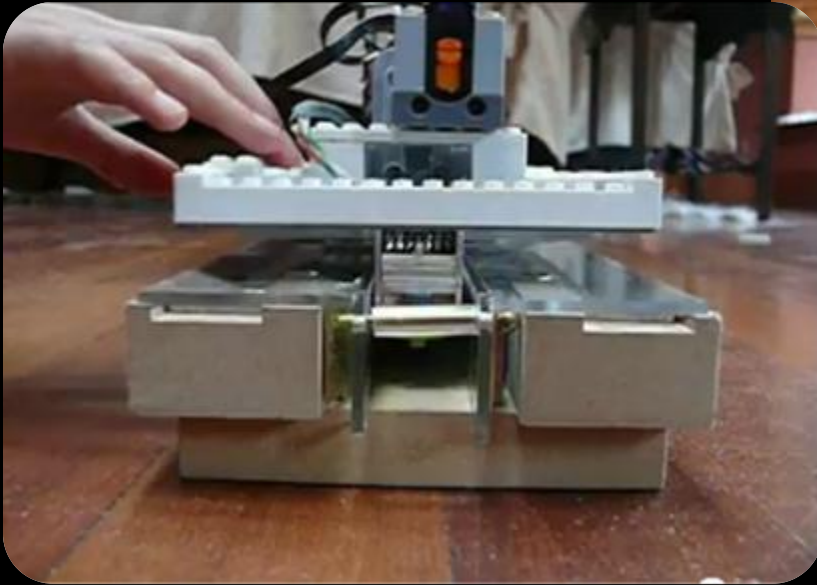
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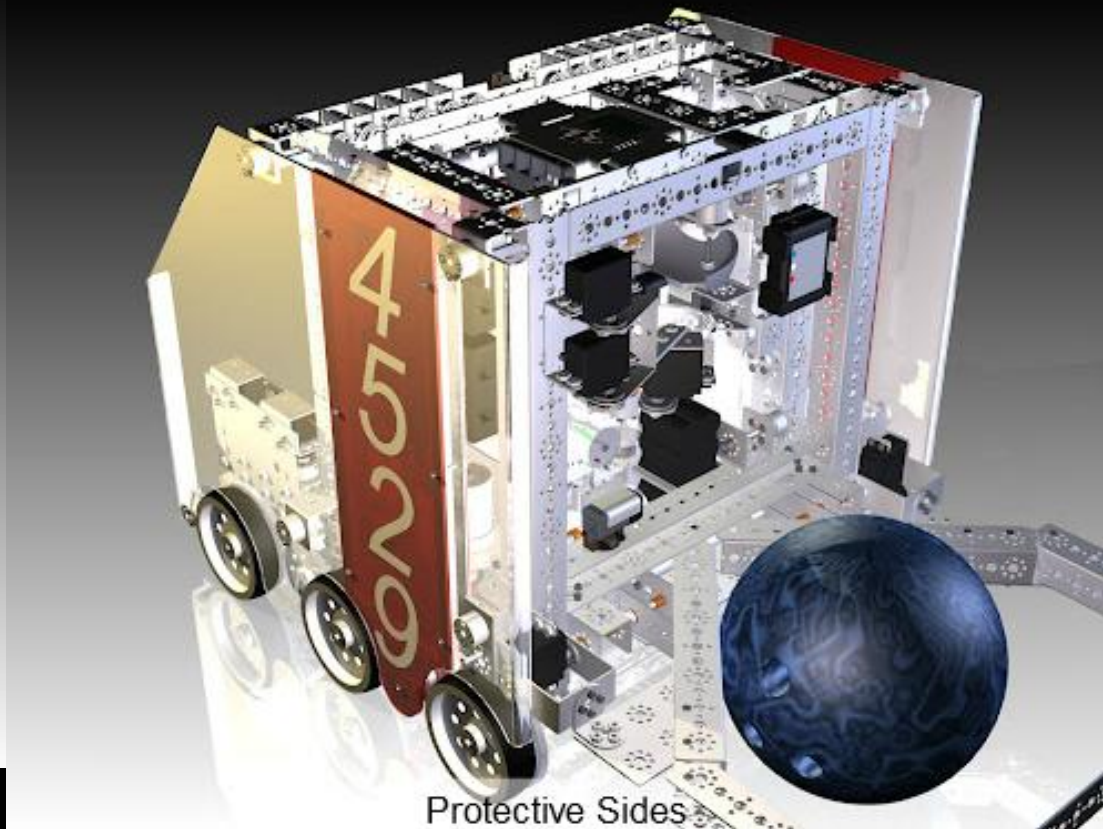


Example: Team Antipodes

- Magnetic Levitation Research – 6 iterations to produce a 3 phase, 6 solenoid



Example: Team Antipodes



Example: Team Antipodes



Example: Intel Science Talent Search

Grand Prize: USD 100,000 Scholarship from the Intel Foundation

Nithin Tumma, 17, of Fort Gratiot, Michigan, analyzed the molecular mechanisms in cancer cells and found that by inhibiting certain proteins, medical personnel may be able to slow the growth of cancer cells and decrease their malignancy. This could lead to more direct, targeted, effective and less toxic breast cancer treatments.



[Learn more about Nithin's research](#)

Second Prize: USD 75,000 Scholarship from the Intel Foundation

Andrey Sushko, 17, of Richland, Washington, designed and built a tiny motor, only 7 millimeters in diameter, which uses the surface tension of water to turn its shaft. Andrey's long-time interest in model boats led him to discover this novel approach, which could have applications in micro-robotics.



[Learn more about Andrey's research](#)

Third Prize: USD 50,000 Scholarship from the Intel Foundation

Mimi Yen, 17, of Brooklyn, New York, isolated and mapped the gene responsible for mutant behavior in *C. elegans*, a worm often used as a model in scientific research. Her work may help us better understand the genes that contribute to behavioral variations in humans.

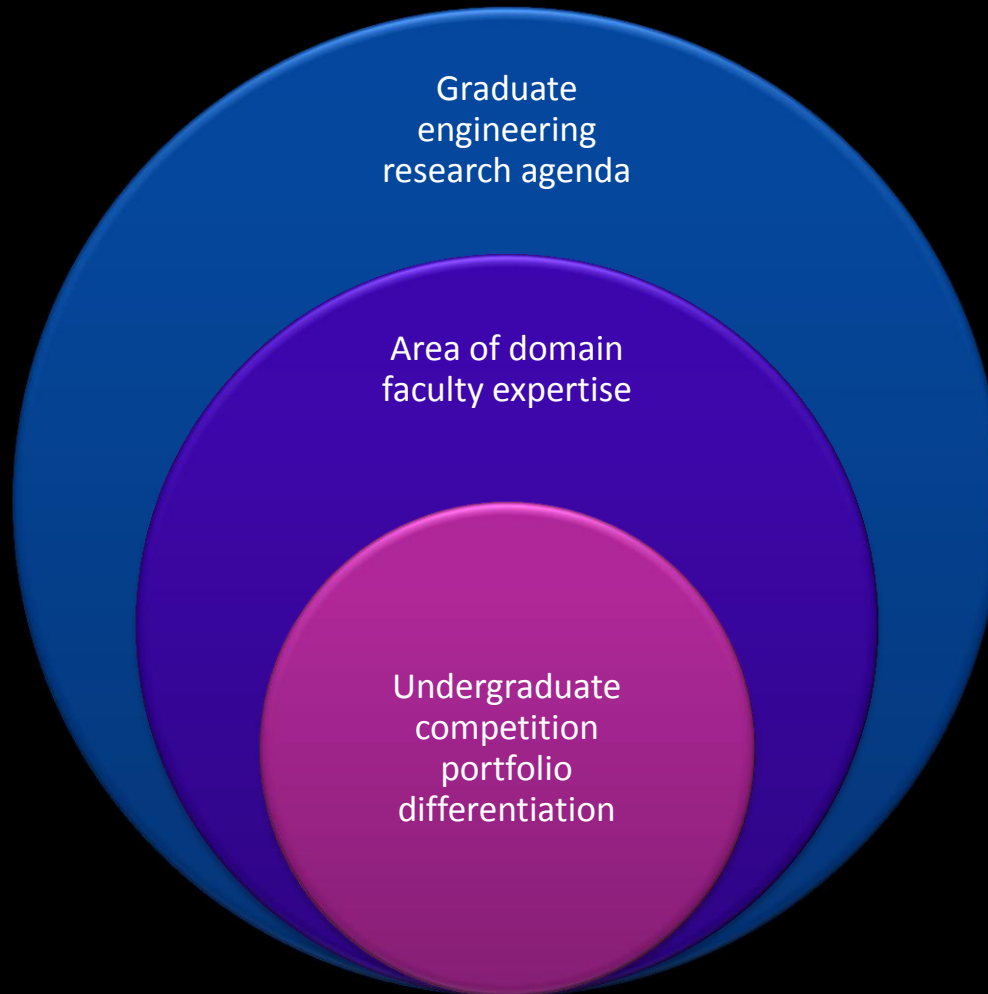


[Learn more about Mimi's research](#)

Engineering Competitions; Implications for the Future

- When engineering competitions are mainstream, how will it effect undergraduate education?
- How will engineering education accommodate students that have grew up with project based, hands-on learning environments?
- When Science and Math high school students become “rock stars” how will universities compete for the best students, if industry is also competing for the same students?

Can the “competition” be the research agenda?



- More integration with department research agenda
- Alignment with faculty expertise
- Particular track in the engineering program focused on innovation, entrepreneurialism
- Directed research agenda in the context of competition environment