AHS Skunkworks Robotics

Team 1983

Tool Kit

Prepared By:
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Concept designs
Development Designs

Competition Designs
Designs used for Competition

Posted Technical Designs
Designs Posted on Chief Delphi

Pneumatic Kicker System

Status: Competition Design

Kicker system for scoring soccer balls

Pros

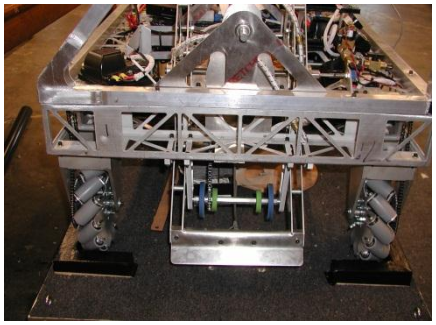
- Multiple stages of power for varying forces
- Consistent trajectory in range, altitude, and direction

Cons

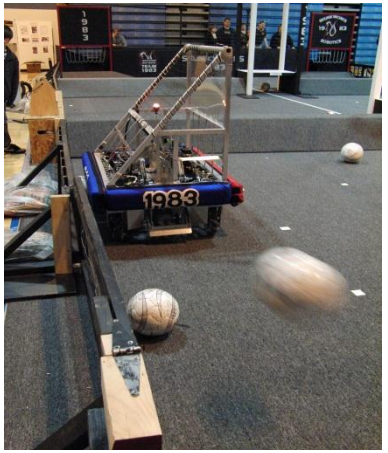
- Pneumatics can be unreliable
- Requires lots of space

Application

- 2010 Breakaway Competition



Kicker in its initial stages



Pepe Le Pew scoring a game piece with kicker

Ball Control System

Status: Competition Design

System mounted in front of the Kicker system to control soccer balls

Pros

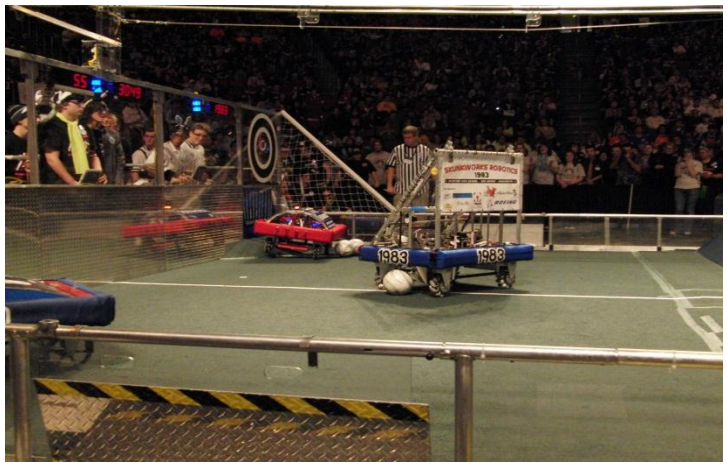
- Simple
- Fairly reliable; backing, turning

Cons

- Inconsistent ball control
- Only usable on flat terrain

Application

- 2010 Breakaway Competition



Robot using the ball control system to get a shot at the goal

Skunkworks Base Frame

Status: Competition Design

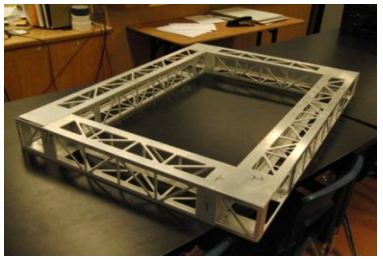
The frame Skunkworks Robotics uses for it's robots

Specifications

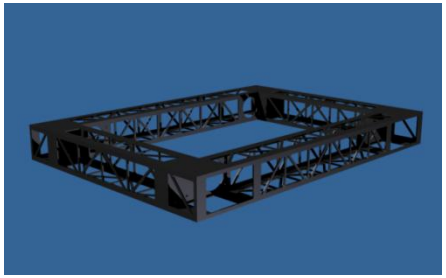
- Water jetting used to cut pieces with precision
- Spaces for easy installation of transmissions & motors
- Spaces on the underside for easy yoke and wheel installation
- Cutouts decrease weight significantly

Application

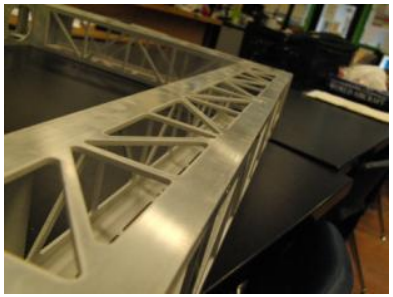
- Base frame for 2009 Swerve Drive and
  2010 Mecanum Drive Systems



Skunkworks base frame ready to be welded together



CAD design of Skunkworks base frame



Lightweight Truss Design

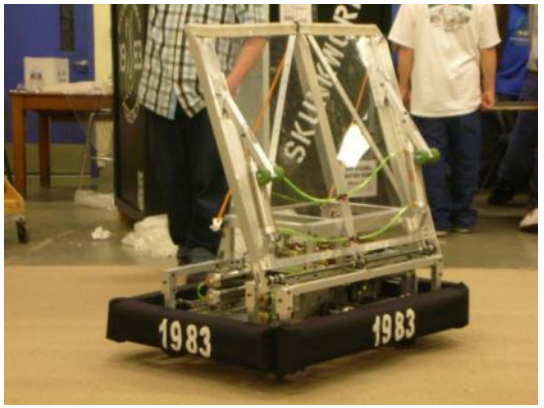
Tank Drive System

Status: Competition Design

Simple tank drive system

Pros

- Simple and Easy to build
- Few motors are required
- Fair Pushing Power



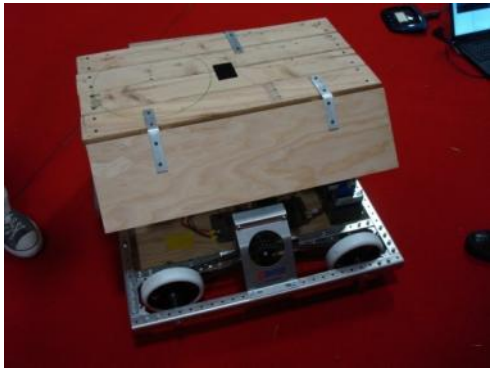
2007 Rack n' Roll Robot

Cons

- Less maneuverable than many drives
- No strafing movement

Application

- Used for developing the 2009 and 2010 camera and software



Kit-Bot Traction Drive Base used for Camera Targeting Development

Six-Wheel Drive

Status: Concept Design

Six-Wheel Drive where corner wheels are raised above the plane of the center wheels, allowing for better maneuverability than a tank drive

Pros

- Very maneuverable
- Fast speed
- Strong at pushing

Cons

- Weight
- No strafing movement
- Minor stability issues

Application

- Fall project of 2008

The 6-wheel drive was the fall project of 2008

Four-wheel Omni Drive

Status: Concept Design

An Holonomic drive where Omni wheels are placed in each corner at a 45 degree angle

Pros

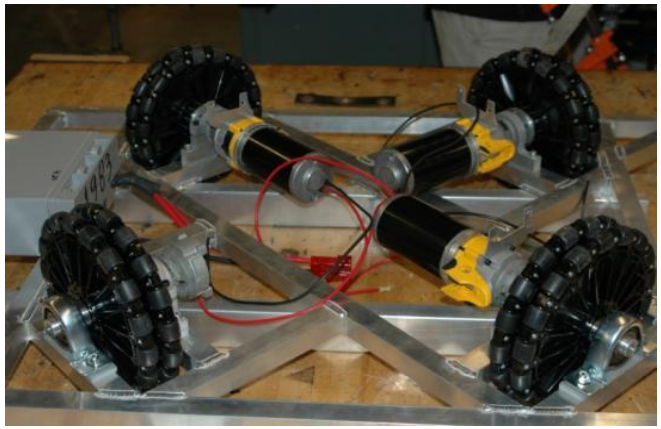
- Omni-directional
- Great mobility and maneuverability

Cons

- 30% power loss from conflicting forces
- Little pushing power due to Omni-wheel layout.
- Complex Software

Application

- Intended for 2008 Overdrive Competition, but was abandoned due to software issues



Omni Drive base Ready for Control System and software development

Close-up on Drive Wheel Assembly

Mecanum Drive System

Status: Competition Design

A Holonomic drive system with Mecanum Wheels

Pros

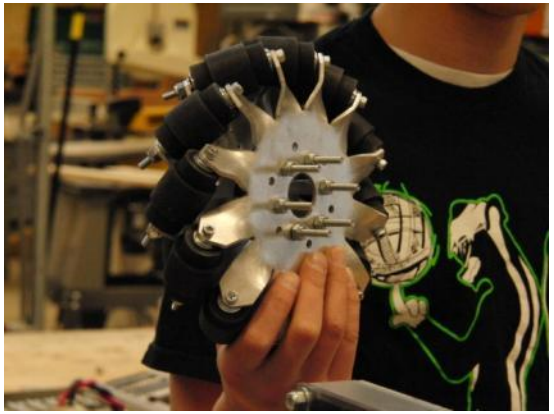
- As simple as a tank drive in construction
- Omni-directional movement
- Frame is the same as a four-wheel drive

Cons

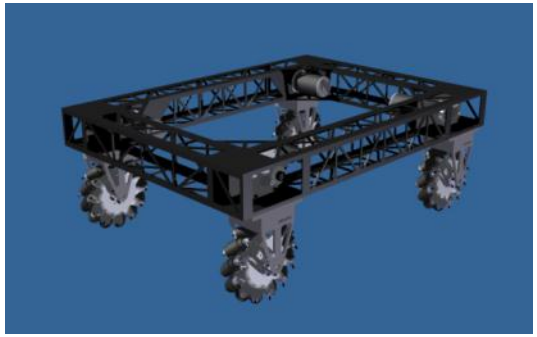
- 30% power loss from conflicting forces
- Power loss results in less pushing ability
- Wheels are expensive
- Programming is complicated

Application

- 2010 Breakaway Competition Drive



Mecanum Wheel displayed in shop



CAD design for the 2010 Competition Drive Base

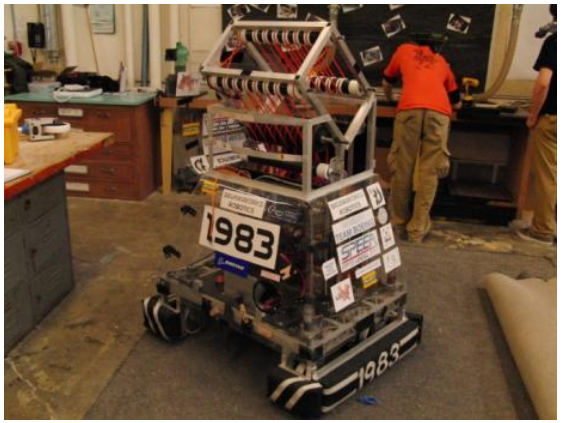
Coaxial Half Swerve-Drive System

Status: Competition Design

A Swerve-Drive System where front wheels and back wheels are steered coaxially

Pros

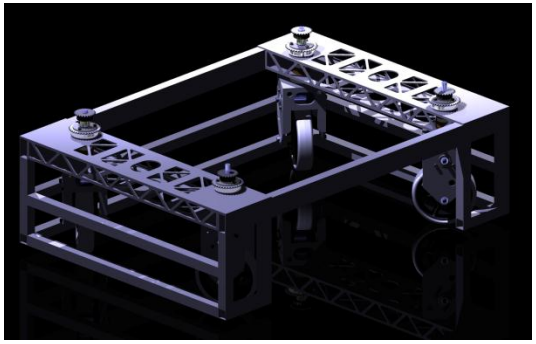
- Vastly maneuverable
- Wheel mounts can rotate indefinitely
- Slightly Less complicated than a Swerve-Drive System



2009 Lunacy Robot

Cons

- Complicated and expensive
- Torque from driving must counteract torque from steering
- Cannot spin in a tight circle as many drives can
- Heavy



CAD rendering of the Half-Swerve Drive

Application

- Used in 2009 Lunacy Competition

Coaxial Swerve Drive Module

Status: Competition Design

A module where independently powered wheel is able to rotate, allowing for great maneuverability

Pros

- Omni-directional movement
- Modular design
- Power loss is low, meaning it can be used for .1 coefficient of Friction wheel-to-ground situations

Cons

- Heavy
- Wheel module may require recalibration
- Programming is difficult
- Bearing cannot handle large mass drive, requiring lots of power

Application

- Used in 2009 Lunacy Competition as Drive Base

2009 Lunacy Competition Swerve Module Construct

Swerve Module in it's casing

Telescoping System

"The Ladder"

Status: Competition Design

A telescoping assembly that uses a series of pulleys and bearings to extend and retract the system

Pros

- Uses a small space to extend to a long distance

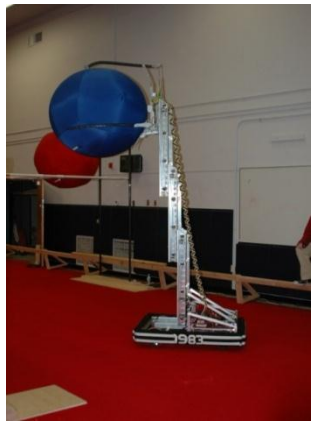
Cons

- Heavy
- Lots of friction within this mechanism

Application

- Used in the 2008 Overdrive competition

Robot being prepared to ship for Portland



The fully extended telescoping system

Camera Targeting System

Status: Concept Design

A system that uses a webcam for enhanced targeting ability

Pros

- Enables autonomous control for a variety of applications:
  shoot, follow, steer, trajectory, distance
- Provides assistance for the drivers to target goals

Cons

- Required large amounts of processing power
- System can be difficult to target with manually
- Complex programming
- Lighting can be a problem

Camera-bot being tested in 2008

Application

- Used with the Firing Control System

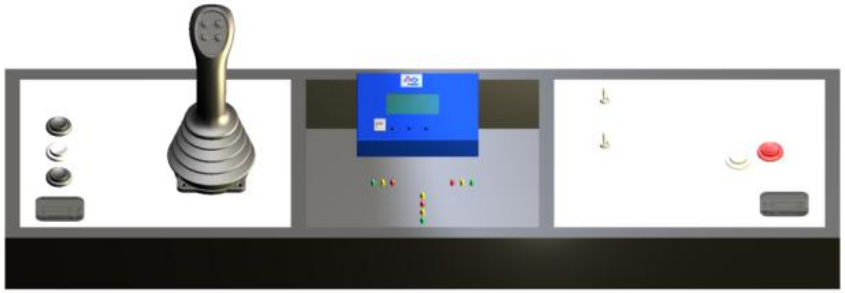
Firing Control System

Status: Competition Design

A Manual Control Panel with three modes to simplify driving ability and using a firing system

Pros

- Can Switch between Manual, Semi-Automatic, and Automatic Modes
- Much easier to drive than the provided remote control
- Warning lights made for easy use
- Impressive design
- Useful for Force Feedback



"Maverick" Console | Coach's Console (Status) | "Goose" Console

Cons

- Different lighting could cause issues
- Driving from robot's perspective could complicate targeting

Application

- Used for all Skunkworks FRC robots

Arm Design System

Status: Concept Design

An arm design meant to accurately lift weight using a dexterous double-joint system

Pros

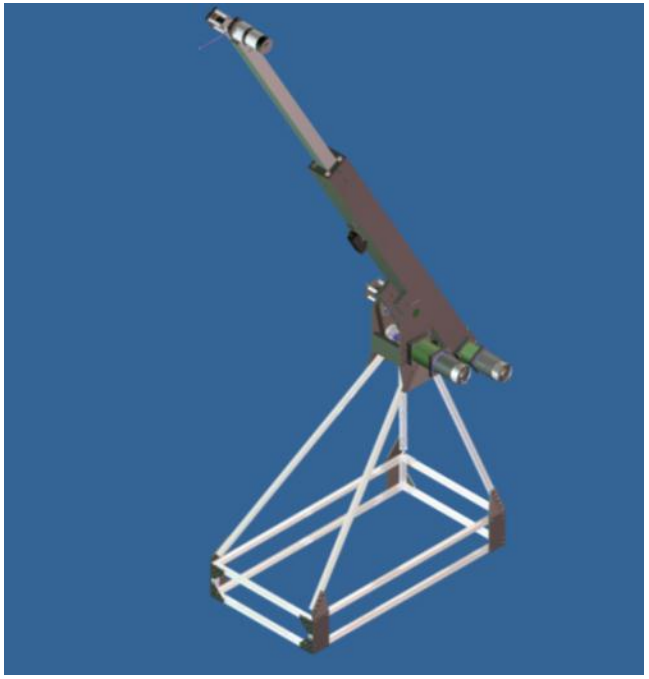
- Second joint allows end effecter to be extremely dexterous
- 3 degrees of freedom: shoulder, extension, and wrist
- Design testing was successful, arm was operative
- Systems work smoothly without interruptions

Cons

- Complex system
- Heavy for intended uses

Application

- Fall Project of 2009



CAD design of Arm System

Universal Transmission

Status: Concept Design

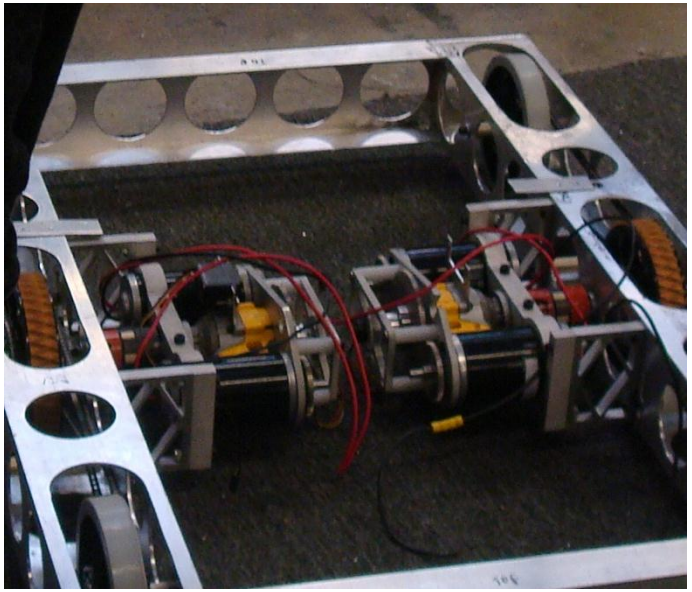
A basic, general-purpose transmission

Pros

- Relatively inexpensive
- Simple concept and design
- Sturdy, hard to break
- Shifting three speeds

Cons

- Default design used by everyone
- Large amount of space required
- Limits the space you can use on the robot
- Heavy



Universal Transmission mounted onto the six-wheel drive

Application

- Evaluating Performance

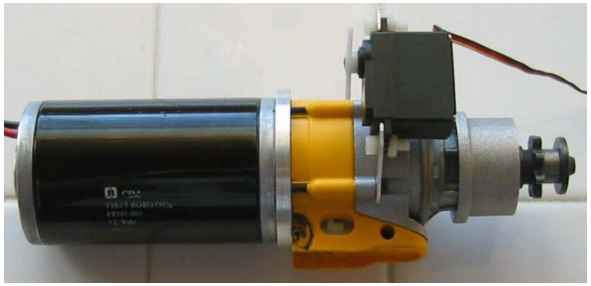
DeWALT Transmission

Status: Posted Technical Design
From Team 647 Cyber Wolves

A Build-It-Yourself Orbital Transmission with three different gear selections

Pros

- Transmission takes less than a couple minutes to put together
- Inexpensive
- Light weight and reliable
- Shifting three speeds



The DeWALT Transmission used for FRC robots, including the 2010 robot

Cons

- Can only use one motor to power transmission
- Shifting can be difficult during use

Application

- Evaluating Performance