KC Robotics Team
A High School and Middle School FIRST Robotics Team

FRC
FIRST® Robotics Competition

KC ROBOTICS TEAM

FTC
FIRST® Tech Challenge
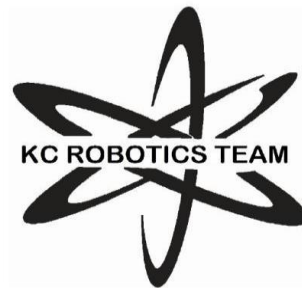
FIRST®

IEEE Switchgear Meeting Presentation
Tuesday Luncheon
Paul Sullivan – Team Lead Mentor
April 26, 2016

Agenda

- **Image Credits**

- **FIRST®**

- **KC Robotics Team**

- **2016 FRC Program**

- **Get Involved**
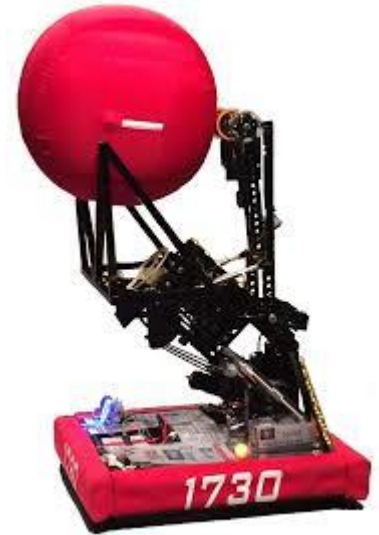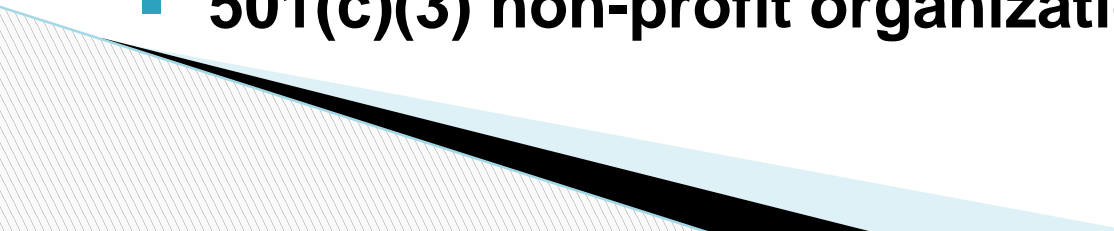
- **Robot Demo**

Image Credits

- **Many equipment and component images used in this presentation are from FIRST or different equipment suppliers the KC Robotics Team.**

- **Refer to the following websites for access to those images.**
  - **FIRST – www.firstinspires.org**
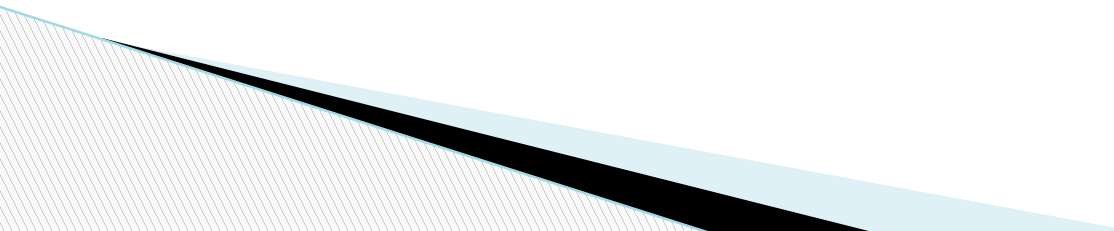 - **AndyMark – www.AndyMark.com**
  - **Vex Robotics – www.vexrobotics.com**

FIRST®

- **"For Inspiration and Recognition of Science and Technology"**   **http://www.firstinspires.org/**

- **Dean Kamen – Founder**

- **Started in 1992 with 28 teams in New Hampshire**

- **Now reaches over <u>400,000</u> young people around the world.**

- **501(c)(3) non-profit organization**

FIRST

- **Vision**
  - **To transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology leaders.**

- **Methodology**
  - **Engage kids in kindergarten through high school in exciting, Mentor-based, research and robotics programs that help them become science and technology leaders, as well as well-rounded contributors to society.**

FIRST

- **"FIRST is More Than Robots"**

- **FIRST participation is proven to encourage students to pursue education and careers in STEM-related fields, inspire them to become leaders and innovators, and enhance their 21st century work-life skills.**

FIRST Programs

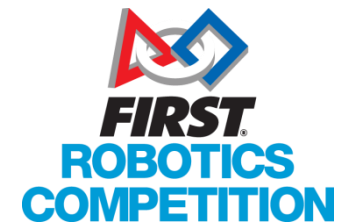- **FIRST Lego League Junior®**
  - **Kindergarten – 3rd Grades**

- **FIRST Lego League®**
  - **4th – 8th Grades**

- **FIRST Tech Challenge®**
  - **7th – 12th Grades**

- **FIRST Robotics Competition®**
  - **9th – 12th Grades**

FIRST Programs

- **The game elements and tasks change each year for each robot program**

  - **FTC**
    - **½" PVC pipe, 2"x2" blocks, plastic balls, bowling ball**

  - **FRC**
    - **Frisbee, basketball, 3' diameter ball, foam balls, plastic totes, trash cans, soccer ball, open weave ball, float**

FIRST Programs

- **Each program includes autonomous modes and teleop modes**

- **Autonomous mode**
  - **Robot performs pre-programmed instructions**

- **Teleop mode**
  - **Robot controlled by human players**

FIRST Tech Challenge

- **Game announced in September**
- **Competitions starting in December**
- **Game changes each year**
- **Middle and high school students**
- **Robot limitations**
  - **18" x 18" x 18"**
  - **Certain motors, batteries, and control systems**
- **12' x 12' playing field**
- **One day competition**
  - **1' wall, soft tile floor**
- **2 robots against 2 robots competition**

FTC

FIRST® Tech Challenge

FIRST Robotics Competition

- **Game announced January each year**
- **<u>Six weeks to design, build and (hopefully) test your robot</u>**
- **Competitions start end of February**
- **Game changes each year**
- **High school students**
- **Robot limitations**
  - **24" x 36" base x 5' tall, 120 pounds**
  - **Certain motors, batteries, and control systems**
- **27' x 54' playing field**
- **Competitions held in coliseums**

FRC®

FIRST®Robotics Competition

FIRST Robotics Competition

- **3 robot against 3 robot competition**

- **Three day competition (Thursday through Saturday)**
  - **1 day practice**

  - **1.5 days qualifying matches**

  - **0.5 day elimination matches**

- **Roughly top 24 teams go to elimination rounds**
- **Approximately 60 teams each competition**

FRC®

FIRST®Robotics Competition

FIRST Programs – Game Pieces

- **The game elements change each year for each robot program**

  - **FTC**
    - **½" pvc pipe, 2"x2" blocks, plastic balls,**
    - **bowling ball, plastic hockey puck**

  - **FRC**
    - **Frisbee, basketball, 3' diameter ball, foam balls, plastic totes, trash cans, soccer ball, open weave ball, float**
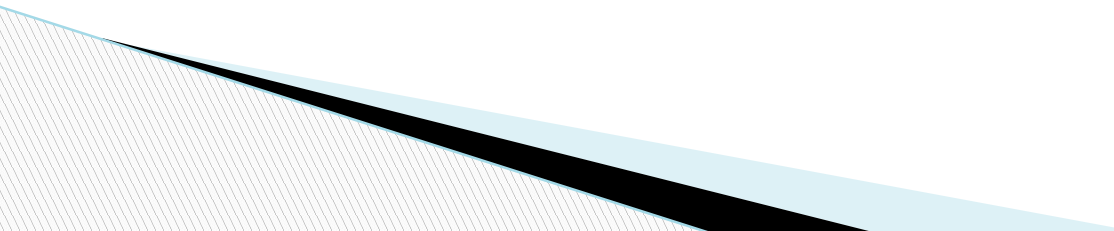
FIRST Robotics Competition
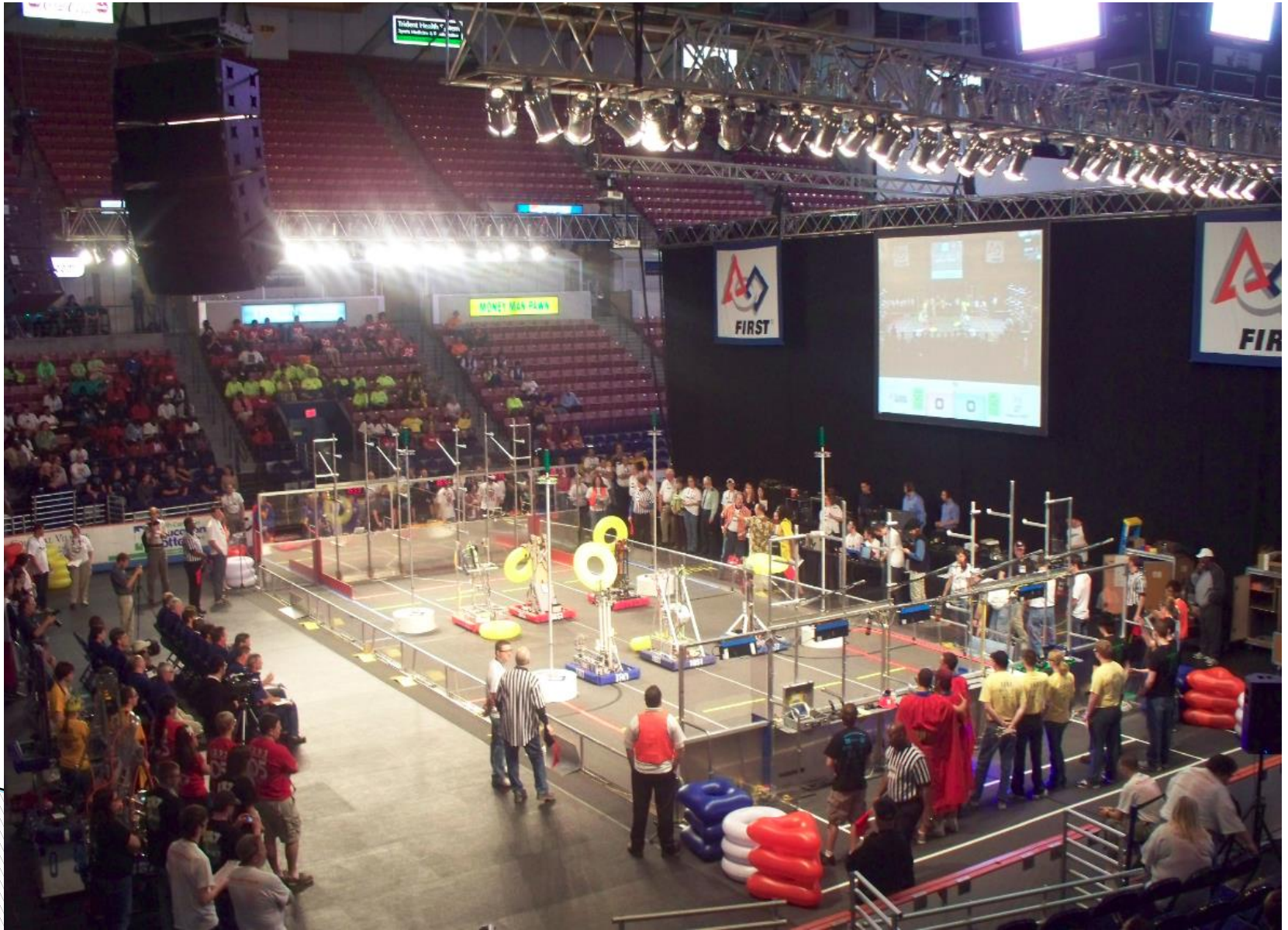
KC Robotics Team – History

- **The KC Robotics Team (KCRT) was started in the 2004-2005 school year**

- **Participate in FIRST Robotics Competition and FIRST Tech Challenge**

- **Open to any middle school and high school students in Kershaw County, SC, USA**
  - **Public school**
  - **Private school**
  - **Home school**
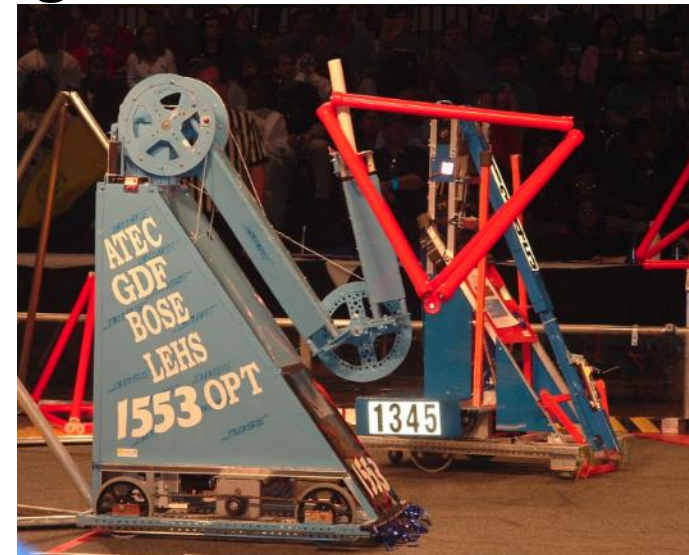
KC Robotics Team – Mission

- **The mission of the KC Robotics Team is to inspire Kershaw County middle and high students to become leaders through participation in mentor based FIRST® robotics programs that build science, technology, engineering, and mathematics (STEM) skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, and communication and leadership abilities.**

KC Robotics Team – Team

- **Approximately 30 students**
  - **4 High Schools**
    - **Three public, one private**
  - **2 Middle Schools**
  - **Home School**

- **Approximately 10 mentors**
  - **2 teachers**
  - **5 technical mentors**
  - **3 involved parents**

KC Robotics Team – Team

- **Based in Lugoff-Elgin High School in Lugoff, SC**

- **501(c)(3) non-profit organization**
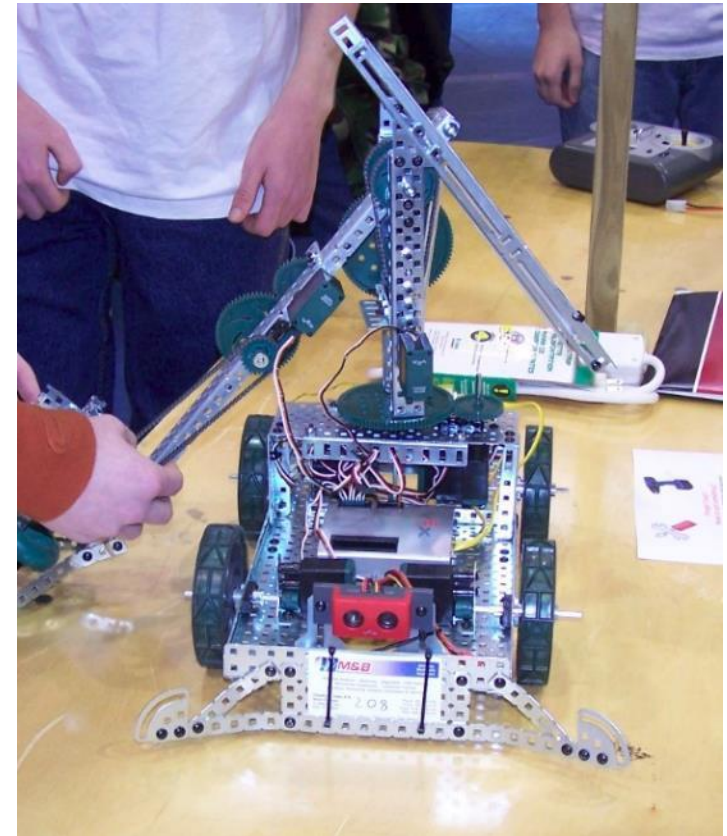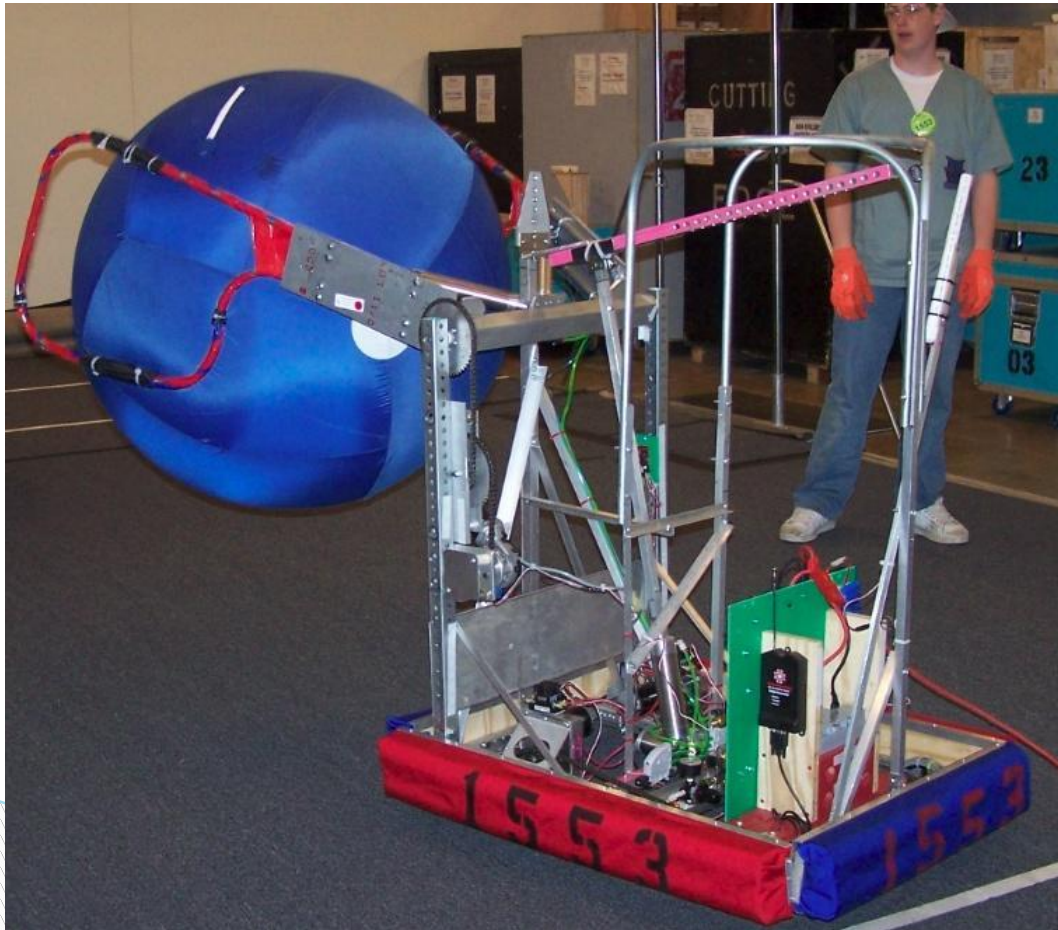
- **Partnership with Kershaw County School District**

KC Robotics Team – Team

- **Much more than just the robot!**
  - **Interpersonal skills**
  - **Communication skills**
  - **Social media**
  - **Marketing**
  - **Tool use**
    - **Drill press, band saws, hand tools, power tools**
  - **Tool safety**
  - **Mechanical and electrical design**
    - **Gear ratios, torque, wiring, sensors**
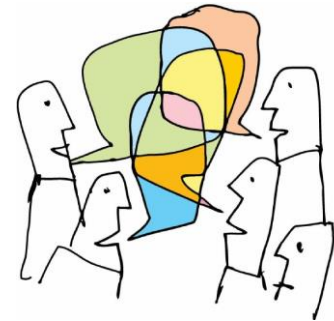
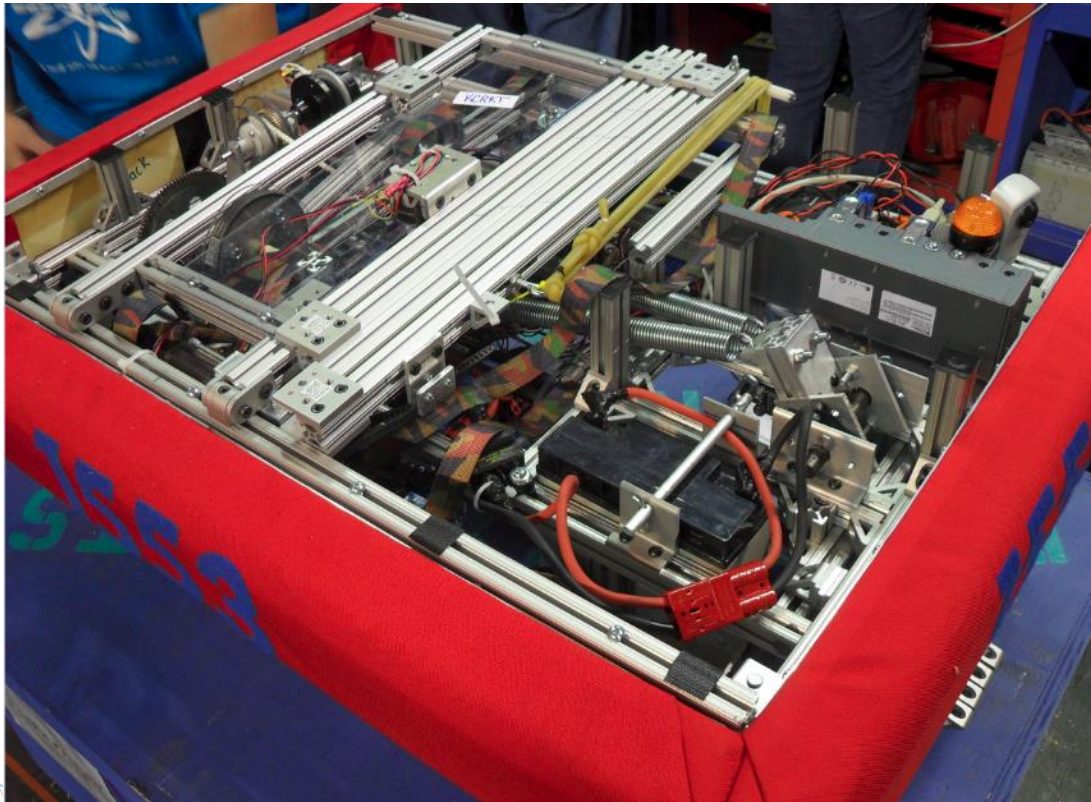# KC Robotics Team – Robots

- **Robots for 2007-2008**

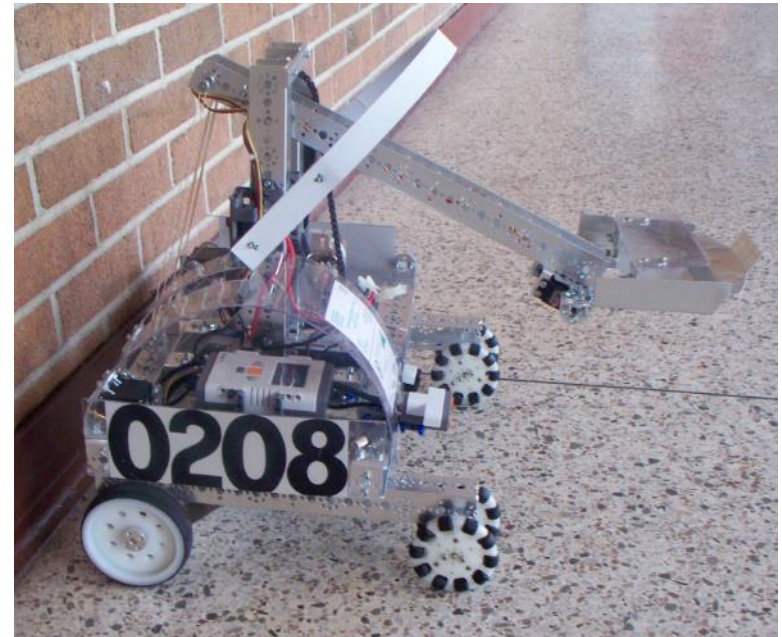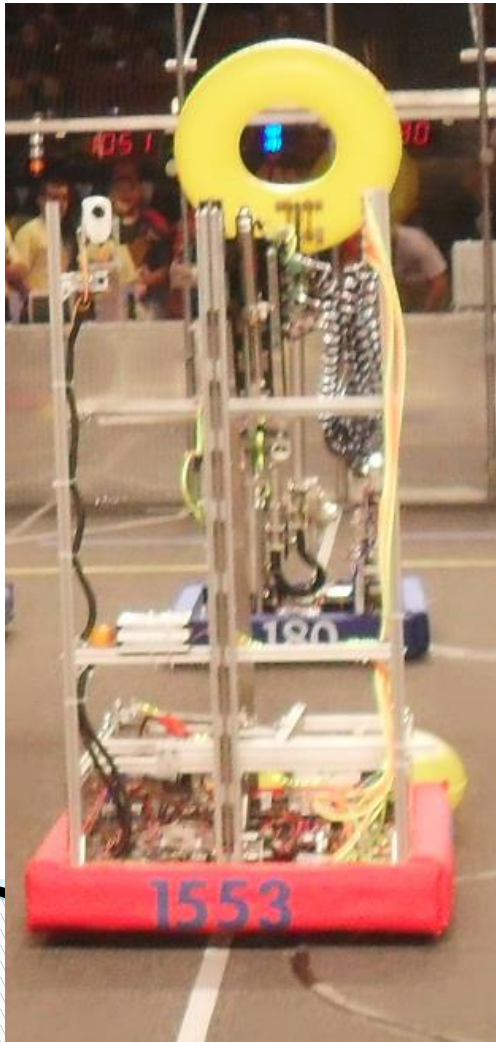# KC Robotics Team – Robots

- **Robots for 2008-2009**
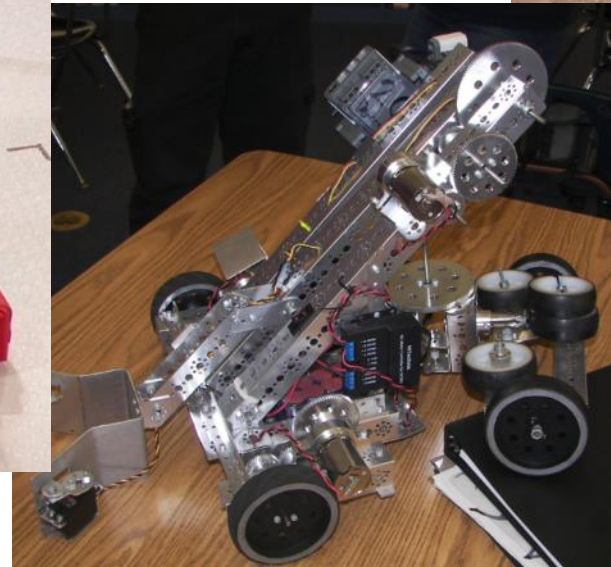
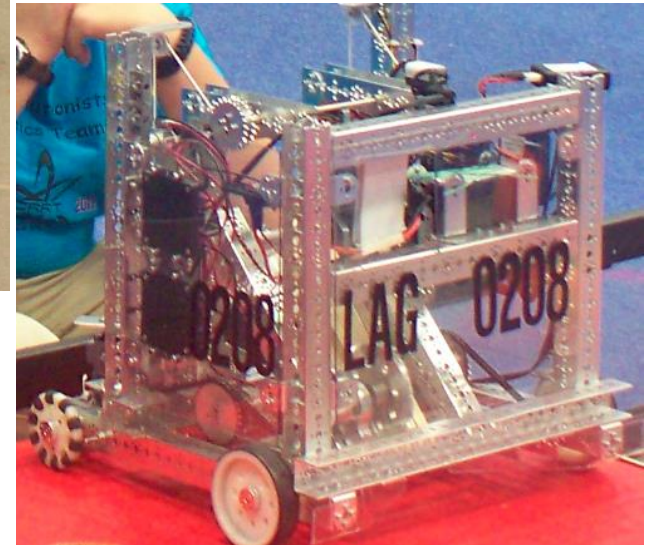# KC Robotics Team – Robots

- **Robots for 2009-2010**
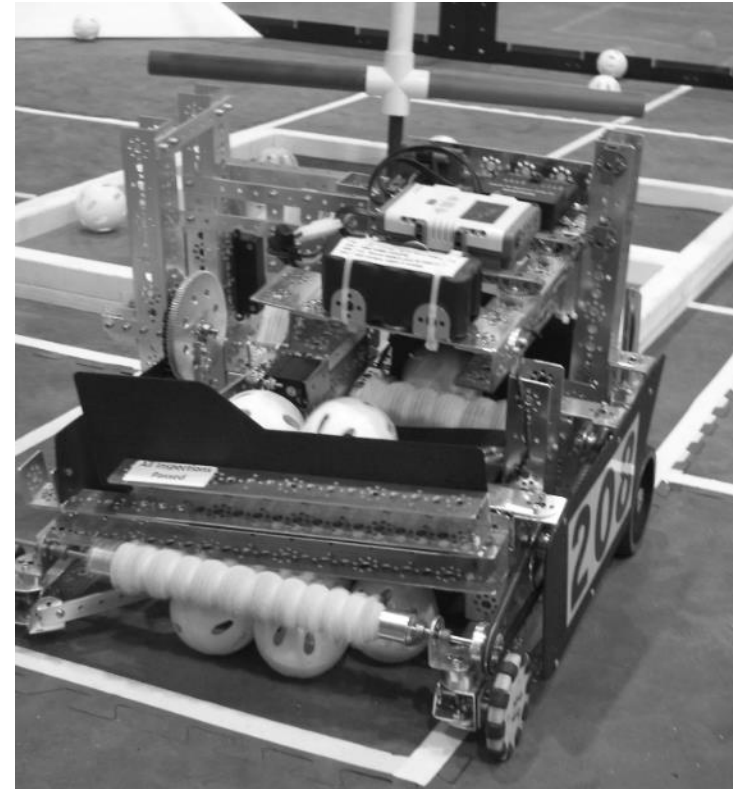
KC Robotics Team – Robots
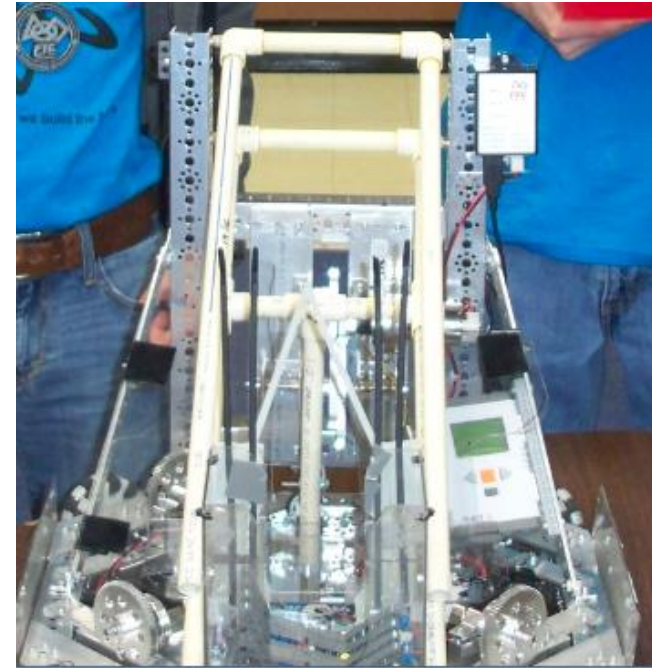
- **Robots for 2010-2011**

KC Robotics Team – Robots
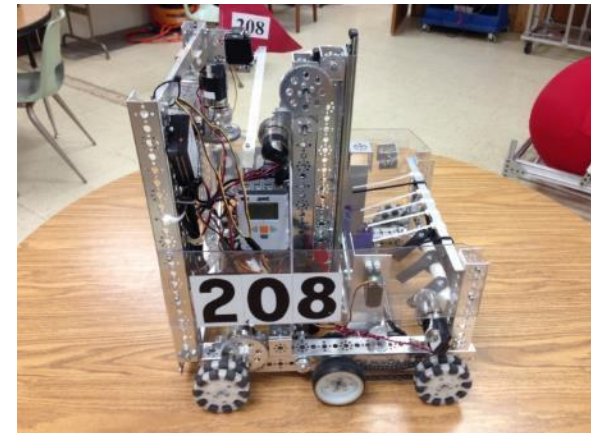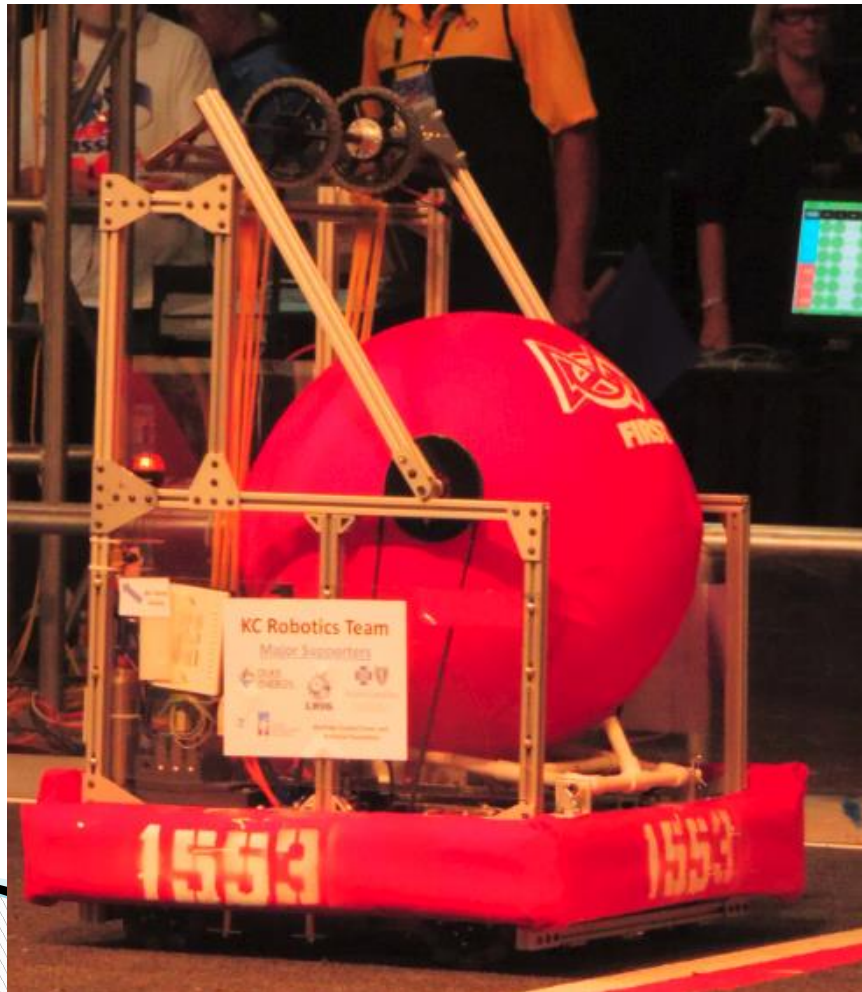
- **Robots for 2011-2012**

KC Robotics Team – Robots

- **Robots for 2012-2013**

KC Robotics Team – Robots

- **Robots for 2013-2014**

KC Robotics Team – Members

- **Wide variety of skill levels**
  - **Some students have never used a screwdriver.**
- **Students learn about:**
  - **Tool use and safety, including power tools**
  - **Working with material**
  - **Fasteners**
  - **Electrical systems (dc)**
  - **Motors, gearboxes, sprockets, chains**
  - **Pneumatic systems**
  - **Programming**
  - **Working with others in cramped spaces**
  - **Working to meet deadlines with too little time and too little resources.**
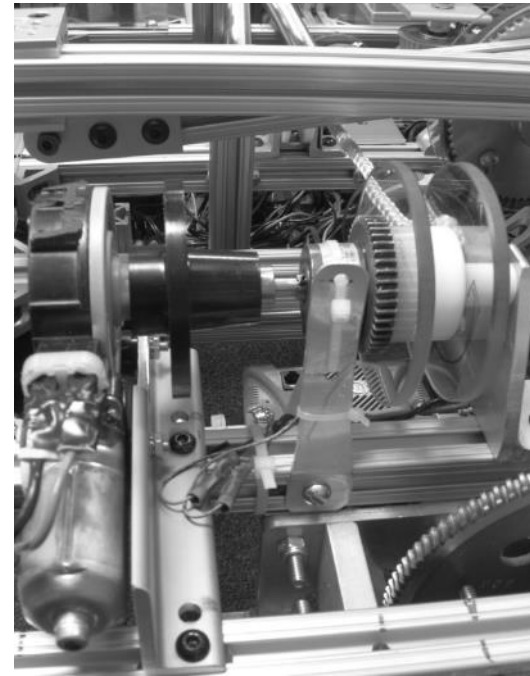
KC Robotics Team – Mentors

- **Adult Mentors**
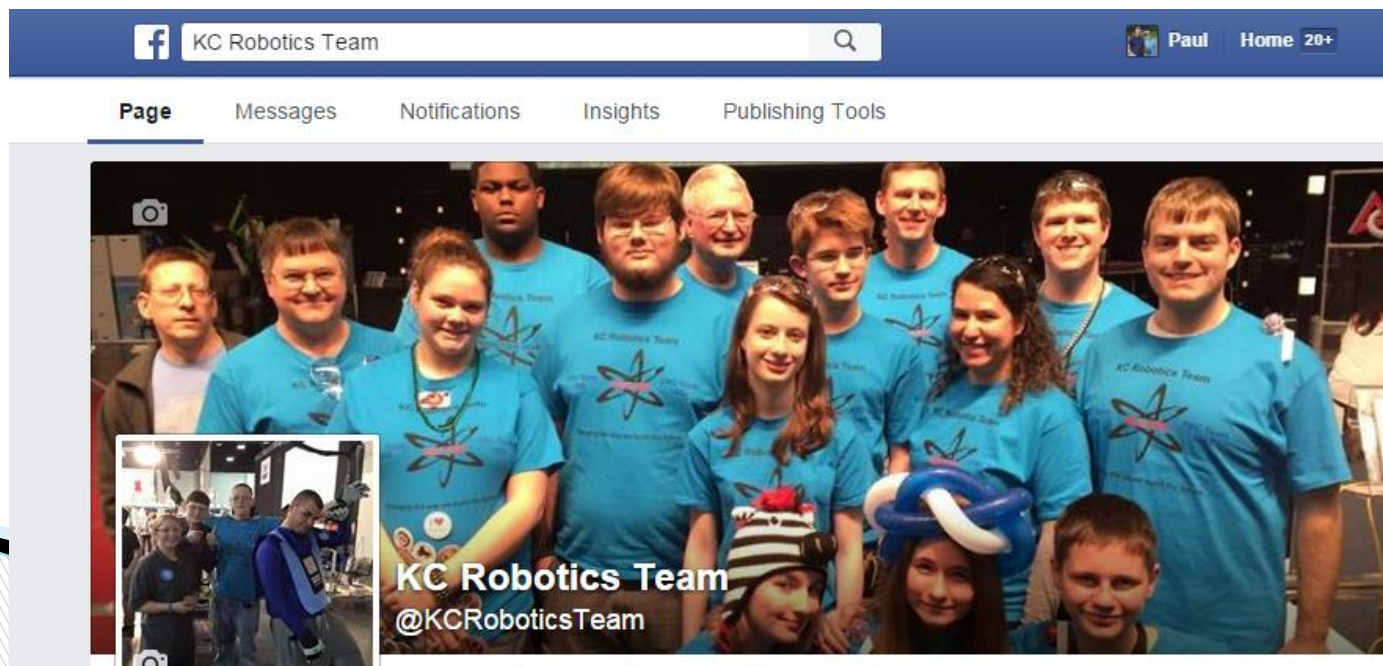 - **Parents**
  - **Volunteers**
  - **Teachers**
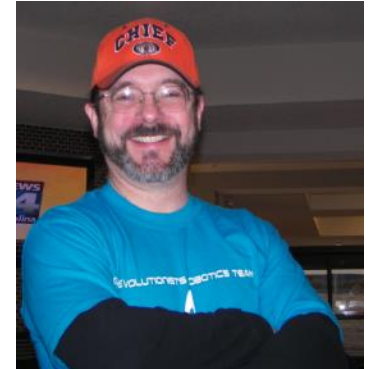
KC Robotics Team – Social Media

- **Team website**

  www.kcroboticsteam.org
- **Twitter – @KCRoboticsTeam**
- **Facebook**

  www.facebook.com/KCRoboticsTeam

KC Robotics Team – Costs

- **FIRST Robotics Competition**
  - **$6,000 in registration fees**
    - **For 1 competition**
    - **$4,000 for each additional**
  - **$3,000 in parts/materials**
  - **Travel expenses**

- **FIRST Tech Challenge**
  - **$700 in registration fees**
  - **$400 in parts/materials**
  - **Travel expenses**

KC Robotics Team – Fundraising

- **Team Fundraisers**
  - **Products sales (Marble Slab)**
  - **Yard sale**
  - **Bowl-a-thon**
  - **Bake sales**
- **Grants**
- **Donations**
- **Material/parts donations**

- **Team is a 501(c)(3) organization**

KC Robotics Team – Supporters

2016 FRC Program

- **Game announced in January**

https://youtu.be/VqOKzoHJDjA

- **Hundreds of pages of rules, instructions, "How To"**

2016 FRC Program – Technology

- **roboRio (Brain)**
  - **National Instruments**
  - **PWM outputs**
  - **Digital inputs**
  - **Analog inputs**
  - **Relay outputs**
  - **Communication**
    - **Ethernet (to field)**
    - **CAN**

2016 FRC Program – Technology

- **Programming**
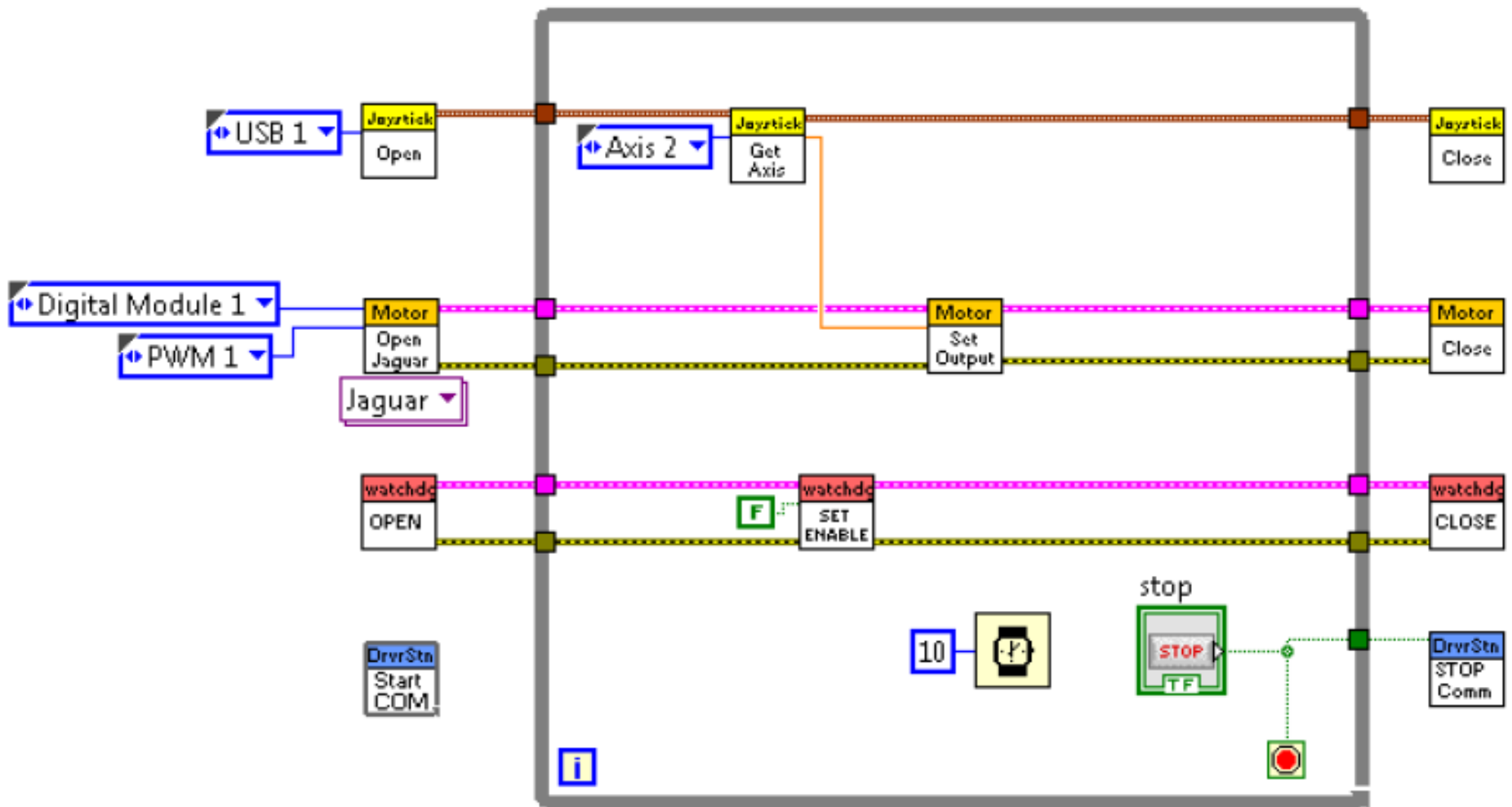 - **LabVIEW**
  - **Java**
  - **C++**
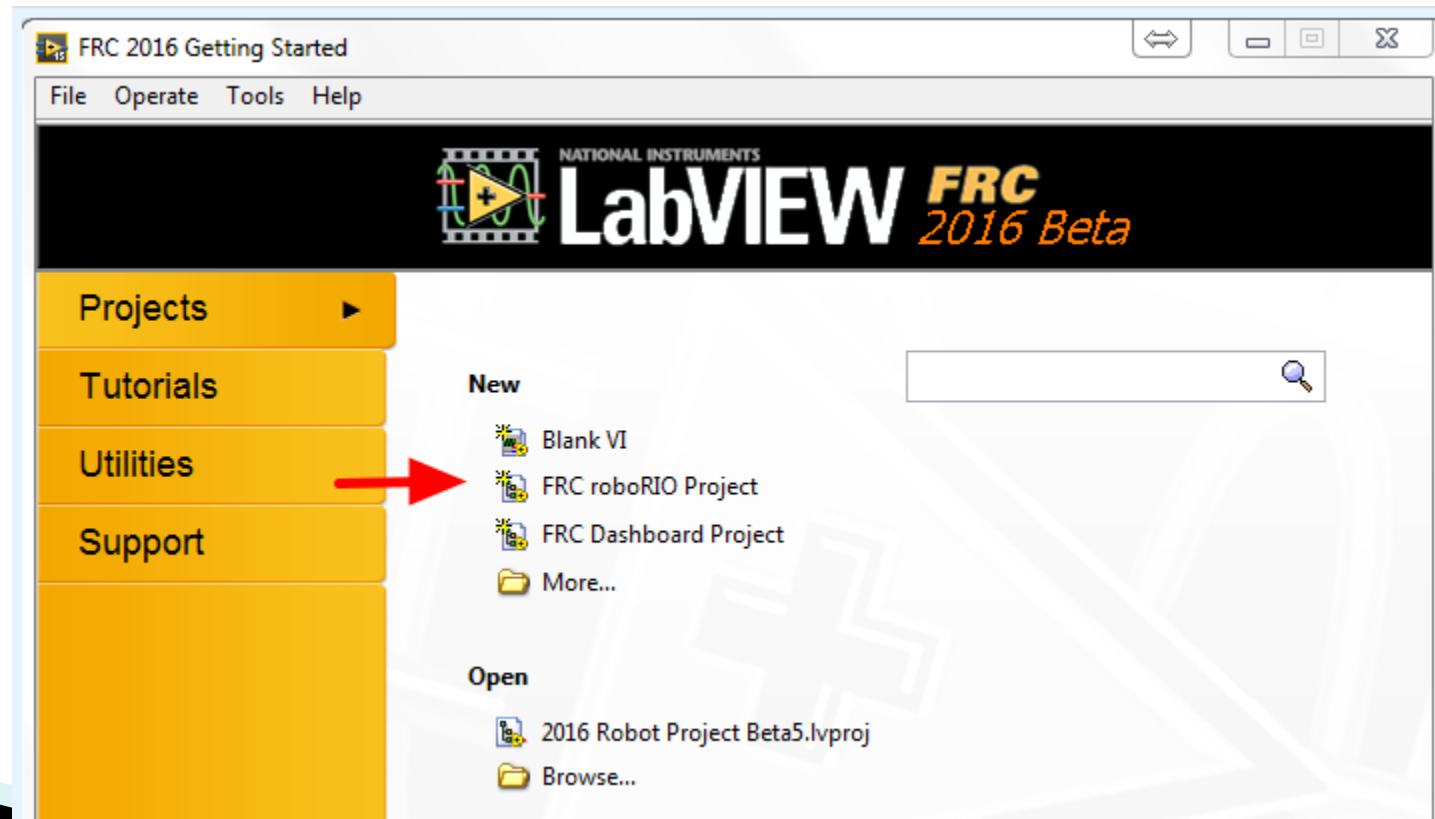
2016 FRC Program – Technology

- **LabVIEW example**

2016 FRC Program – Technology

- **Motor Controllers**
  - **Jaguar**
  - **Victor 888**
  - **Talon SR**
  - **Talon SRX**
  - **Victor SP**

- **Motors**
  - **CIM**
  - **555, 775**

2016 FRC Program – Technology

- **Gearboxes**
  - **Single speed**
  - **Dual speed**

  - **Single motor**
  - **Dual motor**
  - **Triple motor**

- **Wheels**
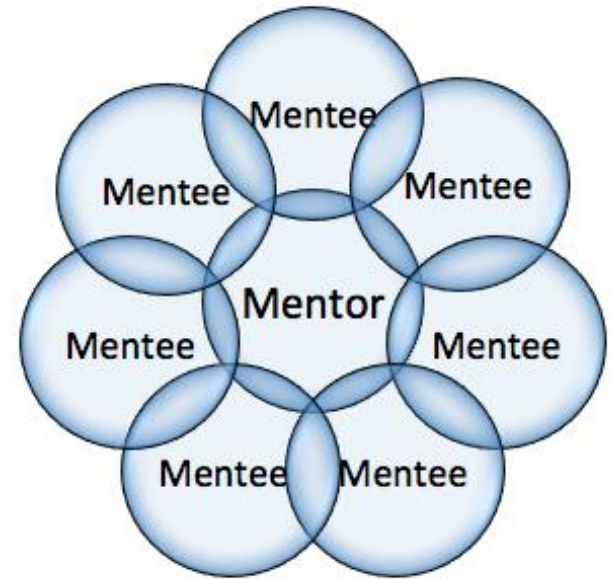 - **Traction**
  - **Omni**
  - **Mecanum**

2016 FRC Program – Team 179

- **Many teams create a "reveal" video for their robot.**
  - **My team has not.**

- **Here is the one from Team 179.**
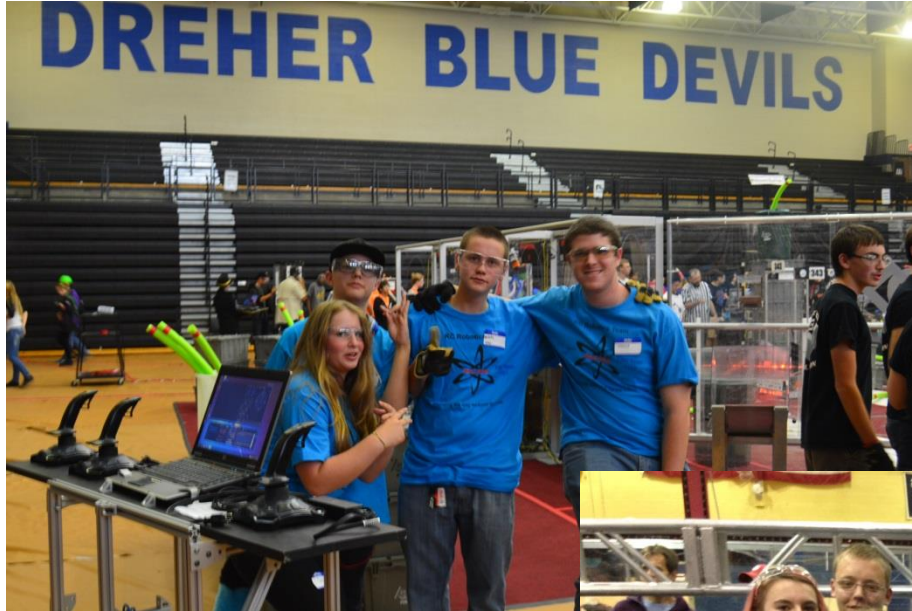 https://www.youtube.com/watch?v=cvHnjYLO-HI

   Note – This is NOT my team's robot!

Get Involved

- **Teams need:**
  - **Mentors**
  - **Money**

- **As an individual:**
  - **Consider being a team mentor**
  - **Consider making a financial donation**

- **As a business person:**
  - **Consider becoming a team sponsor**
  - **Consider donating parts/resources**
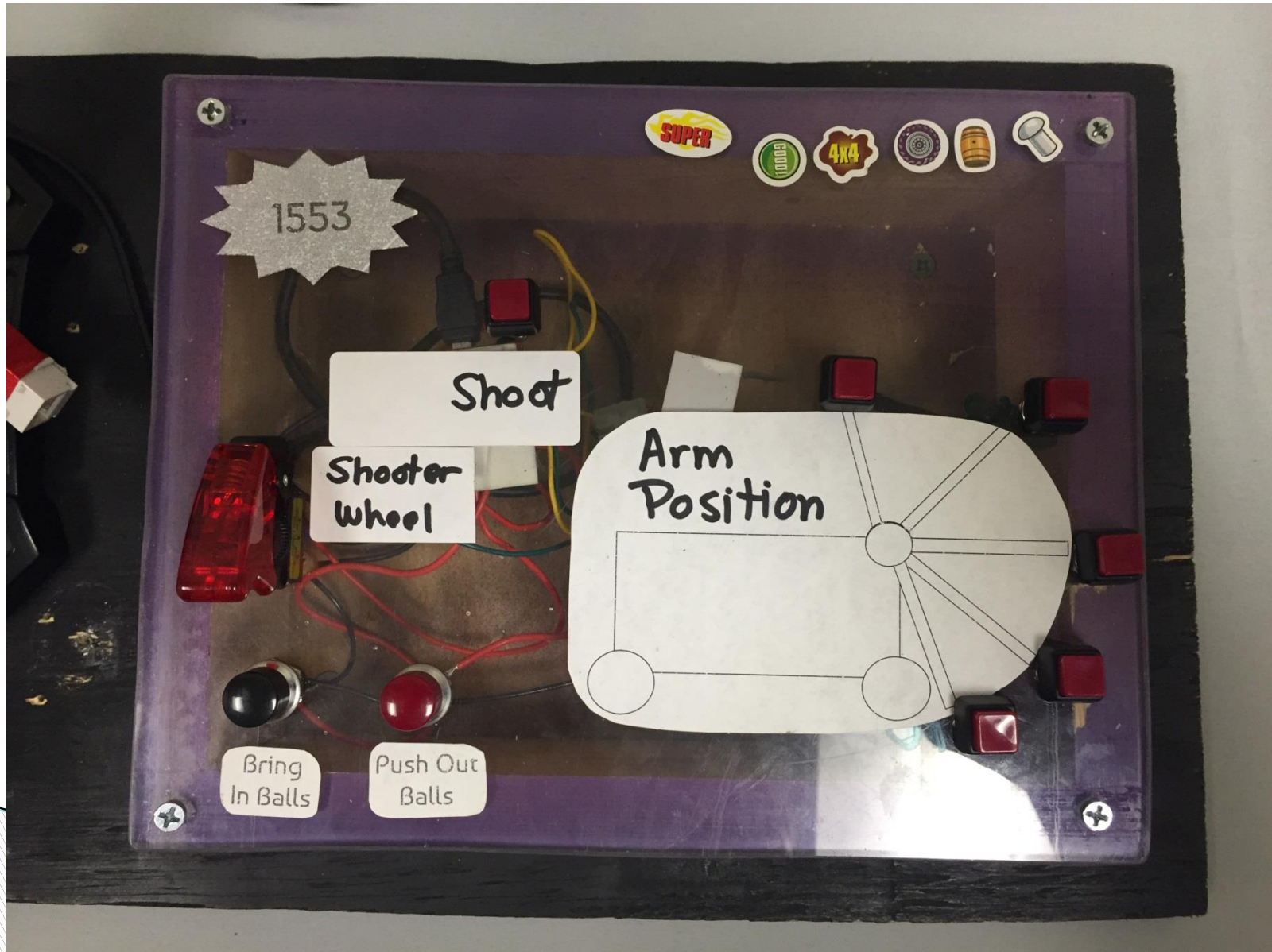
Questions? (Then demo...)

Demo – Control Board

- **Laptop Computer**
- **Joysticks**
- **Homemade input board**

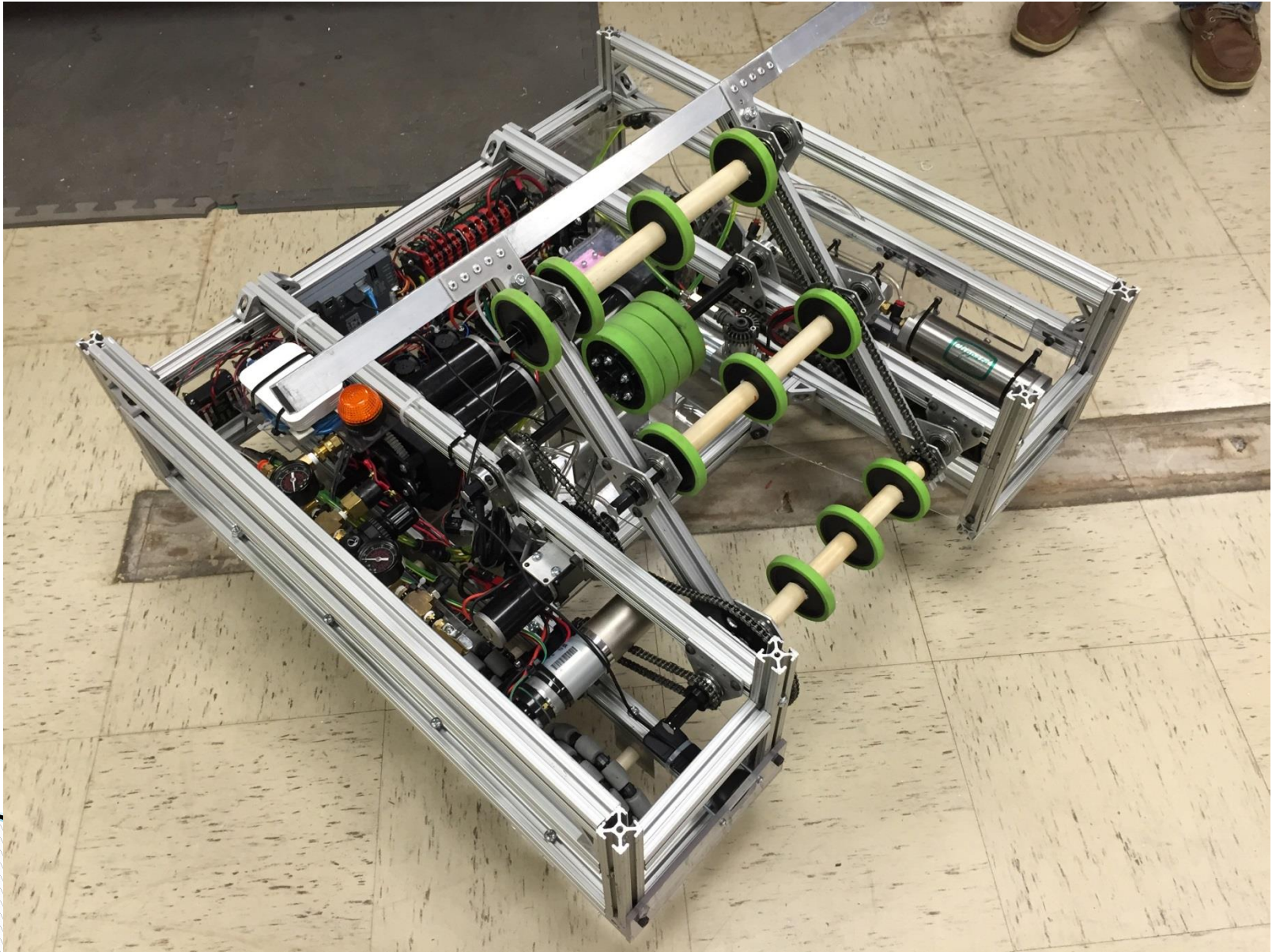# Demo – Control Board

Demo – Control Board

Demo – Robot Features

- **8 Wheel Drive Train**
  - **4 Traction Wheels in back**
  - **4 Omni Wheels in front**
- **Dual Speed Gearbox on Drivetrain**
  - **Pneumatic switching**
  - **For pushing and for power**
- **Front Arm**
  - **Ball collection**
  - **Door operation**
  - **Obstacle manipulation**
- **Low Profile**
  - **For going under low obstacle**
- **Computer programs**

All in 6 weeks!

Demo – Robot

Demo – Need a Volunteer