

Abstracts for the 2009 *FIRST* Robotics Conference

**15-16 April 2009
Georgia World Congress Center**

**ALL SESSIONS ARE OPEN TO ANY ATTENDEE
WITH A VALID PASS.**

Abstracts are listed by program or as 'all' only to assist with scheduling and with finding topics of interest.

FIRST Robotics Competition

Advanced Control System Topics

who: Representatives from National Instruments and WPI

Abstract available soon

Agile Design for FIRST Robotics

who: Greg Marra, Tom Bottiglieri

Organizing a FIRST Robotics Competition, FRC, team and designing a robot from scratch in six weeks is a monumental example of real-world project management. Recently, in the field of Software Engineering, a growing movement has arisen known as "Agile Development". The practices behind Agile Development were designed to help tackle large projects and manage engineering teams effectively. Many of the core Agile tenants can be applied beyond the scope of Software Engineering, and can help FRC teams focus their energy when designing and fabricating their robots. Many of the practices we discuss can be incorporated into existing teams' operations. Working simultaneously in independent small groups within your team can increase productivity, giving students more hands-on experiences. Focusing on system integration increases students' understanding of the robot as a system and reduces headaches that arise during the last days of build. Utilizing COTS components and black boxing controls system elements enables students to focus on areas that interest them, instead of reengineering problems with commercial solutions. We illustrate these examples with anecdotes from our experience as Regional Mentors for rookie teams in the Boston area. We believe that applying some of the Agile practices that have revolutionized the Software Engineering world can have a profound impact on the efficiency of FIRST teams and improve the experience of students participating. Hopefully you can take some of these practices back to your team to reduce design problems, increase hands on experiences and system understanding, and have more fun!

Belt Drive vs. Chain Drive Evaluation for FRC Robots

who: FRC234

To determine the merits of a belt drive or chain drive, Team 234 completed a series of tests on two robot drive systems. The testing was designed and developed using a basic "Design of Experiments" approach to assure an unbiased process, to maximize the value of the data collected and to minimize the variation between tests. Configuration 1 was a drive system with #35 chain and aluminum drive sprockets. Configuration 2 was a drive system with 15mm drive belts and aluminum pulleys. All data was collected on the same chassis, motors, transmission and control system. Only the wheels and drive method changed between tests. This presentation will show the test objective, test plan, test procedures and provide a summary of the data and findings.

Building a Subversion Server

who: Hugh Meyer

This session shows you how to build your own Subversion server. You will learn what is required to take almost any computer and convert it to a powerful code repository system using free software. Subversion is a free and open source version control system. It manages files and directories, and the changes made to them, over time. You can recover older versions of your robot code or examine the history of how your code changed. Many people think of Subversion as a sort of giant "Edit Undo." Subversion operates across networks, which allows programmers to use it on different computers anywhere they have internet access. Student programmers can work at home or in the shop and mentors can review code as needed from where ever they want. Subversion supports simultaneous editing of your robot code by multiple programmers. Without a good version control system this is a common cause of lost work. Changes can result in overwritten code and wasted time resolving conflicts. Subversion supplies the infrastructure to prevent these scenarios and notify programmers that they need to combine or merge changes. In many cases Subversion will seamlessly merge the code without user interruption. You may be surprised how inexpensive and straight forward it is to move your programming team to the next level by using Subversion. If you are not using a version control system, you should be! This session will show you how.

Chairman's Award Chat - Talk with Championship Chairman's Award Teams

who: John Larock & Other Chairman's Awards Representatives

The Chairman's Award is the top award in FRC and is more competitive each year. MOE 365 will lead a panel discussion with representatives from past Championship Chairman's Award teams. The panel discussion will cover the following topics - how each represented team earned the recognition, personal team stories, why submit?, know your team, how to plan, the written submission, the judges presentation. Teams should bring their Chairman's Award questions and be ready for some lively and (hopefully) helpful discussion.

Creating a Team Continuity Plan - Business Plans to the Next Level

who: FRC234

Many businesses have "Continuity Plans" that address risks to their ongoing operations and plans of actions to mitigate those risks. These plans address such events as weather, power outages, loss of key leaders, economic turmoil and other factors. Team 234 completed a process to define a Team Continuity Plan to identify and address the risks and issues that could impact the ongoing operation of the team. This process was based on a corporate model. This presentation will step through the process used by the team, show the major risks that were identified and the actions in place or planned to address those risks and their impacts.

Effective *FIRST* Strategies for Robot Design and Competition

who: Karthik Kanagasabapathy

This presentation focuses on three major areas, Strategic Design, Match Planning/Execution, and Scouting. Rather than spending time on equations and detailed calculations, the Strategic Design gives a more high-level overview of how to design an FRC robot. This portion of the presentation includes sections on such often neglected strategic design areas such as Game Analysis, Chokehold Strategies, Cost-Benefit Analysis, Task Prioritization, and Tradeoffs using case studies from past games. The Match Planning/Execution section of the presentation discusses effective habits and strategies that will help lead a team to victory. This is a must for those who enjoy the strategic aspects of *FIRST*. The Scouting section deals with effective techniques to collect information on your partners/opponents, and how to make the most of this data. The presentation is filled with entertaining and insightful historical *FIRST* anecdotes from the past 11 years. With the information in this presentation, you can turn your team from a mere competitor to a perennial powerhouse!

Electrical Design and Technique For Building A Competitive Robot

who: Al Skierkiewicz

Learn design techniques for maximizing the efficiency of your robot electrical system. The discussion will include topics on electrical system design, electrical component layout, wiring techniques and tooling, planning for replacement and a discussion of some of the common failure points in typical robot design.

FRC New Technology Showcase

who: To Be Announced

This is a review of new technology in the works for the 2010 *FIRST* Robotics Competitions. The showcase will introduce new technology and include some introductory discussions of how it can be implemented in your FRC robot.

From Rookie to Powerhouse: Sustaining Your Team's Membership, Knowledge and Competitive Edge

who: Brandon Mensing

Every new team is warned about the difficult financial sustainability of *FIRST* teams, but the sustained success of a team goes well beyond the money. Teams must recruit and retain students and knowledge while organizing

themselves from year to year. They must build a cohesive group capable of improving their engineering, outreach and competition successes by learning from their strengths and weaknesses on several fronts. Through imparting my past experience as an FRC National Champion, founder of a rookie team, and lead mentor of a once fledgling team, I'll show you how to take a team from rookie status to that of a sustained powerhouse.

Pneumatic Power Concepts

who: Raul Olivera

Most teams are familiar with how to work and optimize systems using electric motors; many even know how to work with their power curves. However, very few are familiar with how the forces, energy levels and associated power concepts apply for pneumatic systems. This presentation will discuss comparisons between electric motor driven systems and pneumatic driven systems. Some teams also struggle with their pneumatic system running out of pressure in the middle of a match. This presentation will also discuss the concept of energy management in pneumatic systems and design considerations to optimize the system.

Technical Entrepreneurship

Who: Andy Baker

Abstract available soon

Transitioning From A Robotics Club to a HS Robotics Class: Curriculum/ Organizational change

who: James Stephan

Starting a robotics club is relatively easy in comparison to starting a high school class. This introductory workshop will address areas of: class credit, creating class objectives and curriculum, locating resources (curriculum sources, textbooks, web resources, local training materials), and lab space acquisition and design and material management.

FIRST Tech Challenge

Using Windchill

LabVIEW for FTC

NXT-G for FTC

RobotC for FTC

Pro/Engineer for FTC

Advanced Building Tips for FTC

Abstracts will be available soon.

FIRST Lego League

Robots in the Middle of Nowhere: Building Rural FLL Programs Through Partnership

who: Toni Wilcox, Jan Derdowski

In rural America the "digital divide" could be described more accurately as the "technical divide." In this presentation we outline the special challenges facing rural youth in gaining access to quality programs, and illustrate how FLL is within reach of even the smallest and poorest communities. By examining one rural partnership, in a case study format, participants will be able to identify previously untapped assets in their own communities. Because robotics programs are virtually unknown in most rural areas, special attention is paid to strategies for attracting youth, gaining support from parents and recruiting volunteers.

The Pragmatic Use of Variables in FLL

who: Randy Miller

One of the rubric questions for First Lego League asks about the ability of team members to use variables if applicable. In our rookie year, we did not use any variables and could not see a need for them. However, as we progressed, we asked ourselves, "What can a variable be pragmatically used for in NXT/G and FLL?" This year's challenge had an obstacle perfectly suited for variables, Find Agreement. We initially solved this challenge using variables but found a quicker, more efficient way to solve the challenge using an attachment. Even so, we found some interesting ways to use variables to solve common FLL problems as well as some limitations to the use of variables in NXT/G. This session will explore the inner workings of variables in NXT/G. It will show common ways to solve problems in FLL using these programming constructs. It will also show some things that will not work but look like they should. We end with a set of tips and tricks as we realize that many have had difficulty figuring out how they work.

Using Lego Robotics to Promote Math and Science

who: Bill Johnson

Using Lego Robotics to Promote Math and Science Prof. Bill Johnson Scottsdale Community College, Scottsdale, Arizona Scottsdale Community College students have been/are being used to mentor kids age 8-12 in Lego robotics at different youth organizations in the local community. The goal of the program is to promote interest in math/science/engineering/programming. The initial phase of the program emphasizes robotic basics (building/programming robots and using the different sensors to accomplish simple challenges). In the second phase, kids are introduced to more advanced building/programming techniques and/or are mentored for FLL competition. To date, ~ 29 kids at the Scottsdale Rose Lane Branch Boys/Girls Club have gone through the basic robotics sessions. Four kids from the initial class competed in the 2008 AZ FLL Competition. This talk will summarize the learning experiences that were obtained and outline some of the key factors for a successful growing program.

All Programs

Applying the Engineering Design Process to Competition Robot Design

who: John V-Neun

This presentation will outline a sample engineering design process and describe its individual steps. Examples of how it can be applied to the typical competition robot build season will be provided along with descriptions of several different tools which can be utilized during this process.

Key engineering principles & lessons will be described as well as methods to demonstrate and emphasize these principles to students on a competition robotics team.

A sample timeline of the traditional 6-week FRC build season will be discussed highlighting ways to integrate the engineering design process and emphasizing milestones where key engineering principles can be demonstrated.

Some key discussions will be: "Prototyping for Success", "Design is an Iterative Process", "Continuous Improvement", and "Engineering Problem Solving".

Challenging elementary students perceptions of engineering

who: Diana Norse, et. al.

An average 3rd grade student thinks engineers drive trains. This presentation is about how we challenge elementary school student's perceptions of what engineers do to thinking about how to apply technology to solve real life problems. Working with professionals our students have developed classroom material and other incentives that allow school to meet state mandated curriculum requirement and simultaneously introduce students to engineering and robotics. Programs like this allow school systems to implement a robotics related program without incurring significant institutional costs. A program like this can be an excellent precursor to students entering FLL robotics programs.

Engineering Robust Solutions Through Better Choice of Targets

who: KK Quah and Dr. Paul Bresnan

This presentation will focus on improving missions by getting a better understanding of the choice of targets for the mission. I present a math proof using trigonometry to show how the width of the target and the distance to the target are important factors. The choice of the target affects the kind of manipulator to use. Once the target is chosen, the question is how to make the mission more robust. A lot of times, it is a case of engineering a better manipulator to maximize the hit ratio to the target. Sometimes the final objectives can be accomplished with intermediate targets. Sometimes it involves making part of the mission model the target as a reference point to help the mission success. I will use LDraw names for the LEGO® pieces described. Since I coach FLL, most anecdotes and examples from FLL but I will have one example from FTC.

FIRSTsteps : Marketing FIRST to Educational Organizations

who: Amber Scales, at. Al

"How do we achieve institutional support for FIRST programs?" In an era of teams and the educational establishment facing constrained resources we will explain how to develop partnerships with district and state level educational institutions that allow them to participate in the promotion of FIRST programs. "How do we effectively communicate with educators and the public?" Here we will explain how to simply break through the "pure massive noise level" and capture the attention of educators and leaders. "How do we help teams become more confident and capable in promoting FIRST?" We will explain an approach that incorporates a network of teams that collaborates to execute a wide area FIRSTsteps marketing and support program across a whole state. Affiliate teams will have an opportunity to more effectively recruit and support new teams and support educators.

Fundraising in Robotics

who: TBD

Abstract available soon.

PI Control, using VEX platform, for high school students and coaches

who: Marc Center

Proportional-Integral-Differential Control is a basic control technique used for closed-loop systems. I have created a simple line following algorithm, programmed in Easy-C, that implements the Prop-Integral correction. This implementation should be understood by high-school students and their coaches, an audience that is often left behind by the technical nature of PI-control. The implementation utilizes two encoders mounted directly to a VEX robot (applicable to FTC) and modifies the motor speed variables to increase the speed via encoder feedback.

The Procedure for Incorporating as a Non-Profit Organization

who: Vicki Davis and Sandy Campbell

There are many advantages for a Robotics Team to incorporate as a 501 (c) 3 non-profit organization. The steps involved can be complicated. We have devised a presentation that explains those steps and are willing to share it with others. Being a non-profit organization allows any person or business to make tax-deductible contribution to the robotics team; an incentive for sponsorships. Incorporation also allows our team to control our own fundraising, monies, and expenses; and not be at the mercy of our large, slow school district.

Producing a Robot Quick Build Session for Your Kickoff

who: Tonya Scott, Ron Markum, Ed Latimer, and Ken York

The FIRST robotics competition has experienced tremendous growth in Oklahoma. In 2008, the possibility existed for the 24 rookie teams to overwhelm the 12 veteran teams mentoring capacity. Experience shows rookie questions predominately center on the Kit of Parts and the process of assembling a basic rolling robot. Answering these questions ensures the teams are successful and return for a second season. We designed two programs. First, is our Robotics Summit held in October. During the Summit we walk teams through a typical robotics season, covering a wide variety of topics, while answering their questions. Teams arrive at our kickoff knowing what to expect and prepared for the build season. Our second program is the Robot Quick Build Session. It takes place immediately after the Kickoff presentation. The RQBS leads each team, step by step, through the process of building a basic kitbot. In a four hour time period, teams start with the unopened kit of parts and end with a working, rolling robot. Every aspect of building the kitbot is presented in four concurrent sub assembly sessions. The electrical, frame, transmission, sub assemblies and their program, are then incorporated together, completing the kitbot. In the last two seasons, the Oklahoma Kickoff has sent 58 teams home with a rolling robot giving them a great start on the build season. In this presentation we will cover the process of planning and conducting a RQBS at your kickoff site

Promoting STEM Education Through After-School LEGO Mindstorms Programs

who: James Lynch, Jenny Filipi, Ian Thompson, Leigh Johnson, Devin McKinnon

Starting at the end of our rookie year, Team 2220 began a program of after-school classes that have broadened awareness of FIRST. Our program has spread from one elementary school to three in less than two years. Our high school team members teach students in grades one through five using LEGO Mindstorms kits and curriculums they have written. The goal of this program is to start more FLL teams by involving teachers and raising their interest in STEM activities. By stimulating interest in LEGO Robotics, we intend to initiate more STEM learning opportunities in schools. To aid in this STEM curriculum development, we plan to create a continuing education accreditation program for educators interested in bringing LEGO Mindstorms into their schools.

Our program is a partnership that has developed between Community Education, local elementary schools, and our team. Community Education provides funding for LEGO Mindstorms kits and teachers' stipends through grants co-written with our team. The local elementary schools supply educators to support the student teachers and space for the classes while our team contributes the student teachers and computers. We foresee our program expanding into all elementary schools in our district within the next five years.

This presentation will provide details on how to get a program like this started, how to apply for and win grants, and our plans for motivating more educators toward STEM curriculum. We will provide copies of a flow chart of steps to building a successful program and will share examples of lesson plans.

So You're Graduating from *FIRST* – What's Next?

who: Nate Edwards, Lisa Perez

This workshop intended for students who are graduating from high school and are looking into what opportunities their futures behold and for mentors who are seeking to provide their students with these opportunities. The presentation portion of the workshop will be split into three main topics, each topic discussing a different aspect of life after FIRST as a high school student:

- Staying Involved in Your Teams as Alumni
- Becoming a FIRST Mentor, Guidelines to Follow
- Robotics and Other Engineering Extracurricular Programs at the College Level
- Research, Co-op, and Internship Opportunities

After the presentation portion, those attending will have the chance to direct questions at a panel of engineers, mentors, and college students who have all graduated from the FIRST program. Also, we will distribute handouts that will include the information presented.

Teen career selection & why robotics programs can make a difference

who: Cecilia (Ceal) D. Craig

The intent of the author, a working engineering director & FRC mentor, is to provide mentors, teachers, and parents with a presentation package to use with companies and schools showing why an investment in robotics programs can help influence more teenagers into STEM careers. Media and industry today cry about a shortage of STEM (Science, Technology, Engineering, and Mathematics) graduates. **Is this shortage real?** Using National Science Foundation data from 1966 to 2006, the author shows the reality of the problem and its nuances. Engineering and STEM bachelor degrees have not kept pace considering all US bachelor degrees. The quantity of bachelor degrees has continued to rise, while the number of engineering and STEM degrees has been virtually flat. Women's participation in engineering for the past 20 years has changed little.

Can FIRST programs help make a difference? After an overview of career theorists showing reasons for **teen career selection**, the author, building on key factors from those career theorists, will show links relative to STEM careers: specifically, hero influences, the impact of pivotal experiences (like FRC), what aptitudes fit, and what types of programs can help grow STEM career interest.

Traction Control - Level 1, 2, 3 Concepts and Implementation on Vex Platform w/Easy_C

who: Marc Center

Traction Control is key to implementation of this year's game. Author plans an overview of Traction Control Level 1 - rate/limited response with max speed setting, Level 2 - adds acceleration control to Level 1, and Level 3 - adds robot relative velocity and implements Automatic Slip Regulation (similar to used in locomotive applications). Author plans to demonstrate all three Levels using VEX platform and Easy_C programming Language base. Vex platform will used 4 omni-wheels with encoders (two driven (powered), two non-driven)

Video journaling in robotics: How to tell YOUR F.I.R.S.T. story

who: Dee and Randy Weber

Video journaling in robotics: How to tell YOUR F.I.R.S.T. story There is growing need for video storytelling in the FIRST community. This can be cited by the Presidents Circle call for video submissions for the two past years, but even more significantly by the video submission requirement for the Chairman's Award this year. Video has emerged as a powerful media with easy access and nearly unlimited potential. Despite this, many teams still find themselves unable or unprepared to get into capturing and/or producing video. This seminar is aimed at robotics teams at every stage(FRC, FTC and FLL)wanting to get started as well as those who have just begun to video journal and are looking for fresh ideas, may have a few questions or are looking for a few tips. The session will be slightly tweaked from the one we conducted at the 2008 FIRST conference. We will cover the basics of getting started, what equipment is needed, what one should capture and how to target the intended audience. Sprinkled in will be few photography and videography techniques. Attendees will experience examples of video that captures the highlights of a season, celebrates an individual's accomplishments and shows exactly how fun FIRST can be. At the end of the day we aim to send teams out with the tools and creative energy needed to capture and tell their stories of life in FIRST, to share with their teams, the FIRST community, and the many future FIRST'ers out there.