

# “How to Win”

Strategy, Game Play, & Effective Design

# Who are we?

- Andy Baker

- Lead Engineer, Team 45
- Mechanical Engineer, Delphi Corporation
- Co-Owner, AndyMark.biz
- '03 Championship Woodie Flowers Award Winner
- Coach of 1998 National Champion team

- John V-Neun – Team 20, 229, 148

- Mechanical Engineer at Innovation First, Inc.



**DELPHI**

**TECHNO** *Kab*

# What We'll Cover Today

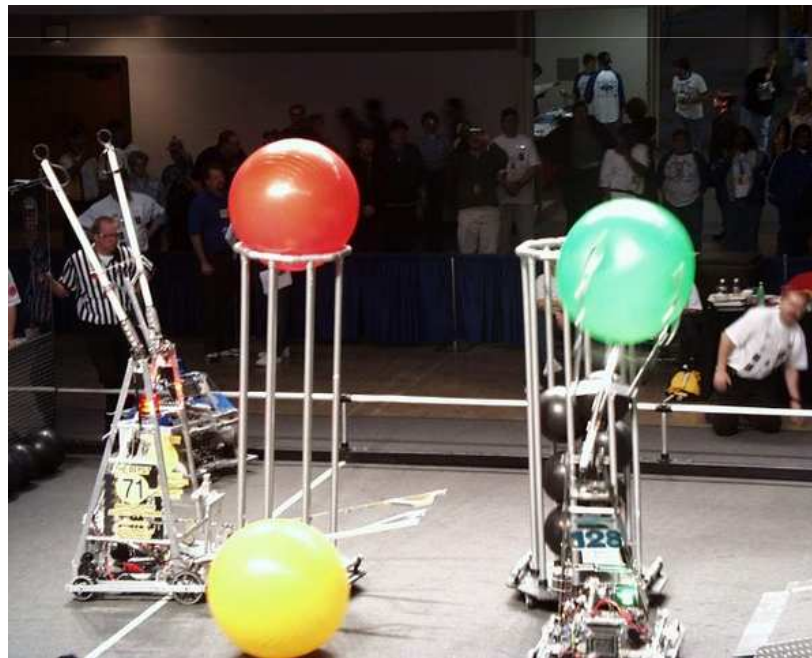
- Historical Successes – Who Won and Why?
- Strategy – ***What*** the robot does during a match.
- Design – ***How*** your robot will do it.
- Preparing for Competition
- At the Event – Successful Execution

# Who Won and Why?

- 2000 – Team # 25
  - Blocked Center Field, Controlled Score

# Who Won and Why?

- 2001 – Team # 71
  - Innovative Design “Balance off Ramp”
  - Do-All Robot Construction



# Who Won and Why?

- 2002 – Team # 71
  - “Absolute Lock” – Grab all 3 Goals.



# Who Won and Why?

- 2003 – Team # 111
  - Why Stack? – Adapt Strategy.
  - Block Central Ramp, Control Main Points.



# Who Won and Why?

- 2004 – Team # 494
  - Specialized. – Defense + Hang





# Who Won and Why?

- 2005 – Team # 330 & 67
  - Simplicity & Execution – Everybody Caps.



# Who Won and Why?

- 2006 – Team # 217
  - Winning Autonomous Mode
  - Get Ahead Early.



# Choosing a Strategy

- Choosing a Game Strategy:
  - Learn the Game
  - Try to distill the essence of the game
    - Sometimes this is easy, sometimes it is harder.
      - 2005/2006 vs. 2004
  - Think about “what” not “how”.
    - “How” will come later. Keep it in the back of your mind.
- This all may seem intuitive; these decisions are easier when you think about them in terms of these basic elements.

# Basic Strategy Types

- Offensive Robot – Score LOTS of points.
  - Do 1 Thing vs. Do All Robot
    - Specialize?
    - Beware: Jack of All Trades, Master of None
  - QB Robot vs. Support Robot
  - “Win” Robot vs. “Play” Robot
    - Do we go for the “lock”?
    - Let our drivers win the matches?
    - Offensive “Power Moves.”

# Basic Strategy Types

- Defensive Robot – Stop Opponent Scoring.
  - Basic Blocking – (Use the drivetrain.)
  - Advanced Blocking – (Specific Mechanism.)
  - Control Scoring Elements
    - Block key features (goals/choke points)
    - Block scoring objects
  - De-Score Opponent Points

# How do Teams Decide?

- Democracy
  - Everyone has a say.
- Decision Making Group
  - Top Leaders get a say.
- Consensus Building
  - Faux-Democracy
- Dictatorship
  - The “Golden Rule”

# Tools to Help Decide

- Quantitative Decision Making
  - Decision Matrix / Weighted Objectives Table
- Scoring Analysis
  - Where are the points?
  - List all ways to score & worth.
  - How many opportunities?
  - What will be a “good” score?

# Tools to Help Decide

- Sub-Team Process
  - Multiple Parallel Efforts
- Putaside
- Prototyping / Game Walkthroughs
  - Try to simulate how the game will play out.
- Think about Diminishing Returns!



# Strategy Execution – Robot Design

- What are the three most important parts of a FIRST Robot?

# Strategy Execution – Robot Design

- What are the three most important parts of a FIRST Robot?
  - Drivetrain
  - Drivetrain
  - Drivetrain!
- If you can't move, you can't score.
- If you can't move, you can't defend.

# Strategy Execution – Robot Design

- Manipulate the Scoring Object:
  - Fast, Fast, FAST!
  - Prototype, Test, & Tweak
  - Smooth like buttered silk.
  - Hold securely.
- Think about Motor Allocation Early!

# Design Principles

- PROTOTYPE IT! (Can't over-stress this.)
- Design for Fabrication/Assembly/Repair
- Design for Use!
  - Must be easily controlled.
- Seek Inspiration
- Celebrate Mistakes

# Design Principles

- Simplify it!
- Make it FAST – (Do Less, Faster?)
- Unify Functions
- Innovate, but don't reinvent the Wheel
- Every Ounce Counts
- Pay Attention to the Details
  - We CAD EVERYTHING.

# Design is an Iterative Process

- How do I make this:
  - Lighter?
  - Faster?
  - More Robust?
  - Smaller?
  - Simpler?
  - More Efficient?
  - Cheaper?
  - Easier to Construct?
  - Easier to Repair?
  - Easier to Assemble?
  - More Effective?
  - Easier to use?
- How can I combine this with something else?
- What else can this do easily?
- Who can help me with this?
- Is there anything I can use to accomplish this?
- Does this fulfill our primary strategy goals?
- **Why am I doing it this way?**
  - Beware: Propagating Constraints

# Incremental Advantage

- Continually ask yourself... “What can I do to get even a slight edge over our competition?”
- Get enough of these slight advantages, and your winning chances increase greatly

# Prepare for Competition

- Leave time for Software & Debug
  - Autonomous is more and more important.
- Driver Selection
  - Choose dedicated students.
  - Robot ability isn't most important factor?
  - Leadership Role.
- Coach Prep
  - Critical Role, needs to be prepared.
    - Think Dungy & Manning...



# Driver Practice

- Practice Makes Perfect.
  - Robot Familiarity
  - “Wax On, Wax Off” training.
  - “Play your game.”
    - Tailor your game to different partners.
  - Situational Adaptability
  - Dealing with Defense
  - Playing Successful Defense

# Pre-Event Scouting

- What are other robots doing?
  - How does the game play out?
  - What works?
  - How should we adapt our game?
  - Game Evolution
- 
- Early Regionals vs. Late Regionals

# At-Event Scouting Preparations

- Determine most important factors
- What a Robot Does?
  - Hang? Cap? Plow?
- How well it does it?
  - Try to be Quantitative
    - “Averages 10.6 balls per match”
    - Capped 6, 5, 2, 5, 7 Tets in the last 5 matches.

# Pit Planning & Organization

- Get this stuff done early!:
  - Robot Maintenance Checklist
  - Pre-Match Checklist
  - Fabricating / Purchasing Spare Parts
  - Team “at the event” organization

# At the Competition

- Robot Adaptability
  - Making smart changes is risky, but can yield good results.
- Strategy Adaptability
  - Fulfill your robot/team's potential!
  - Based on “at the event” observations and “pre-event” scouting.

# At the Competition

- Be Organized as a Team
  - Come to the event each day with a plan.
  - If there is a major Robot overhaul to be done, outline each step in the process!
- Team Support is Critical
  - Scouting
  - Pit Crew
  - Field Runners

# Networking for Success

- Identify and talk to the main decision makers on other teams.
  - Not limited to Coach/Driveteam.
  - Make Friends.
  - Give Robot Updates
    - “We had some trouble with the blah, but it’s all fixed now.”
    - Be Honest!
  - Seal the Deal
    - Make them feel good about working with you.

# Team Image

- Professional.
- Organized.
- Experienced.
- Reliable.
- SMART.
- “Not-A-Jerk”
  - Don’t get black-listed. It happens.



# Performing Under Pressure

- Drive-team, Pit Crew, Support Team
- Food, Water, & Rest

# Manage Your Alliances

- Well Oiled Machine
- Everyone needs to know their role.
- Ensure Communication during the match.
- Be Creative with Strategy to win tough victories.

# Be Prepared for the Draft

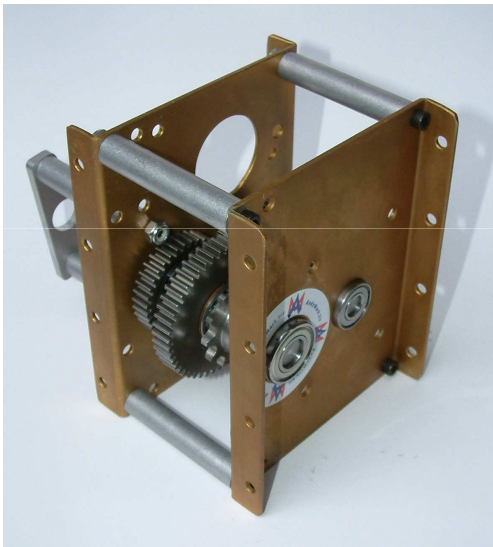
- Make a List, no matter what!
  - Full Draft Length (24 teams)
  - Typically started on Thursday
  - Detailed on Friday Night
  - Finalized Saturday Morning
- Go over the list with your student rep.
  - Give them a copy, make sure they are one of the people to help create the list.

# Most Important Factor

- Bring your Lucky Rabbit's Foot (or two).
- Winning has a LOT of luck involved.
  - Get the planets as aligned as possible through hard work. Then cross your fingers.
  - Preparation brings Confidence, Confidence brings Success.
- Play at a high enough level for long enough, and eventually you will win it all.

# Thank you!

- Any Questions?



<http://www.andymark.biz>

<http://www.ifirobotics.com>

