History of Simplicity

Using Strategy to Simplify your Design

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Clinton Bolinger

- Lead Robot Mentor and Field Coach for Team 2337

- President and Founder of The Robot Space

- Bachelors of Science in Mechanical Engineering from Kettering University

- Involvement in Robotics:
  - 1 year as a High School Student
  - 13+ Years as a Mentor

Strategy Dictates Design Method

Why developing a *Strategy* before creating a *Design* is beneficial

Always decide WHAT a Robot is going to do before determining HOW to do it:

1. Evaluate your Team's resources:
   * Time
   * Money
   * Man-Power

2. Realistically identify your Team's capabilities:
   * Knowledge and Skills of Team Members
   * Machining and Fabrication
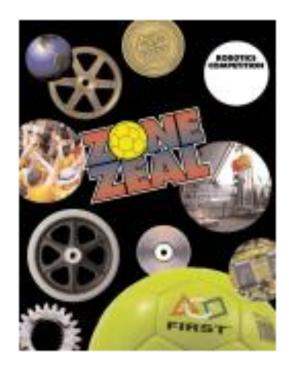   * Create vs. Purchase – Return on Investment

Simple ≠ Ineffective

Simplicity is an art that is often difficult to master.

1. Simple Robots achieve the objective with the least amount of resources,
2. Simplicity does *not* mean creating a robot that does not perform the task,
3. Simple designs spend less effort to create
4. Gives Teams the opportunity to "perfect" their design, and more practice time
5. Some of the most prestigious Teams have used simple robots
6. Simple strategy ≠ simple design

Simple Winning Robots

2002 – Zone Zeal

Game Pieces – Soccer Balls
Field Elements – Goals on Casters, and Field Zones

Winning Simple Strategy:
"The Balls Don't Matter!"

Simple Winning Robots

2003 – Stack Attack

Game Pieces – Plastic Totes
Field Elements – Scoring Zones

Winning Simple Strategy:
"Knock 'em Down!"

Simple Winning Robots

2007 – Rack N' Roll

Game Pieces – Inflatable Circular Tubes
Field Elements – Scoring Rack

Winning Simple Strategy:

"Ramp Bots"

Simple Winning Robots

2008 - Overdrive

Game Pieces – Track Balls
Field Elements – Overpass

Winning Simple Strategy:
"Lap Bots"

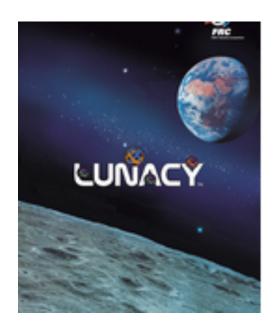# Simple Winning Robots

2009 - Lunacy

Game Pieces – Moon Rocks, Super Cells and Empty Cells
Field Elements – Trailers

Winning Simple Strategy:

"Empty Cell Runners"

Simple Winning Robots

2010 - Breakaway

Game Pieces – Soccer Balls
Field Elements – Goals, Tower, Bumps and Ball Return

Winning Simple Strategies:

"Diverters"
"Plowie Bots"

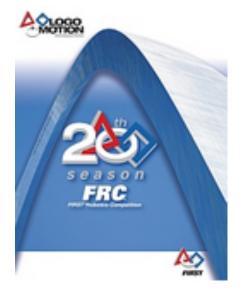# Simple Winning Robots

2011 – Logo Motion

Game Pieces – Triangle, Circle and Square Tubes
Field Elements – Scoring Rack, Mini-Bot Tower

Winning Simple Strategies:
"Who's Our Juggernaut?"

Simple Winning Robots

2012 – Rebound Rumble

Game Pieces – Compact Foam Basketballs
Field Elements – Hoops and Bridge

Winning Simple Strategies:
"Bridge Bots"
"Feeder Bots"

Simple Winning Robots

2013 – Ultimate Ascent

Game Pieces – Frisbees
Field Elements – Pyramids and Goals

Winning Simple Strategies:
"Pool Noodle Fortress"

Simple Winning Robots

2014 – Aerial Assist

Game Pieces – 24-inch Exercise Balls
Field Elements – Truss, Goals and Zones

Winning Simple Strategies:
"The First Assist"
"The Bloop-Bloop"

Simple Winning Robots

2015 – Recycle Rush

"Turning FIRST Robotics Competition into FIRST Robotics Exhibition"

"A game that needed to be recycled before it even happened."

#RecycleRecycleRush

Simple Winning Robots

2016 – Stronghold

Game Pieces – 10-inch Foam Balls
Field Elements – Multiple Defenses / Obstacles

Winning Simple Strategies:
"Breeching Robots"
"Low Goal Cycle Bots"

Simple Winning Robots

2017– STEAMworks

Game Pieces – 4-inch Whiffle Balls and Plastic Gears
Field Elements – Boiler, Airship and Climbing Ropes

Winning Simple Strategies:

"MUST Climb Every Match"
"Passive Gear Bots"

How to Achieve Simplicity

In order to achieve any level of success – even simplicity:

- Understand the game rules
  - What do the rules say?
  - What don't they say?

- Categorize Game Objectives
  - Scoring
  - Ranking Points
  - De-scoring

- Identify Strategies
  - Offensive vs. Defensive
  - Scoring vs. De-Scoring
  - "Choke Holds"

A Simple Approach:
Return on Investment

- *Identify ALL scoring methods*
- *Determine finite and unlimited scoring*
- *Calculate Alliance scoring potential*
- *YOUR Robot's contribution of Alliance total score*
- *"One-time" Bonuses*

	Points	Percent of 305	Alliance Needs	Total Points
Auton Mobility	5	2%	3	15
Auto Gear	60	20%	1	60
Gears - 2nd Rotor	20	7%	2	40
Gears - 3rd Rotor	10	3%	4	40
Climb	50	16%	3	150
			Total Points	305

Calculate Points Per Second

Using 2017 KoP Chassis - AM14U3
at standard 10 feet per second

Action	Seconds
Travel Length of Field - 60 feet	6
Aquire Gear from Load Station	5
Travel Length of Field - 60 feet	6
Place Gear on Peg	8
ONE Gear Score Time	25

Calculated Points Per Second

	Points	Estimated Time	Points Per Second
Auton Mobility	5	5	1
Auto Gear	60	15	4
Gears - 2nd Rotor	20	25	0.8
Gears - 3rd Rotor	10	25	0.4
Gears - 4th Rotor	6.7	25	0.3
Climb	50	5	10

Simplifying Your Design

There are many ways to create a low-cost, simple design:

1. Use the Kit of Parts Chassis from AndyMark,

1. Purchase COTS (commercial off-the-shelf) Items:
   - VEXpro VersaFrame and Gusset System
   - VEXpro VersaPlanetary
   - RoboPromo Bumper Kit

2. Don't "knock" Home Depot materials:
   - PVC
   - Wood
   - Foam Insulation

Steal from the Best...

Design the Rest.

Resources to Check Out:

1. Robot in 3 Days
2. West Coast Products (WCP) – Minimum Competitive Concept (MCC)
3. Chief Delphi Forums
4. The Blue Alliance (Blog, Team, Events, and CAD Files)
5. RoboSports Network (check_in, GameSense, Behind the Lines)
6. The Robot Space - AndyMark - VEXpro
7. RoboPromo

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