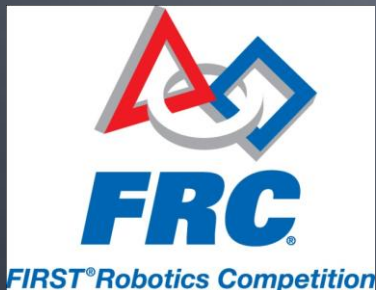


William J. McClung, PE
Coach/Engineering Mentor
Pitt County Robotics
FRC Teams 2642/2682



Cost Effective Robotics - Roboxsumo



A Moment for SAFETY!



- Location
- Exits
- Fire extinguishers
- Safety equipment (AED?)
- Fire Assembly point
- Weather Assembly point
- Any issues/injuries/problems...
 - Local Contact



WELCOME!

- Welcome to our Roboxsumo Training
 - First Trial was in 2013
 - STILL a work in progress!
 - Amazing growth and interest
 - Be sure to fill out roster
 - Don't forget your take tools and parts
 - Please get comments/suggestions/improvements back to me.
 - Thank YOU!



Introductions

- Ann McClung – Coach -Marketing & Safety
 - Science Teacher (Retired)
 - Middle and High School
 - Math and Science
 - Science Coordinator CSTEM – at ECU
 - Mentor/coach in FRC since 2008
- Bill McClung – Coach/Engineering Mentor
 - Maintenance Engineer at PotashCorp
 - Degree in Mechanical Engineering
 - Mentor/coach in FRC since 2008



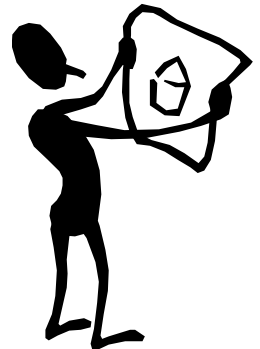
Introductions - continued

- Please introduce yourself
 - Name
 - School
 - Interest – What you hope to learn/see?



Today – Plan

- Only have 6 hours – Need to move fast
- Participants will learn about:
 - Robotics in the classroom
 - Cost effective options for this endeavor
 - Safety and good practices
 - Review Roboxsumo program
 - Review components
 - Assemble basic Roboxsumo robots
 - Lead/direct/participate in a short contest
 - Learn by doing!



Why Robots?

- Very popular and exciting subject
- Huge need for STEM qualified students
- Changing Economy
 - Especially important in North Carolina
 - Economic Drivers same
 - Different Jobs
 - NC Economy still dominated by Agriculture
 - Hogs and Turkeys STILL the largest industry in NC
 - This is changing
 - Students need to be ready for different jobs in the same industry.



Why Robots (2)

- We need more engineers!
 - It's not just Math & Science
- Every Year I make presentations for E-Week
 - President's Day in February
 - Talk to students about careers in STEM
 - We emphasize the "E"
- Students don't know what engineering is.
- Students don't know what an important career option this is.
- Most students don't think they can do it!



Why Robots (3)

- **Build Interest!**
 - Introduce them to famous/Interesting Engineers
 - Importance of this career to society
 - Opportunities available
 - Travel
 - Education
 - Career
 - Good pay and benefits
 - It Still Doesn't Work..... Why?
- **They don't believe!**

How to Make Science
Fun and Interesting



Why Robots (4)

- **Take the “Test Drive”**
 - I don’t think I can do this!
- How to learn more about this and find out if this is the sort of thing you’re interested in?
- Programs where you can try it out
 - Envirothon
 - Chemithon
 - Odyssey of the Mind
 - Engineering “Camp”
 - Science Olympiad
 - **Robotics Competitions**



Why Robots (5)

- What can robotics do?
 - Puts the tools in their hands
 - Provides a chance lead & develop their own solutions
 - Students learn about real applications for:
 - Science
 - Math
 - English
 - Business
 - Marketing
- Helps them to **believe**



So, Why Robots?

- YES, Virginia
 - You can succeed in the “hard” classes
 - You can go to college
 - You can get that high paying job
 - You can help the people around you.
 - You can use your skills and mind to make the world a better place.
- Robotics in Educations says
“YES, You Can”

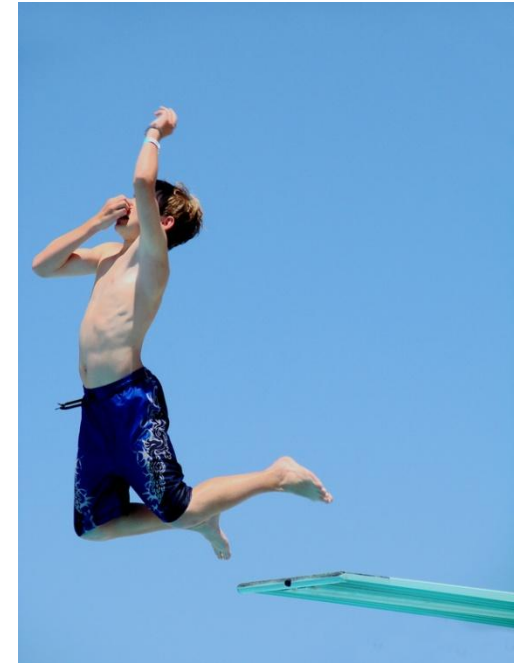
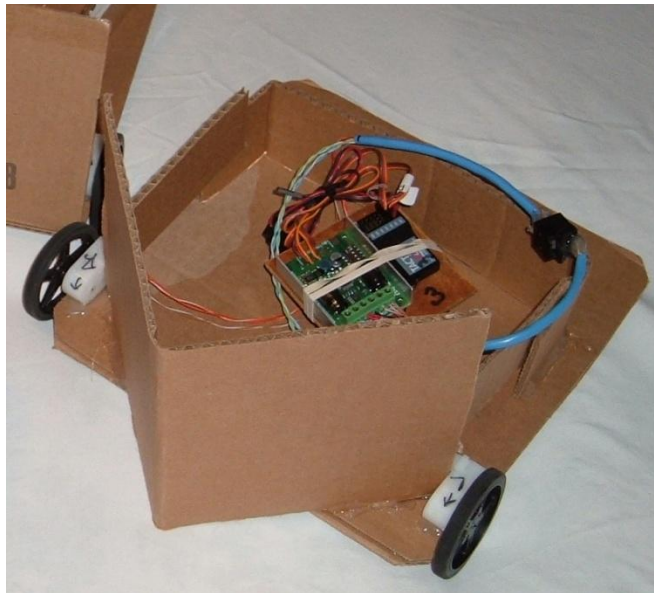
WHY Roboxsumo?

- IT WORKS!
 - Surprise
- Reaches a diverse group of students
 - Age – 10 and up!
 - Skills – technical and non-technical
 - Gender
- Participants have fun using their brain!
- GOAL is to “plant the seed”



Roboxsumo – Key Points

- FUN!
 - Very Important
 - Gets students engaged



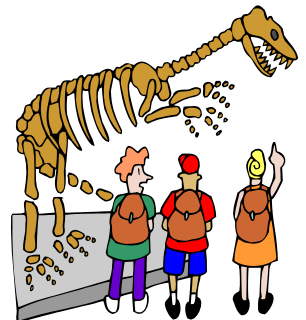
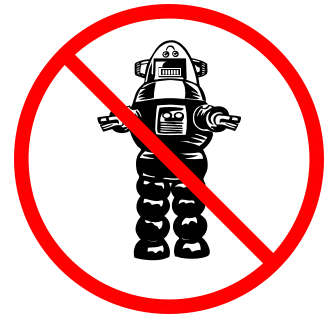
Roboxsumo – Key Points

- Accessible (Low barriers)
 - Safe -
 - Cost Effective
 - No technical training required
 - Finite/Compact time frame
 - Readily available parts/supplies/tools
 - Build anywhere
 - Compete anywhere
 - Flexible – adjust to fit participant needs
 - Increase or decrease complexity and goals



Roboxsumo - The Plan

- It's not about the ROBOT!
- Do we have to do it "THIS" way?
 - No!
- Will get some details on how we ended up here
 - Still evolving
 - Use the parts/materials/techniques that work for you.
- Goals are learning, fun and accessibility!
 - Edit as needed!
- Problems/Questions/Ideas
 - Please contact us!



“Gateway” Robotic Programs

- We have three programs to share with you.
- Roboxsumo
 - Cardboard robots compete in a sumo competition
 - No computer – Hand held RC
 - Complete in 2-3 hours in any location
- Creek Creepers
 - Underwater ROV
 - No computer – Wired control unit
 - Complete in 2-3 hours – need water
- Programmable Roboxsumo
 - Simple robotics platform to build maze follower
 - Computer controlled – Autonomous
 - Program can vary from 12-40 hours

Roboxsumo

- Cardboard robots in “sumo” competition



Creek Creepers

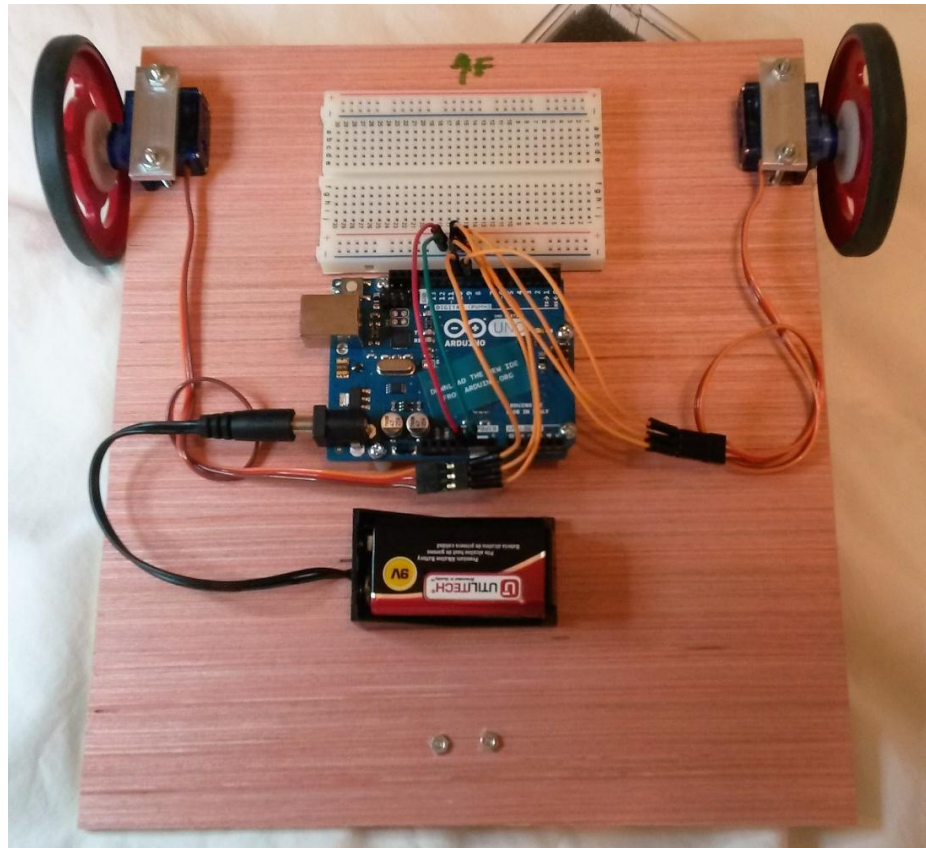
- Underwater ROV robots
 - Design follows the Sea Perch Program*



* <http://www.seaperch.org>

Programmable Roboxsumo

- Simple programmable robots
 - Arduino based



Cost Effective Robotics

- All three programs available for outreach!
 - Host by Pitt County Robotics
 - Host locally
 - Training
 - Support
 - Parts
 - Through Technology Solutions of Eastern Carolina, LLC.
 - Documentation
 - www.roboxsumo.com
 - A work in progress

Start with SAFETY

- Major focus on SAFETY
 - Place real tools in the students hands
 - Cutters, shears, hot glue, solder irons, etc....
- Many people do not realize the career opportunities in safety
- Utilize and enforce good practices
- Involve the students in these activities
 - Buy in / Engagement
 - Learn about new career paths



MODEL Safety

- Most important job for adult leaders
- Must MODEL safe behaviors
 - Establish policies and stick to them
 - You have to do it too!
 - No cutting corners - be consistent
- Make a priority – Kick off with Safety
 - EVERYBODY'S PRIMARY JOB IS SAFETY

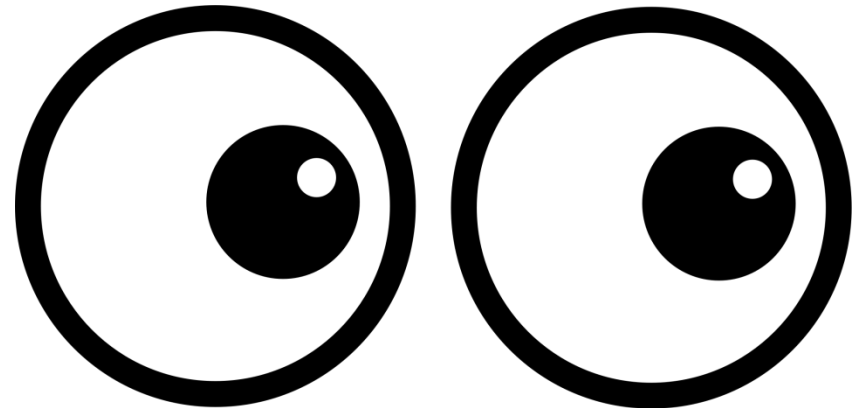


Safety Issues for Roboxsumo

- Make this part of instructions
- Review as frequently as practical
- Main topics to review
 - Proper tool selection/use
 - Utility knife, shears, diagonal cutters, hot glue
 - Policies/Practices
 - Cutting boards, glue and cutting stations
 - PPE
 - Gloves, goggles or safety glasses as needed

Safety – Tool Selection/Use

- Review all of the tools to be used
 - Utility knife, diag. cutters, hot glue gun
 - Everybody uses the same tools
 - Many locations choose NOT to use the Utility knife
- DON'T assume they know how to use
 - Demonstrate
 - Discuss the hazards
- Circulate during event
- Lots of eyes



Safety – Policies/Practices

- Establish your policies at the beginning
- Policies we use
 - Tool selection same for everybody
 - All work is done on the cutting boards
 - Specific locations for hot glue and utility knife
 - Adults monitor and supervise these stations
 - Establish required PPE
 - Gloves
 - Safety glasses
 - Supply PPE as needed

Safety – PPE

- Two main pieces of PPE
- Safety glasses
 - Not always used
 - Follow practices for your facility
- Cut Resistant gloves
 - WONDERFUL!
 - Use with cutting and hot glue
 - Provided in your kit today
 - ANSI or ENN level 3



Robox – Learning Objectives

- Even the most basic Robox event includes:
 - Hands-On Construction experience
 - Basic physics
 - Planning
 - Time and materials Constraints
 - Teamwork
- Advanced Robox program
 - Electronics
 - Computer programming

Robox – Standard Day Program

- Students are placed in groups of 2 or 3
 - Teamwork activity
- Students receive safety orientation
 - Adults and experienced students supervise
- Students get the rules and objectives
- Teams get 1.5 hours to assemble robot.
- Teams Compete in a sumo match
 - Robots attempt to push each other out of “ring”
 - 1 Minute to do this
 - Tie breaker is lowest robot weight

Robox – A Sumo Contest

- Robox compete in 5' x 5' square
- Robots try to push other out of bounds



Robox – Shared controls

- Students use same controls
- Controls are “recycled” to keep down costs



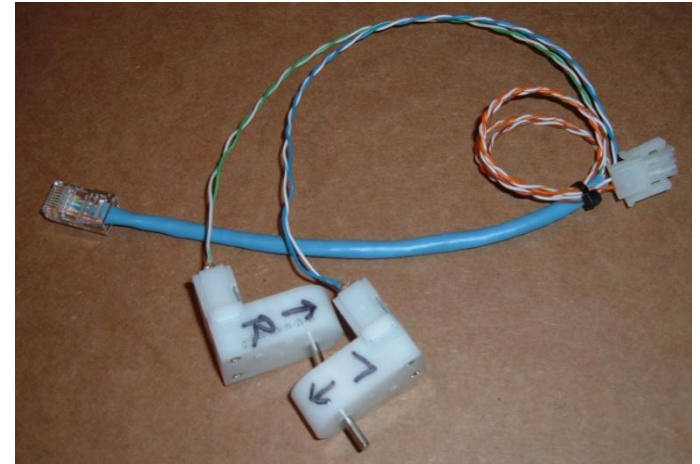
Robox – Standard Kit of Parts

- All Students get the same parts



Standard Kit of Parts

- All Students get the same parts
- Review these with the students
 - 1 - Motor and wire harness
 - 1 - Set of wheels and tires
 - 5' – Aluminum tape
 - 10 – 4" zip ties
 - 2- Pieces of 8.5" x 11" paper
 - 1 – Ping pong ball
 - 1 – 20" x 20" cardboard piece (1/2 of 10x10x10 box)



Auxiliary Kit of Parts

- Advanced Roboxsumo adds two motors
 - Connect to aux connectors
- Additional components
 - Auxiliary motors
 - Two more wheels
 - Fasteners
 - Other building materials
 - Decorations
- Use other parts as you choose.



Tools You Will Need

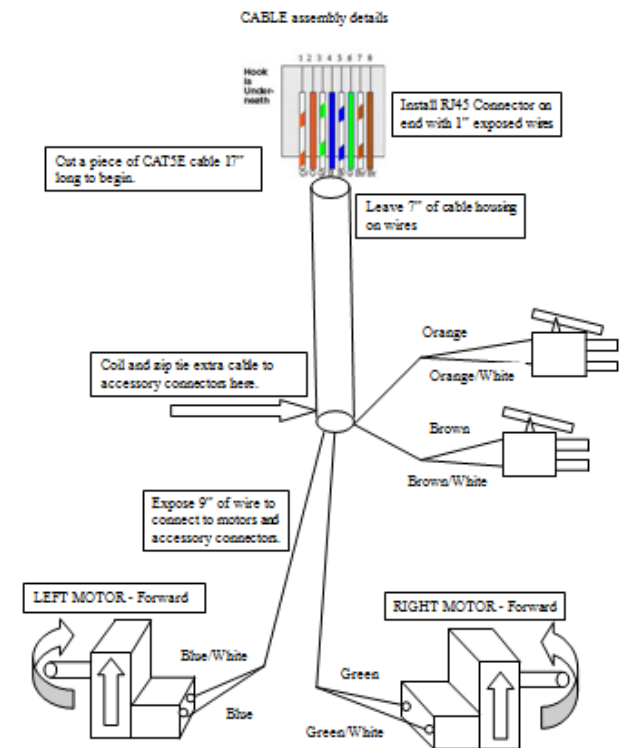
- Each Group should have
 - Cutting board
 - Pencil
 - Marker
 - Shears
 - Ruler
- Shared tools at common stations
 - Utility knives (1 for two teams)
 - Hot glue guns (1 for two teams)
 - Glue sticks (approx 3 per team)
 - Diagonal cutters for zip ties

The Parts – A Review

- Most important – harness and wheels
 - All other parts easily substituted
- Review/Describe all the parts
- Present all the parts
- Highlight any details/issues
 - Motor orientation
 - Wheel installation
 - Aluminum tape
 - Zip tie use and removal
 - Hot glue is HOT

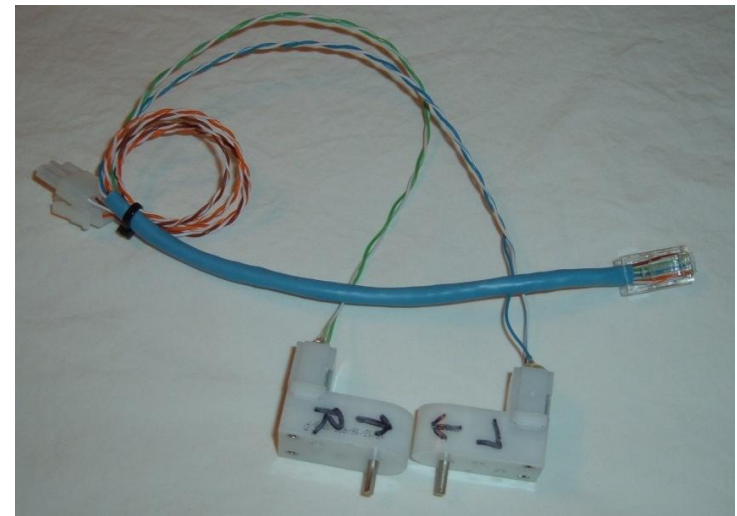
Let's Begin – Wire/Motor Harness

- Simple Robust main harness
 - Heart of Roboxsumo
 - Lan cable with motors attached
 - Lan connector – easy connect
 - Two motors hard wired
 - Basic roboxsumo uses only two motors
 - Build your own
 - Great project for students – basic wiring
 - All parts documented
 - Purchase from Roboxsumo.com



Wire/Motor Harness - Guts

- Simple Robust main harness
 - Off the shelf components
 - Lan cable with RJ45 connector
 - 2 Motors
 - 2 Molex connectors
 - Zip tie
 - Allows quick assembly
 - Note LEFT and RIGHT motors
 - Warn students about this
 - Also note "D" shaped shaft



Wheels and Tires

- Each kit - Two wheels with tires
- Pololu – PN 1420
- Install rubber tires for traction
- Push wheel directly on to axle
- NOTE:
 - Line up “D” shaped hole – DO NOT FORCE
 - Support gearbox
 - Point hub inboard



Tape, Zip Ties, Paper & Ping Pong

- 5' of Aluminum tape each kit
 - Peel paper backing to use
- 10 Zip Ties
 - Students may not have used these
 - Warn them not to zip fingers
 - Explain how to remove
 - Have cutters handy
- Two Sheets of paper
 - Use any way they want
 - Do design before build
- Ping Pong Ball
 - Can be used in many ways
 - Mostly for fun



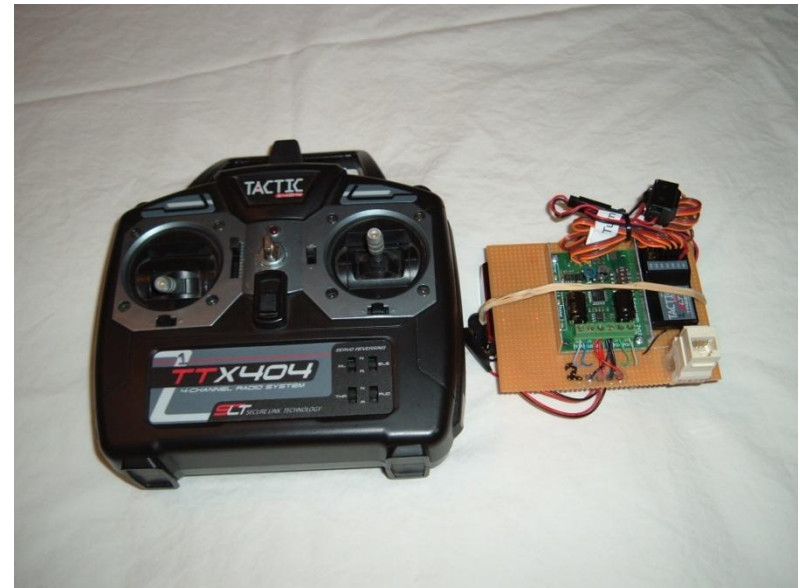
Cardboard

- 20" x 20" piece provided each kit
 - 1/2 of a 10"x10"x10" box
 - Everybody gets same amount
 - Use recycle mat'l
 - Old boxes
 - AFTER BUILD
 - Collect leftovers
 - Save scraps for repair



Controllers – 2 Types

- Two types of controllers used
 - Wired controller – 15 foot cable
 - Wireless controller – RC controls



Wired Controller

- 4 Circuit control box with 15' cable
- Battery powered
- On/Off Only
- Cost effective
- Robust
- Good for testing
- Static models
- Use with "Brain Block"



Wireless Controls

- 4 channel RC control
- Fully proportional
- 2.4 GHZ – Digital
 - Multiple radios at same time
- Receiver contains
 - RC receiver
 - Motor drivers
 - Battery pack



Controls - Sourcing

- Build yourself
 - Great project for students
 - Part of advanced/expanded programs
 - Wiring and electrical systems
 - All components listed in parts list
- Documentation is in process
- Can also purchase from Roboxsumo.com

Controls – Use

- Power up transmitter first
 - Controller will drift if transmitter is off
- Power up receiver
- Plug LAN cable in to controller
- No need to shut off controller between matches
- Watch “error” lights
 - Flashing “error” lights usually mean low battery
 - 6 – AA battery pack will last 30-40 bouts
- See RC Users Guide

Robot Competition

- We have all the parts
- The controls are ready
- Let's build robots and compete!
- Rules are provided
 - Summary follows
 - Make your own!

Setting Up for Competition (1)

- Find flat smooth location for contest
 - Remember to leave space for spectators
 - Double wall tape square if needed
- Create Bracket for competition
 - Double elimination works best
 - Everybody gets two tries
 - Got to printmybracket.com for examples
 - Make large paper copy or present on laptop
- Robot Weigh in/Check in station
 - Need a scale to weigh robots and impound

Setting Up for Competition (2)

- Assign helpers
 - Referee/MC – Run and call matches
 - Bracket recorder – Record data
 - Brain changers – Swap brains
 - Repair technician- Supervise repair station
- Additional Tables/Stations
 - Robot storage
 - Brain changing
 - Robot repair – with supplies

Setting Up for Competition (3)

- Robot repair station
 - Tools and supplies and cutting boards
 - Provide cardboard, zip ties, tape, glue
 - Use leftover materials and scrap from build
 - Need supervision to confirm safe work
 - Re-weigh any robot with big changes

The Rules - Construction

- Build from provided materials
- Fit inside 12" x 12" square (on board)
 - Review what "inside" means
- Brain must install and remove READILY
- Support and retain the brain
 - If my brain falls out – you lose
 - Prevent students from damaging controls
- Remind them of wheel orientation
- All robots must weigh in and impound

The Rules - Competition

- Start in opposite corners of 5' x 5' square
- You have 1 minute to push out opponent
 - All the way out
- If nobody is pushed out – Lowest weight
- Weight tie breaker – footprint
- You must make contact with opponent
- Referee's decision is final

Competition Field

- 5' x 5' Tape square on floor
- Use painters tape for easy removal
- Tile and smooth surfaces work best
- Can make an "arena" with plywood or flooring materials
- Odd sizes/shapes – OK as long as everybody has the same issue

Competition Options

- Build something else!
 - Solve a problem or develop a solution
- Use a different contest
 - Capture the block
 - Robot Olympiad – multiple competitions
- Incorporate different materials
 - Add decorations - Santa Sumo
 - Give them a challenge object
 - Use auxiliary motors

Potential Competition Issues

- Make the students build the robot
 - Parents can observe but hands in pockets
- Students need to decide who will drive
- Carefully monitor bracket
- If batteries in one controller droop
 - Swap batteries in both
- Have an extra controller handy if possible
- Packing list attached

Robox – Sample Competition

- Today – simplified/shortened example
- We will build robots
- Break into teams
- 1 hour to build – 1 hour to compete
- Sign up and compete.
- RULES
 - Start in the corner
 - 1 minute to push opponent out of ring
 - Must push completely outside the ring
 - If tie – Lowest weight wins
- Build your robot!

Roboxsumo – Wrap up

- Documents
 - Documents also available on-line (latest updates)
- Materials
 - Each person taking home supplies
 - Cutting boards, shears, hot glue guns, gloves
- Controllers
 - Can be borrowed or purchased
 - Wired and Wireless controls for use
- Materials
 - Make yourself or contact Roboxsumo.com

Roboxsumo – Documents

- Documents
 - PPT
 - Packing list
 - Rules
 - Parts list
 - Main harness assembly
 - Lan Cable assembly
 - About Roboxsumo
 - Aux package
 - Rc Instructions

Questions?

- Thanks for attending!
- Please feel free to contact me with questions
 - juhling@suddenlink.net
 - Cell – 252-347-3498
 - www.roboxsumo.com
 - Bill McClung
 - Coach/Engineering Mentor
 - FIRST Team 2642 – The Pitt Pirates

