

# Design Process Continuous Improvement

Cyber Blue  
FRC 234

April 2011 / FRC Championship Conferences



# Design Process

- Design is a continuing process
- The goal is to continually improve and increase the overall knowledge of the team
  
- *“Our 2012 Design Is Already Underway”*
  - What Does That Mean ?
    - We Don’t Know Next Years Game
    - We Are Preparing For It



# Design Process

- Our “Design Season” starts immediately after the CHP event
  - *Begin with Lessons Learned*
  - *Finish with the 2012 Competitions*
  - *Make continuous changes and improvements along the way*
  
- We follow 7 major steps



# Design Process

- Cyber Blue “Design Process”

- 1. Innovation and Opportunity
- 2. Concept Development
- 3. Preliminary Design
- 4. Critical Design
- 5. Product Realization
- 6. In Service / Competition
- 7. Lessons Learned



SUMMER / FALL



JAN / FEB



APRIL



MAY



# Design Process

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# Lessons Learned

- End of Season Event
  - Formal Process
    - All Team Members and Mentors
  - Put “Thick Skins” On
    - Open, Honest Feedback
  - Answer These Major Questions
    - What did we do well?
    - What did we not do so well?
    - What do we need to be sure we keep doing?
    - What do we never want to do again?

What do we need to learn?



# GOOD

- Foot Repairs
- Design/Build of kicker gearbox
- testing/prototypes
- Chairman's presentation
- R1 & R2
- continuous improvement
- CHP forum presentations (2)
- Food
- Scouting
- 100% attending freshmen performance
- Robot function weighing (value analysis)
- team conduct → no PDA
- safety
- judge coverage
- evaluating game
- human Breakaway #2
- Building Field elements
- new machine training
- dedication → never quit
- subteam floatation
- unique brainstorm idea
- learning from past designs
- kicker design efforts
- email comm w/sponsors
- transforming culture in school
- new image
- Fall Project → & Follow Through
- Fall Attendance
- friendliness
- LDR
- Everyone vs everyone else
- community outreach
- wire organization
- bumpers
- robot - good look
- autonomous selections
- switch
- mock kickoff
- surrounding team outreach
- open house
- NFA
- having field in build area
- student leadership
- underclassmen initiative & learning actively

# BETTER

- Protect Digital sidecar/Electronics
- More spirit!!
- More robust design
- absolute understanding of rules (bumpers)
- Reaching out internationally (or in new ways)
- Time management
- more testing on crab drive
- soft drink management
- Scouting
- interactions with other teams + robots
- Pit display/tent
- initiation of new team members
- team bonding
- respecting our build area/tools
- distribution of responsibilities (i.e. trash)
- website overhaul & New MEMBERS
- punctual, on time
- No sleeping in stands
- take manual for what its worth
- weight management
- fully prototype all systems
- try to prototype with robot function imitated
- more drive practice
- training new members to talk to judges
- general communication beyond team meetings (video and announcement <sup>after school</sup>)
- use of forums/training on C.V.
- parent meetings
- team history organization
- faster brainstorming
- practice field built quicker (parents)

# Innovation and Opportunity

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# Innovation and Opportunity

- From the Lessons Learned Event and Other Observations
  - What Design / System do we want to create
  - What Classes / Projects do we want to do
- Goals
  - Learn new systems/skills
  - Become more competitive
  - Create capability before competition season



# Innovation and Opportunity

- Projects
  - 2008 – Belt v. Chain Evaluation
  - 2009 – Swerve Drive Design / Build Project
  - 2010 – Traction Test
  - 2010 – Chassis Assembly Instructions
  - 2011 – Elevator / Lift System
    - An option for 2011 game, but we had limited experience
  - 2011 – Belt Drive Evaluation
    - Implement on 2011 Prototype (R1)



# Concept Development

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# Concept Development

- FIRST Kick-Off! New Game!
  - Understand key points/strategies of the game
  - Create possible strategies to “play the game”
  - Create possible concepts to support the strategies drawing from:
    - Past games
    - Past robots (ours and others)
    - Knowledge gained in fall projects
- End of process = “final” concept



# Preliminary Design

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# Preliminary Design

- Create preliminary designs to support the team strategy and concepts
  - CAD Modeling (Inventor)
  - Sketches and drawings
  - Mock-Up and demonstration parts
- Make a final design decision
  - Full scale CAD modeling
  - Concurrent build/test of prototype parts and prototype robot



# Prototype Robot (R1)

- Goal is for very similar to final design
- Based on emerging designs
- Primary objectives of R1:
  - Space claim
  - Preliminary wiring and programming
  - Something to drive and play the game
  - Makes the build of final robot quicker and easier and provides a more robust final product



# Critical Design

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# Critical Design

- Formal Critical Design Review (week 3-4)
  - Outside professionals evaluate our decisions and design and provide valuable feedback
  - Student developed and led presentation
    - FIRST introduction
    - Game animation and rules
    - Our strategy, solution, and design
    - Parts and Robot Prototype demonstration
  - This also offers a fresh perspective on our ideas, many of which we talk ourselves into.



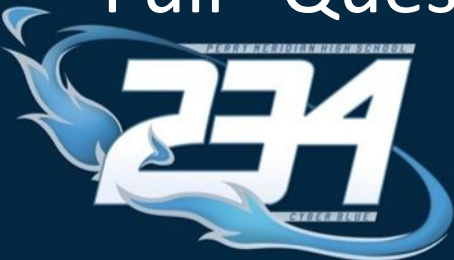
# Critical Design

- Detailed information provided

- Decision matrix
- Sketches
- Sample parts
- Detailed drawings
- Electrical schematics
- Weight analysis
- Motor / power requirements

Cyber Blue 234 Design Matrix								Totals
	Manipulator	Chassis	Mini Deployment	Minibot	Control	Game		
Autonomous - Top	5	-	-	-	5		100%	
Autonomous - Any	5	-	-	-	5		100%	
Drive Speed	-	5	-	5	-	*	100%	
Pick Up Speed	5	-	-	-	2	*	70%	
Reliability	5	5	5	5	5	*	100%	
Hang Accuracy	3	-	-	-	4		70%	
Hang Speed	5	-	-	-	4		90%	
Minibot	-	4	5	5	5	*	95%	
Full Auto Mini	-	-	2	5	3		66%	
Universal Mini	-	-	1	1	-		20%	
Low CG	4	4	-	-	-		80%	
Mini Deployment Speed	-	-	5	-	-		100%	
Human Load Tubes	4	-	-	-	2		60%	
Pick Up Tubes from Floor	5	-	-	-	-		100%	
Repairability	5	5	4	4	4		88%	
Top Row Score	5	-	-	-	-		100%	
Weight	4	5	1	5	-		75%	

- Full “Question and Answer” discussion



# Product Realization

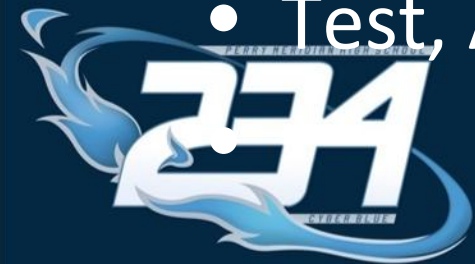
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# Product Realization (R2)

- Final Manufacture and Assembly of Competition Robot
  - Knowledge from prototype robot
  - Input from Critical Design Review
- Complete detail and assembly level drawings
- Manufacture finished “final” parts
- Assemble, Wire, Program
- Test, Adjust, Modify, Break, Rebuild,

Ship



# In-Service / Competition

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# In-Service / Competition

- Final “proof” of the concept and realized robot
- Continual refinement and modification
- Tweak, modify, replace, adjust as needed once the game play is understood fully
- Practice with prototype when at home
- Replacement parts
- Continuous review of what works / what does not work



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Close the loop –  
Start Again!



# Questions / Comments

## Team Contact Information

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