Skunkworks Robotic Management Plan 2011-2012

Aviation High School Team 1983

www.ahsrobotics.us

Created By: Systems Integration Team
Prepared By:
Grace Cieszkiewicz
Sydney Miller
Drew Wall

Photography By:
Andrew Reece

Mentors:
Gary Miller
Connie Wood
Steven Wright

Table of Contents

ABSTRACT iii
1.0 Overview 1
1.1 Introduction 1
1.2 FIRST Overview/objectives 1
1.3 AHS Overview/objectives 3
1.4 Team 1983 Objectives 3
1.5 Pertinent Documentation 4
2.0 Objectives 5
2.1 Build Robot 5
2.1.1 FTC 5
2.1.2 FRC 6
2.2 Community Outreach 6
2.2.1 FLL 6
2.2.2 Promote Community Support 8
2.2.3 Gracious Professionalism 8
2.2.4 STEM 8
2.2.5 New team recruitment and mentoring 9
2.3 Industry Mentoring 9
2.3.1 Expose students to real-world experiences 9
2.3.2 Demonstrate engineering concepts and processes 9
2.3.3 Provide Resources 10
2.4 Prepare Students for college 10
2.4.1 Support school goals and objectives 10
2.4.2 Maintain student needs & passing grades 10
3.0 Team Organization 11
3.1 Schedule 11
3.2 Leadership Team 13
3.3 Parent Team 13
3.3.1 PTSA 13
3.3.2 Mentor Co-ordination 13
3.3.3 Secretary-forms 13
3.3.4 Fundraising and sponsor recognition 14
3.3.5 Accounting 14
3.3.6 Communications and Outreach 15
3.3.7 School Pride 15
3.3.8 Travel 15
3.3.9 Study Hall 15
3.3.10 Student Participation handbook 16
3.4 Mentor Team 16
3.4.1 Recruitment 17
3.4.2 Workshops 17
3.4.3 Outreach 17
3.4.4 Judging 17
3.4.5 Lessons Learned 17

3.5 Student Teams 18
3.5.1 Systems Integration 18
3.5.2 Safety 19
3.5.3 Mechanical 20
3.5.4 Electrical 20
3.5.5 Pneumatics 20
3.5.6 Programming 21
3.5.7 Pit Crew 21
3.5.8 Training driver/operator 21
3.5.9 CAD Team 21
3.5.10 Webpage Team 21
3.5.11 Marketing Team 22
4.0 Volunteers and team goals 22
4.1 Resources 22
4.2 Mentors 23
4.3 Team Goals 24
4.3.1 Small Teams 26
4.3.2 Medium Teams 26
4.3.3 Larger Teams 26
4.4 Fundraising 26

Appendix A: Team Alumni Directory 29
Appendix B: Team Competition Participation History 33
Appendix C: Grant Sales Pitch 35

ABSTRACT

This plan documents the management approach for the Aviation High School (AHS) robotics team. The AHS robotics team is registered as Team #1983 AHS Skunkworks under *FIRST* (For Inspiration and Recognition of Science and Technology), a non-profit foundation formed for the purpose of stimulating the academia of the youth of the world. This management plan sets forth the AHS Skunkworks' plan for managing the team, including: objectives, organization, and design/build strategy. Overall team objectives as well as business planning, sponsorship and funding are addressed in the Skunkworks Robotics Business Plan.

1.0 Overview

This plan will address all aspects of *FIRST* robotics participation to include *FIRST* Lego League (FLL), *FIRST* Tech Challenge (FTC), and *FIRST* Robotics Competition (FRC). In so doing, this plan defines AHS Skunkworks, its supporting organizations, and its activities. *FIRST* (For Inspiration and Recognition of Science and Technology), is a non-profit foundation formed for the purpose of stimulating the academia of the youth of the world.

1.1 *Introduction*

This Document lays out the organization of Team 1983 AHS Skunkworks Robotics. It defines the Team's goals, the features necessary to achieve these goals, and descriptions of how each feature is addressed and achieved. This document provides an in-depth explanation of how Team 1983 functions at any time and in any place. This document supplies the framework into which the other planning documents (business plan, scouting plan, etc.) fit and function.

1.2 *FIRST Overview/objectives*

FIRST is an organization founded by inventor Dean Kamen in 1989 in order to develop ways to inspire students in engineering and technology fields. The organization is the foundation for the *FIRST* Robotics Competition, the *FIRST* LEGO League, and the *FIRST* Tech Challenge competition.

FIRST also operates *FIRST* Place, a research facility at *FIRST* Headquarters in Manchester, New Hampshire where it holds educational programs and day camps for students and teachers.

FIRST seeks to promote a philosophy of teamwork and collaboration among engineers and encourages competing teams to remain friendly, helping each other out when necessary. The term frequently applied to this ethos is "gracious professionalism," a term coined by Woodie Flowers which supports respect towards one's competitors and integrity in one's actions.

FIRST Robotics Competition (FRC)

The original program developed through *FIRST* was the *FIRST* Robotics Competition (FRC), which is designed to inspire high school students to become engineers by giving them real world experience working with professional engineers to develop a robot. The inaugural *FIRST* Robotics Competition was held in 1992 in the Manchester Memorial High School gymnasium. As of 2011, over 2000 high school teams totaling over 52,000 students from Australia, Bosnia, Brazil, Canada, Chile, Germany, Israel, Mexico, the Netherlands, Turkey, the United States, the United Kingdom, and more compete in the annual competition. The competition challenge changes each year, and the teams cannot reuse components created for previous robots. The robots weigh around 120 pounds (depending on the current year's rules). The kit issued to each team contains a base set of

parts. Registration and the kit of parts (KoP) together cost about $6000. In addition to that, teams are allowed to spend another $3500 on their robot. The purpose of this rule is to prevent richer teams from outspending newer (and therefore poorer) teams. Details of the game are released at the beginning of January, and the teams are given six weeks to construct a competitive robot that can accomplish the game's tasks. This year's rules can be found at www.usfirst.org. In 2010, teams competed in 43 regional competitions throughout March in an effort to qualify for the *FIRST* Championship in Atlanta, Georgia in April. Previous years' Championships have been held in Houston, Texas and at Walt Disney World's Epcot. In 2011 there will be an addition of 16 regional competitions.

FIRST Tech Challenge (FTC)

The *FIRST* Tech Challenge (FTC), formerly *FIRST* Vex Challenge (FVC), is a mid-level robotics competition first begun by *FIRST* on March 22, 2005. According to *FIRST*, this competition was designed to be a more accessible and affordable option for schools. *FIRST* has also said that the FTC program was created for those of an intermediate skill level. *FIRST* Tech Challenge robots are approximately one-third the scale of their FRC counterparts. The FTC competition is meant to provide a transition for students from the FLL competition to the FRC competition. FTC was developed for the Vex Robotics Design System, which is available commercially, but is now done using the Lego "Tetrix" system, with the NXT programming system

The 2005 FVC pilot season featured a demonstration of using a 1/3 linear scale mock-up of the 2004 FRC Competition, *FIRST* Frenzy: Raising the Bar. For their 2005-2006 Pilot Season, FVC teams played the Half-Pipe Hustle game using racquet balls and ramps.

For the 2010-2011 FTC Season, the *FIRST* Tech Challenge teams competed in the "Get over It" challenge using PVC pipe batons, and ramps that you need to cross in order to score. It requires a great deal of dexterity and maneuverability to handle the challenge effectively. Competitions were held around the United States, Canada, and Mexico.

FIRST LEGO League (FLL)

In 1998, the *FIRST* LEGO League (FLL), a program similar to the *FIRST* Robotics Competition, was formed. It is aimed at 9-14-year-old students and utilizes LEGO Mindstorms sets to build palm-sized LEGO robots, which are then programmed using the RCX programming software to autonomously compete against other teams. The ROBOLAB software is based on National Instruments' LabView industrial control engineering software. The combination of interchangeable LEGO parts, computer NXT 'bricks' and sensors, and the aforementioned software, provide preteens and teenagers with the capability to build reasonably complex models of real-life robotic systems. This competition also utilizes a research element that is themed with each year's game, and deals with a real-world situation for students to learn about through the season.

Junior *FIRST* LEGO League (JFLL)

The Junior *FIRST* LEGO League is a variation of the *FIRST* LEGO League, aimed towards elementary school children, in which 6-9-year-olds build LEGO models dealing with the current year's year's FLL challenge. At least one part of a model has a moving component. The teams participate in exhibitions around the country, where they demonstrate and explain their models and research for award opportunities.

Jr. FLL, FLL, FTC, and FRC are organized and incrementally introduced to young people to the excitement and technical challenge inherent in the design/build process

For more information on *FIRST* robotics please visit:
http://www.usfirst.org/

1.3 *AHS Overview/objectives*

Aviation High School (AHS), a Public School in the Highline School District (HSD) founded on a Gates foundation Charter, is the only college preparatory aviation-themed public high school in the Northwest. It is our aim to become the premier school of choice for science, pre-engineering, and technology in the Puget Sound region. AHS is a small school with a big vision — that students can be simultaneously prepared for the rigors of college and the performance demands of a high-tech world and workplace. The school is temporarily located at the Olympic Middle School site in Des Moines, Washington, 10 miles Southwest of Seattle. Students commute from surrounding districts, some as far away as Monroe and Issaquah. Many aspire to become scientists, engineers, astronauts, pilots, aviation technicians, and CEOs in aviation/aerospace fields. Many are drawn by the school's focus on math, science, and technology. Some are simply drawn by our unique approach to teaching and learning. This plan documents the management approach for the AHS robotics team registered as Team #1983 Skunkworks under the *FIRST* (For Inspiration and Recognition of Science and Technology), a non-profit foundation formed for the purpose of stimulating the academia of the youth of the world.

For detail information on AHS see the school webpage at:
http://www.aviationhs.org/pub/pub.aspx

District:
http://www.hsd401.org/

School:
http://www.hsd401.org/ourschools/highschools/aviation/

For additional information about the Skunkworks robotics team see:
www.ahsrobotics.us/

1.4 *Team 1983 Objectives*

The overarching team objectives are set forth in the Skunkworks Robotics Business Plan Executive Summary; it is these objectives that will enable us to accomplish the goals of

both *FIRST* and Aviation High School. As per these mutual goals, Team 1983 seeks to meet several high level objectives. Ultimately it is our goal that every student has a safe, and fun experience that makes them excited and interested in math, science, and engineering. It is our goal to be a premier *FIRST* Team in Washington State. All year round our team seeks to be a positive influence in our society, and sustain *FIRST* while generating excitement about technology jobs and applications, producing more students who want to be mechanical and electrical engineers rather than the paparazzi bait that our society seems to currently esteem. The strategy and implementation of these goals are discussed in section 3.0.

1.5 *Pertinent Documentation*

The following team documents are prepared and edited by Skunkworks students under the direction and mentorship of our mentors.

1. Business Plan: Provides an overview of Skunkworks Robotics, contains the executive summary of the team objectives and provides sponsorship and funding information for the team.

2. Management Plan: (This Document) The master document that defines the organization goals and implementation of the team.

3. Safety and Health Plan: Team involvement, safety analysis, hazard prevention and control, training and education, are all encompassed in this document.

4. Chairman's Award Application: Application to show we are the team that best encompasses and pursues the goals of *FIRST*

5. Bill of Materials: The final list of parts used on the Robot and their cost.

6. Part List and Weight Assessment: The list of all the parts used on the Robot and their weight

7. Driver Operation Training Plan: Processes for training and picking the robot driver, operator, and other field members

8. Scouting Plan: Defines how the team scouts other teams at competitions, pit and field also includes forms for the scouts to fill out, and sample data from scouting

9. System Requirements: Requirements for the robot defined by the Systems Integration team

10. Packing Lists: Checklist of all the tools and materials taken to competition

11. CAD Award Application: Application material submitted for CAD award.

12. Game Checklists: The pre-game checklists filled out by the pit crew previous to the robot's starting play. Each of the checklists filled out are kept in this section.

13. Lessons Learned Form: Sample Lessons Learned Form, used to provide team leaders with constructive feedback from the rest of the team.

14. Rapid Prototyping: photo copies of each large poster generated during the team's early brainstorming sessions can be found here.

15. Community Outreach: A brief overview of all that our team has done to help out our community.

2.0 Objectives

AHS Skunkworks' bases its objectives on the *FIRST* objectives of creating a life changing career molding experience for our student participants that is fun, safe, and embraces the true meaning of Gracious Professionalism. AHS's objectives truly align with *FIRST* in that it seeks to become the premier school of choice for science, pre-engineering, and technology in the Puget Sound region, as well as the premier *FIRST* team in Washington State. As a public school, AHS sets high academic standards to assure its students are prepared for college. In order to meet the goals of both *FIRST* and AHS, the team has set out objectives that exactly correspond to both establishments.

2.1 *Build Robot*

Skunkworks uses the processes of designing, building, and operating robots in the *FIRST* competitions to better meet the objectives set forth in Section 1.0.

2.1.1 FTC

The First Tech Challenge is a robotics competition for High School students, much like the *FIRST* Robotics Competition, but less expensive. The Kit used in FTC is smaller and less expensive so that a wider range of students and schools can participate in it. Originally the competition was called the *FIRST* Vex Challenge and the kit was entirely composed of Vex components. In 2008, a new kit of parts was showcased at the *FIRST* World Championship event in Atlanta, Georgia. The new kit is composed of a hybrid of Lego programming components, and a new Lego compatible building kit, with the option of incorporating metal Vex parts. The idea behind the change is that students will be more familiar with the Lego software if they have gone through FLL first, making FTC more interesting and challenging since students will be able to program more complex functions into their robots.

Upon joining Skunkworks, the idea of building the giant FRC robot could be rather intimidating to most people. Because of this Skunkworks has a team specifically focused towards preparing new students for the task of working on the FRC team. In the past we have done this with an FTC team, but due to the expense that came with the new kit Skunkworks has converted to using the VEX Robotics Competition as its secondary team. The VEX team is comprised of the freshmen and sophomores of the team for the purpose of getting the new members more experienced with the program, and more

interested in the work required to properly run the FRC team. By having a team for the freshmen and sophomores to get more experienced with the program they become more confident in their abilities and different parts of the engineering process. It also helps them to understand which portion of the build process they would like to take part in. In the future Skunkworks would like to improve the outreach of the VEX team and also include the VEX robot in our demos, so as not to totally intimidate prospective student participants out of joining the team.

2.1.2 FRC

After getting the basics of robot construction and engineering down by participating in VEX, students graduate to more key roles on the FRC Team. Participation in FRC gives students the hands-on experience of designing and building something on a much larger scale relative to VEX. FRC, because it requires a much greater time commitment to complete, requires much more organization and development than VEX, especially when the award applications are considered. Because of these heightened requirements, students get an experience that is much more similar to a real-world situation than VEX. Students have to choose specific areas of expertise in order for the team to function effectively, rather than VEX where students can work on just about anything and the team will still be successful. The organization of students into specific groups with specific objectives is very similar to the way real engineers do their work, further familiarizing the students with their prospective careers. Thus FRC allows Skunkworks to not only build a functioning and hopefully competitive robot, it also helps the team meet its goal of exposing students to real-world type situations and problems and the real process of solving said problems.

2.2 *Community Outreach*

Community involvement is an integral part of participation in *FIRST*. As a participant in *FIRST,* Skunkworks strives to involve our local community through various methods and with a few specific goals as noted in section 3.3.6 Communications and outreach.

2.2.1 FLL

In May of 2007, the Skunkworks team decided to mentor several *FIRST* Lego League teams as well as take on the responsibility of hosting the Des Moines Regional of *FIRST* Lego League competition. Several schools were mentioned as possibly wanting to be mentored. School principals were contacted and in the end, only two schools expressed interest in having a team at their school.

The contact person at the schools was contacted by the FLL coordinator of the Skunkworks team, first by email and then in person. At a meeting, information regarding starting a team and how Skunkworks could be involved was discussed. Timelines were presented. This was important as registration ends in September, or whenever registration fills up. At present, Lego League is the fastest growing part of *FIRST* Robotics.

One school decided to have a team. Two of our team members, who were former students at the middle school, offered to help. A problem was encountered regarding the

amount of time the Skunkworks members were actually mentoring. This stemmed around the dismissal times of the two schools: the middle school dismissed an hour earlier than AHS. The students did the best they could and nearing the time of the competition, did work with the team on Saturdays when possible.

In later years the Skunkworks Robotics team became more involved in the FLL teams that it was mentoring. Due to scheduling changes in the Highline School district it became much easier for the Skunkworks members to deploy out to middle schools to act as mentors for their FLL teams, and in the past year, and this year, several Skunkworks members have put themselves forward to mentor FLL teams at North Hill, Gregory Heights, and Bow Lake.

Hosting the regional was a learning process since it was our first time. While one mentor was coordinator, the team parents and students helped. Support was needed in the following areas: volunteers for various jobs, such as volunteer room, pit and floor help, set-up and clean-up, registration, awards, judges and referees; obtaining the playing fields; facilities. The mentor was in communication with the Washington *FIRST* LEGO LEAGUE Operational Partner for both support and information. See table below for time table.

The following is an example schedule of the FLL season:

What	When	Who	Other
Registration with *FIRST*	May-Sept	Teams	Cost involved
Robot & Team manuals ship	July	From *FIRST*	Or after a team registers
Field Set up kits ship	August	From *FIRST*	Of after a team registers
International Challenge release	Early September	Teams	Kickoff!
State tournament applications accepted	Early October	Teams	To be able to compete in state regionals
Regional qualifiers in various locations	Early December (Saturday)	Teams	Skunkworks hosted the Des Moines Regional
State FLL Tournament, Bellevue WA	Weekend in Dec. after regional	Winning Teams from regional	Skunkworks volunteered at the State Tournament

Improvement can be made in ensuring that communication between the FLL teams and Skunkworks is in place. Student mentors need to take their role seriously and be there for the younger students, communicating with the coordinator and the FLL coach if there are

problems of any sort. A schedule of when the Skunkworks mentors will be helping will be created. A plan for continued communication or support after the season is over should be put into place. This might include inviting the FLL teams over during build season, including the FLL teams in one of the Skunkworks functions, inviting the FLL team to the ship party and a regional if one is in the area.

We also need our own training on the Lego Mindstorms in order to better mentor the FLL teams. This could be a one day workshop in the summer for Skunkworks members and potential FLL coaches and mentors.

2.2.2 Promote Community Support

After getting adjusted to the key components of building a robot and becoming involved in *FIRST*, Team 1983 has done numerous activities to involve support from the surrounding community. For the past two years, Team 1983 has participated at Challenge Air located in Paine Field. Challenge Air is an event where pilots volunteer their time and take children with disabilities or life-threatening diseases for a short ride within their planes. We took our robots for FTC and FRC and gave small demonstrations as well as, helping the children into the planes. Team 1983 participated in the 4th of July Burien parade. Each year, we have hosted a spaghetti dinner and auction and invited the public to attend and show support for the team and became more familiar with members of the community. And each year, Aviation High School hosts a PTSA Dinner and Auction and Team 1983 gladly volunteers their time to help out and promote the team to the community surrounding Aviation High School. Team 1983 has presented our robotics team to some of our sponsors along with several rotary clubs. We have taken advantage of the organizations involved with Aviation High School by speaking to them about how much *FIRST* has made an impact on the student body within Team 1983. All of these experiences have given us the opportunity to spread the news about *FIRST* and allow us to become more involved within our community.

2.2.3 Gracious Professionalism

Gracious professionalism is a faculty of our team which we actively promote and apply to everything that we do. Gracious professionalism involves helping out anyone who you can if they need it. Our team facilitates numerous events and activities to just this end. We have organized, advertised and done several workshops for local teams, rookies and veterans alike in order to make sure that everyone knows how our team facilitates its success. We also host an FRC practice field every year, helping teams to develop their robot as much as possible before ship day. Our team also helps outside of the *FIRST* community; we aid our School in putting on its fundraiser auction. All of these efforts benefit the community as a whole, rather than just our team.

2.2.4 STEM

STEM: Science, Math, Technology, and Engineering, the four areas of interest that Skunkworks seeks to cultivate in its student participants. Skunkworks students, because of their experience with the robots, have a great deal of exposure to these areas. We also promote the same things outside of the team itself, traveling to elementary and middle schools to raise awareness of the STEM opportunities available both at the school in general, and on the team in particular. In this way Team 1983 gets students interested in

STEM applications and careers. Skunkworks students help out at AHS Events, promoting the team and the school at open houses where prospective students come to investigate the school, as well as at the PTSA Auction, allowing the school to raise funds to continue its progress in teaching students in a STEM context. Thus, Skunkworks not only promotes STEM through student participation, but also through community outreach and publicity.

2.2.5 New team recruitment and mentoring

Within the past years since the start of the robotics team at Aviation High School, Team 1983 has mentored many teams and continuing to do so this year. We have hosted workshops for new teams in both FTC and FRC along with hosting competitions for FLL regional. We have volunteered at regional competitions and helped teams. For each team that we mentor, we sent out a couple students to help and supervise the team in order to allow the team to ask questions and receive feedback prior to various deadlines. As for recruiting new teams to join the experience that *FIRST* provides, Team 1983 has gone out to local elementary schools and hosted small classes where the elementary students worked with small tinker toys and K'Nex. For the Microsoft Seattle Regional, we have encouraged other schools along with our own to come and show support for our team and experience the wonders of *FIRST*. Team 1983 tries to spread the news of *FIRST* around to local schools in order to influence new teams to start their own FLL, FTC, or FRC team. We have influenced many local schools to start their own teams already and have gotten them situated with the game objectives each year, and now we are looking into sustaining it.

2.3 *Industry Mentoring*

In order for the student participants to both learn as much as possible about real-world engineering processes and construct a functioning and successful robot, the team must get mentoring from adult volunteers who have real world experience in the areas that the students are just beginning to explore.

2.3.1 Expose students to real-world experiences

Members within Team 1983 are exposed to various experiences that prepare them for life outside of high school such as working with mentors who are experienced in various fields. Each department within the team has a supervising mentor who guides the students in a professional environment. Students facilitate the workshop and work with machinery in a safe manner with their mentors other students are in charge of managing the team and creating professional documents that create the basic requirements of the team. Occasionally, students visit other job sites such as Boeing or another engineering site and work with other employees and receive hands on experience in a work environment.

2.3.2 Demonstrate engineering concepts and processes

The Skunkworks mentors are on the team for the purpose of education. Being high school students most team members don't know how to do certain jobs or understand certain ideas that are important to the build process. The mentors come onto the team, not to do work for the students, but to help the students along and show them new ways to

complete necessary tasks. The mentors help the students to learn and understand needed concepts and processes that will not only help now, but help them in their future.

2.3.3 Provide Resources

Being a high school team, Skunkworks does not have access to many resources that are helpful to the construction of a robot. Having several mentors from companies like Boeing and OMAX gives the team the benefit of being able to use some work areas and tools that we would normally not have access to. Having mentors like this also helps with access to information and contacts that the team wouldn't normally have.

2.4 *Prepare Students for college*

The goal at Aviation high School is "To prepare all students for college, career and citizenship through a personalized, rigorous and relevant learning experience that is facilitated in the context of aviation and aerospace." Team 1983 has taken this mission into extreme consideration while in the process of developing the team and its members. Members of Team 1983 besides being committed to the team, must keep their grades at a passing level. Team 1983 allows students to experience working within the engineering world while they are still in high school and allows them to receive hands on experience with our mentors within the engineering area. Both Aviation High School and *FIRST* seek to provide high academic standards for students to be well prepared for college and a math and science career.

2.4.1 Support school goals and objectives

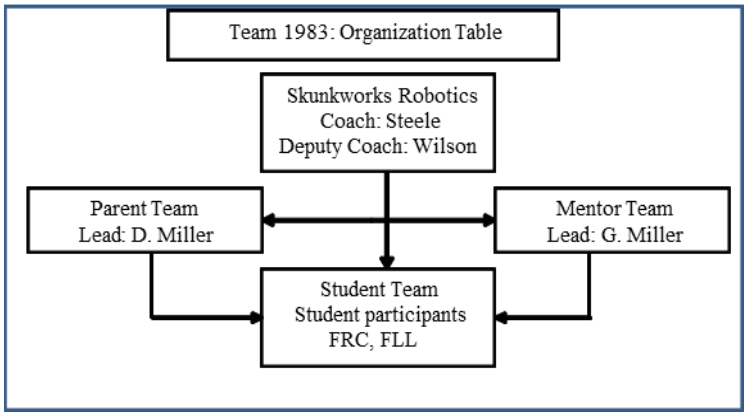
Team 1983 provides an intensive environment where students spend their whole day at school for six weeks straight working on the robot and other items related before the shipment day. And after the shipment day, students continue to work on strategies, fabrication of items, etc. The vision of Aviation High School "is to be the premier public high school of choice for students in King County and the region who wish to pursue their passion for aviation and aerospace in a learning environment that prepares them for higher education, citizenship, and work." Team 1983 puts students in an environment where they can work with mentors and apply the applications of engineering to building a robot to obtain this year's objective. The goal of Team 1983 is to maintain a passing grade point average while working with other students and mentors in order to create a robot. We support the school's vision as Team 1983 is about working together as a team and showing gracious professionalism to other teams while working in a field that pushes our students to the best of their abilities.

2.4.2 Maintain student needs & passing grades

In order to be able to attend competitions, students must have a grade point average of 2.0 and no F's. Team 1983 has created study hall after school for students to work quietly on homework or other work that needs to be completed. A parent volunteers his/her time to ensure that the students in study hall are working and that the room remains quiet. If a student has a club during study hall, they must report to our coach and speak to him about that. Students with all A's must come to study hall once per week, those with any B's must come at least twice, and those with C's must come all four days of study hall. Those

with F's are suspended temporarily from team practice until their grades no longer contain an F.

3.0 Team Organization

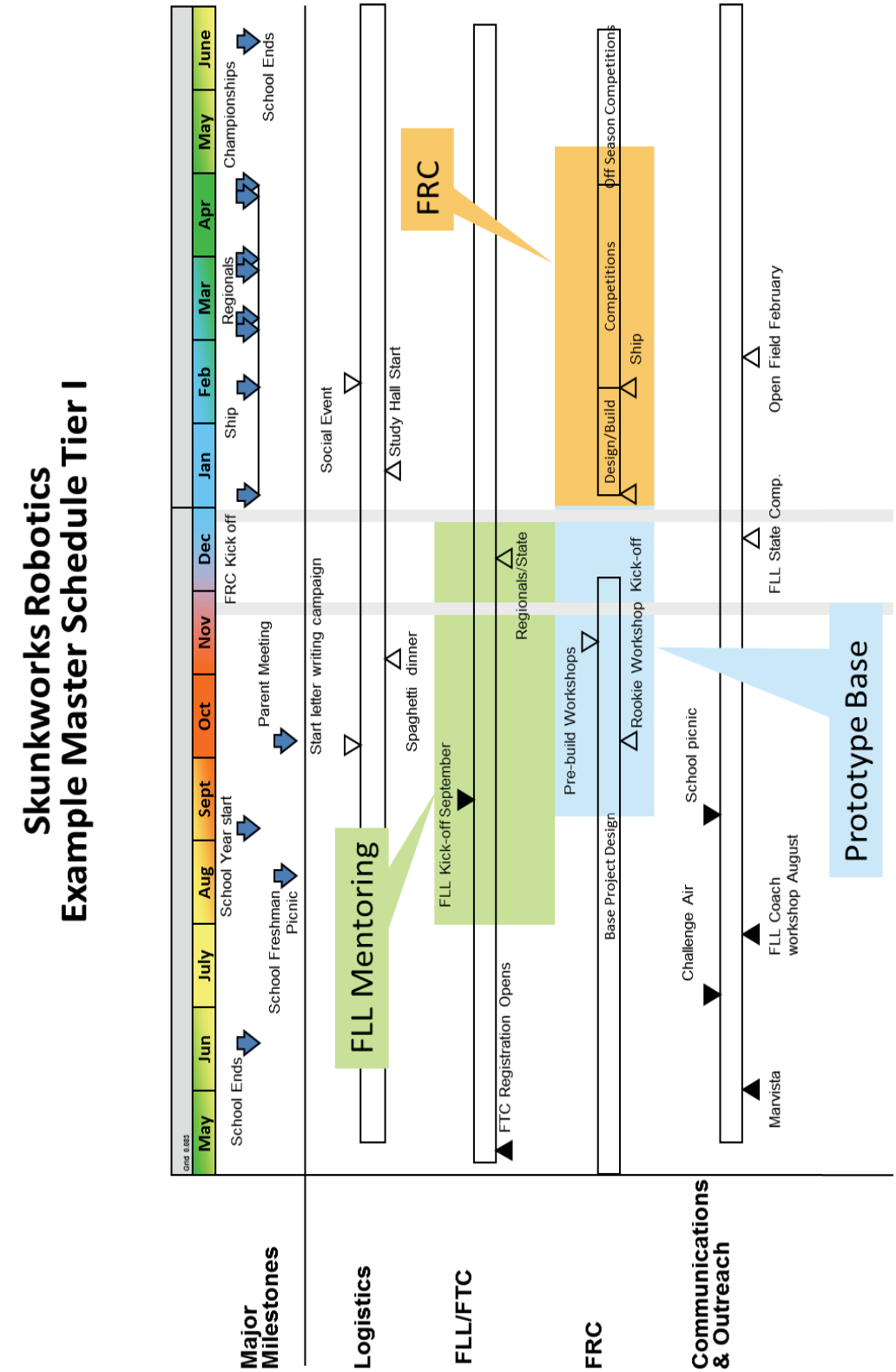


Aviation High School is sponsoring a *FIRST* Robotics Team; the team is organized as shown in the figure above. The Parent Team manages all non-technical detail associated with the running of the team, including communications, transportation, procurement, food, team activities, setting up fundraisers, and managing team funds. The Mentor Team aids and supports the students in all the technical aspects of the competition, including robot design, design/build, materials, safety supervision, and award applications. The Design/Build Teams are made up of the student participants, as supported by the parent and mentor teams, who design, build, repair, and evaluate the team's robot in FRC and in FTC. In FLL the students run as well as work at competitions. A Central leadership team is used to organize team ideas and create and submit award documents.

3.1 *Schedule*

Figure 3-1 shows the Skunkworks Robotics Master Schedule covering the school year. The schedule is paced by Major Milestones shown at the top. Major program areas are listed on the left side with corresponding schedule bars shown in the body. Each major program area is managed by ether the parent, mentor or student teams. School starts in early September. Shortly after the Robotics team is formed the students undergo safety and skills training. Pre-Build begins in early November with a FRC build project(s) designed to investigate possible design options and give students additional hands on experience with design and manufacturing concepts. Before and during the pre-build season, the parent and student teams work on fundraising as well, holding events like the Spaghetti dinner and Dessert Auction. The FRC kickoff meeting in early January begins the design/build/ship period. At this time the design is developed and teams are formed to design and build the robot. This period ends 6 weeks after kickoff with the shipping of the robot to our first regional competition. The second regional FRC competition follows 3 weeks after and the Atlanta Nationals follows approximately a month after that. Following the FRC competitions a lesson learned review is conducted to evaluate improvements for the following year. For further detail see the Parent, Mentor or Design/Build team descriptions.

Figure 3.1:


Skunkworks Robotics
Example Master Schedule Tier I
May
Jun
July
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
June
Major Milestones
School Ends
School Freshman Picnic
School Year start
Parent Meeting
FRC Kick off
Ship
Regionals
Championships
School Ends
Logistics
Start letter writing campaign
Social Event
FLL Mentoring
Study Hall Start
Spaghetti dinner
FRC
FLL/FTC
FLL Kick-off September
FTC Registration Opens
Regionals/State
Pre-build Workshops
Base Project Design
Rookie Workshop Kick-off
Design/Build
Competitions
Off Season Competitions
Ship
FRC
Communications & Outreach
Challenge Air
School picnic
FLL Coach workshop August
Marvista
FLL State Comp.
Open Field February
Prototype Base

3.2 *Leadership Team*

The leadership team is a comprised of the coach, lead mentors, and lead parents. This body runs the team, determining goals and objectives. The team meets monthly or as needed throughout the year. Leadership integrates the lessons learned feedback into the organization on the team as a whole, based on assessment of team accomplishments. The leadership team is the body primarily responsible for volunteer coordination.

3.3 *Parent Team*

The parent team facilitates all non technical operational aspects of the team. Parent team task are critical and integral to the success of the team. These include interfacing with the AHS staff and Parent Teacher Student Association (PTSA), mentor support, fundraising, communications, school pride, travel, and team study hall. The parent team is made up of student parents/guardians interested relatives and friends. The parent team also supports PTSA functions for student experience and team visibility, coordinating PTSA/Skunkworks activities. The parent team is chaired by a parent and all tasking is facilitated by the participants. Students are typically engaged to support major projects, like fundraisers.

3.3.1 PTSA

AHS PTSA provides parent volunteers and leaders, contact resources and organizational context for the Parent Team. PTSA processes are used for management of funding, audits, and its non-profit affiliation. During our first year, PTSA heavily funded AHS Robotics and continues to provide volunteers and funding.

From the Parent Team an AHS PTSA representative is selected. The representative maintains good relations with the AHS PTSA, communicates the benefits of *FIRST* robotics to the school, and volunteers team staffing power for PTSA events.

3.3.2 Mentor Co-ordination

The parent team provides leadership for the development of the Mentor team. The mentor team leader is ideally both a parent team member and a mentor. The mentor lead coordinates mentor team support drawing from AHS parents and local industries. See Mentor Team for more information.

3.3.3 Secretary-forms

There is also a Team secretary whose primary job is to coordinate volunteers, without the secretary the team cannot function properly. They track team PTA Membership, with a goal of maintaining 100% participation. They send tax forms to those donors who want them, as well as send thank you notes. Also the secretary helps the team send out the end of season letter to all sponsors. They must also make sure that all volunteers on the team have WA state clearances. This responsibility includes:

- Checking with the Highline School district on the expiration dates of the WA State Clearances of all adults in contact with students
- Work with all non-cleared individuals to get all paperwork filled out, ensure that said individual's drivers license has been verified by AHS staff

- Make sure that AHS office staff have sent forms in, and then check with Highline Schools two weeks later to ensure that the individual has been cleared
- Record names in Team/Parent/Mentor roster

Finally the secretary confirms that all parents, coaches, and mentors track their volunteer hours on a bi-weekly schedule and then turn the hours in to the AHS office.

3.3.4 Fundraising and sponsor recognition

The parent team organizes several fundraising activities to raise the over $1,000 per student necessary to properly fund AHS Robotics program. The primary sources for funding include:

Student letters (minimum of 5) asking for financial support from their community
Spaghetti Dinner and Dessert Auction
Private and corporate sponsorship

Other fundraising activities are conducted to evaluate possible improvement to our core fundraising methods. Our primary source is industry grants and donations for which the team makes application. Secondly are donations from mentors and families in the form of company volunteer hour matching (companies pay the team a fixed hourly rate for each hour their employee volunteers to the team), direct donations and donations of resources (i.e. machine shop time, materials, etc). Our third source of funding is letter writing where each student writes a letter asking for a donation to the team. This is a particularly effective program in that students are engaged in the fundraising task leading to their educational experience, their recipient is made aware of FIRST and the team, and for those that support the team they receive a thank you letter from the student sharing with them the accomplishments of the team, the student, and the FIRST program. A Business Plan has been prepared, and is updated annually by the students, which fully explains the sources of our funding and how the money is budgeted and spent.

Major industry supporters of the team are acknowledged as sponsors and their name and logos are located on the robot, team signage, webpage and apparel. Major individual and family supporters are acknowledged in the same fashion except on the robot due to space limitations. Our Business Plan sets forth the specific team policies.

3.3.5 Accounting

The parent team also appoints an accounting team. Accounting deals with all of the team's transactions. They confirm all reimbursements and transactions with the coach, as well as maintain the status of the team budget. They also keep track of multiple accounts and maintain records of names, donation amounts, addresses, and tax form requests. The treasurer supports the students in the letter writing campaign and the thank-you notes.

3.3.6 Communications and Outreach

Communications is a critical function of the parent team. Without communications, team members and other students would never know about upcoming events and other important information. Communications includes both within AHS, and outside AHS. Within AHS the parent team prepares releases to the NOTAM (AHS weekly newsletter) and facilitates communications within the robotics team via a Skunkworks googlegroup. External to AHS the parent team prepares news releases to the press and coordinates presentations to legislators and business leaders for both AHS and *FIRST* promotions. Examples include: The Burien 4th of July parade, Challenge Air, and a letter to the editor of Aviation Weekly from one of the team's mentors drawing attention to *FIRST*. Similarly AHS facilitates a whole-school field trip to the Microsoft Seattle Regional.

3.3.7 School Pride

The parent team organizes school pride and other booster events such as: maintaining and coordinating the student operation of Newton, the team mascot, the shipping party, and team meals during the build season. Twice weekly the parent team arranges for dinner for the students during the 6 week build season.

3.3.8 Travel

To assure all students can participate equally in the competition events, the parent team coordinates travel and lodging costs for the students from the team funds. Travel arrangements include choosing the hotel, arranging team meals, carpools, air travel, and team meetings during competition.

3.3.9 Study Hall

Because significant demand is created by both AHS class work and the Robotics schedule, students attend Study Hall to support their continued success in the classroom. Organized by the parent team Study Hall Coordinator, who arranges for one adult to chaperone each day, Study Hall is a critical aspect of achieving our team goals of sustaining or increasing student academic standing. Study Hall is held 4 days a week during the week day for 1.25 hours. Parents chaperone the meeting to ensure that studying is taking place either on an individual basis, or in small groups.

AHS academic requirements are integrated with the Skunkworks Robotics team. Each student must be passing (earning a "C" or better) in all of their classes. Failure to meet this standard by a student will result in the student being prohibited from going to team meetings until their grades improve to meet the standard. As a result, the school academic requirements are also the requirements of the robotics team.

The study sessions are meant to help the students so that they maintain the passing grades that they need to stay on the team and do well in school. The students with the best grades help out the students that are struggling. This basic principle is the same as that of *FIRST*: gracious professionalism.

During the build season study hall is held four days a week, Monday through Thursday, after school. The session begins at 3:45 p.m. and goes until 5:00 p.m. The only exception is Wednesdays when the session goes to 5:15 p.m., because the parent team serves dinner, removing the need for students to go long distances to get food. A Meal Coordinator from the parent team arranges for one family to supply food on a given day.

Being a member of the team means teamwork. Each student has to make an effort; study sessions help with that. In short, it is these seemingly simple-sessions that embody the principles and achievements of what a college prep high school is, what being a member of the team is, and what being involved with *FIRST* is.

3.3.10 Student Participation handbook

To assure expectations are clearly set forth for both the students and parents, an AHS Skunkworks Student Participation Handbook will be created by the Parent Team. The handbook will highlight the benefits to the students of participating in AHS *FIRST* Robotics, as well as define fees, time commitment, academic requirements, Study Hall, fundraising commitments, travel and other team involvement.

3.4 *Mentor Team*

The Mentor team seeks to support the AHS Robotics students, faculty and parents in the *FIRST* design, build and competition. The mentor team solicits support from local professionals from the fields of engineering, manufacturing, and other related fields. Early in the school year employees and parents throughout the area are asked to volunteer their time to support the robotics team. Advertising includes company newsletters, professional unions, and other specialty organizations (such as Society of Women Engineers (SWE)). All mentors must have background checks by the Washington State Patrol before they can work in the school with students as coordinated by the parent team.

Mentor time commitment can vary greatly. Mentors may be involved in student training, and the pre-build activities. Mentors may also assist in the facilitation of FLL regional competitions, as well as assist the sub-teams and their individual competitions. During the FRC design/build season, mentors are teamed with students to complete the robot in the 6 week period. Mentors are also encouraged to participate in the competitions. Their primary function, however, is to always be teaching student participants and to always be safe.

Mentor/sponsors are unique in that they also make available the resources of their company. These include, but are not limited to the use of machine tools, professional machinists, and scrap materials used to build the robot. Mentor/sponsors are recognized with their company logo on the robot and with other sponsorship recognition. Without mentors Team 1983 would, in all probability, be largely incapable of building the many

complex systems required on a robot, or produce planning documents such as the Business Plan or Management plan.

3.4.1 Recruitment

Mentors are in many cases the parents of a student on the team; these mentors then go back to their place of work and recruit other mentors from amongst their co-workers. Similarly, AHS frequently hosts dignitaries from major local industries. Skunkworks of course presents at these events and generates interest, enticing more mentors. In this fashion Skunkworks has built-up a considerable number of mentors with numerous areas of expertise between them.

3.4.2 Workshops

Mentors are responsible for facilitating many of the team's various workshops. Most recently our mentors have conducted instructional events teaching students from Skunkworks and other teams how to work with Autodesk Inventor, assemble their kit-bot, and organize their teams. Mentors present on their various areas of expertise. Former shop teachers instruct students on how to use shop equipment safely and mentors who regularly work on mechanical components advise students on how to construct the robotic components.

3.4.3 Outreach

A benefit of having mentors on Skunkworks is that they come in with their own resources, and thus their own contacts. The mentors have friends or co-workers that they believe would be able to help mentor our team. By having these contacts the mentors can help bring people into team that can solve certain issues that we may be having. Also, the mentors can get help from companies that they know, allowing us to use their facilities and tools.

3.4.4 Judging

While helping our team go through the building process for the FRC challenge, our mentors voluntarily help out at FTC and FLL tournaments. Our mentors have prior knowledge of the judging process as they have traveled to various competitions for FRC, FTC, and FLL and are familiar with the rules and regulations. Our mentors have continuously used their knowledge gained from assisting various teams and from competitions to volunteer their time to judge at FLL competitions.

3.4.5 Lessons Learned

As a means of achieving the goal of continuously improving the team, the mentor team facilitates a system of participant feedback called "Lessons Learned." This consists of each member of the team submitting comments via a form about how they think the team worked in the last season. With the accumulated individual input the team can determine what changes need to be made in order to make the next year more successful than the last. The sheet used may be seen in the "Lessons Learned" section of the Skunkworks Robotics Systems Integration Planning Notebook.

3.5 *Student Teams*

Students are assembled into subsystem teams by student choice with mentor facilitation. Some of these teams exist year-round while others like the design and build teams, only exist during the actual season because the only time they are needed is when the robot is actually being designed, built and tested. The idea behind the team distribution is to get older, more experienced students to teach the younger students about working on the team. Both groups of students learn about how to really do their job from mentors who have actual field experience. For instance, the build teams are mentored by engineers who have worked on designing and making mechanical devices for much of their careers.

3.5.1 Systems Integration

The System Integration Team (SIT) will perform tasks necessary to develop and coordinate the robot design across the program design/build teams.

System Requirements - System (robot) requirements will be developed and maintained to assure the system will perform as intended by tracking Key Performance Parameters (KPPs) across the program. The Systems Integration team will maintain Scouting sheets to compare the robot with competitors.

Systems Design - Weight and balance (W&B), and power management (and others as applicable) will be tracked from a systems design perspective to assure key interactions between subsystems are addressed. The robot's weight and balance will also be tested using the robot from last year, or a simulator using equivalent overturning moments. A KPP sheet will be made on the overturning moments based on performance, safety, and handling. Power management will also be looked over by defining the KPP for the total dissipation load for a match.

Risk Mitigation Planning – During the development of a system certain risks will be identified that can be mitigated by various teams. Risk mitigation planning will identify risks from various sources and then develop and coordinate the mitigation plan across the various teams. This will all be done by developing and maintaining Risk Mitigation plans based on the weight and balance, the power, the cost, the safety, and any others as necessary.

Competition – Prepare team for competition by defining each skill (Drivers, Coaches, Payload Specialist, pit crew, and scouts) and facilitating training to include: preparing pit list, develop scouting plans, and repair/redesign plans. SIT will choose a Driver, a Coach, and a Payload Specialist. SIT will train and practice with these people so that they are adept at controlling the robot, have developed strategies for game play, and test them against models. SIT will select a Pit Crew that will work developing the pit design, developing the packing list, and making redesign options, along with people from other teams, in case of some post-ship redesigning. They will also need to be able to perform standard maintenance for all of the sub teams. SIT will select a scouting master who gathers scouts who need to make a plan and use scouting sheets to evaluate other robots. The scouts will also need training so that they know what they are doing, which they will receive from the lead scouts.

Master Parts List – Maintain master cost assessment. We will need to develop a master equipment list of all parts on the robot, and list respective costs.

Systems Test – Various tests of the subsystems will be performed before during and after the competition season to measure the performance against KPPs and Subsystem requirements. System level testing will be performed concurrent with team training to finalize the team strategies and models/trade studies.

Award Applications
Systems Integration does the award applications for the Chairman's Award, the Entrepreneurship award, and the Woodie Flowers award.

Outreach
Plan for and document outreach events. Systems Integration organizes a PowerPoint document called "Outreach Summaries," which outlines all outreach events that Skunkworks has attended or hosted in the past and present.

3.5.2 Safety

It is the policy of Skunkworks Robotics, Team 1983, to pursue every reasonable effort to provide a safe and healthy working environment for mentors and team members. The team recognizes that it is first and foremost the individual team member's responsibility to conduct their work and activities in a safe manner. With this in mind it must be understood that if the individual members are going to be responsible for their own safety then they must be trained and taught how to be safe. It is therefore most important that team members and mentors know how to work safely.

To facilitate a safe robotics season the Skunkworks Safety and Health Program (SSHP) was developed; this program consists of four elements: the coach/mentor commitment and team involvement, shop and pit job safety analysis, hazard prevention and control, training, and education. Coach/Mentors commitment and team involvement is a coach policy statement on safety and health, provision for resources to maintain a safety and health program, team participation in safety commitments, and disciplinary actions for safety and health infractions. Team safety analysis is on site inspection of shop and pit area, and audits by mentors. Hazard prevention and control is the development of accident prevention plan, addressing engineering controls such as exhaust and machine guards, procedures on health and safety, personal protective equipment, and relying on the *FIRST* team safety manual.

Unsafe working conditions, unsafe practices, or machines that are unsafe to operate must be reported to Coach, or a Mentor, or the Student Safety Captain (all considered Safety Team Leaders) immediately. Mentors or Team Members also must report to the Safety Team Leaders any injuries that occur as part of the design, construction, travel and competition events for the Skunkworks Robotics Team. Also, as part of gracious professionalism advocated by *FIRST* we shall mentor and support other robotics teams in safety and health issues. Said mentoring may be direct: during competitions providing input in pit operations; or indirect, mentoring new teams in our locale.

The safety team also inputs their safety plan for the Industrial Safety Award.

3.5.3 Mechanical

The mechanical design team is in charge of prototyping, building and testing all of the mechanical apparatuses that were needed to play the game based on an over-all design. In 2009, this consists of a drive base, a lift, ball delivery device, referred to as the Dumper. Each of these sub teams built their part based on a master plan, these were then integrated together to form a working robot. Prototyping, consists of quickly building a model that in theory simulates what the real component should do, these prototypes are quickly assembled and evaluated for how well they can accomplish their designated task. Once the prototype has been evaluated, each part, with whatever changes have been decided upon, is constructed according to design. Testing involves putting the part through its paces and making sure that it can in fact get through the challenges that have been set for it and so, play the game.

The work done by the mechanical team is also put up for the Imagery award, Quality award, Design Award, Creativity award, Engineering Excellence award, as well as compete to become Regional Winners.

3.5.4 Electrical

The Electrical Team is in charge of laying-out, procuring, assembling, and testing all the components of the robot's electronics, including the control system. The team must lay out the electronics to ensure that they can fit around, and so not interfere with, the mechanical pieces and pneumatic systems. The team is also in charge of procurement; making sure all parts that are not included in the kit are obtained in time for the completion of the robot. Assembly involves physically putting each part into place and plugging it into the correct component. Testing is making sure that after everything is plugged in according to layout, it all works the way it should. The team is also responsible for making sure that said testing is carried-out in time for any and all problems to be fixed prior to ship date.

The Electrical Team contributes to the quality of the robot, and contributes to the Innovation in Control award.

3.5.5 Pneumatics

Pneumatics is responsible for making sure that every pneumatic component of the robot is procured, set-up and tested. The team must order and/or purchase every part of the pneumatics system that is not included in the kit that they need. They too must lay-out the pieces of the system so that they work without getting in the way of any other sub-system. Testing works exactly as already detailed under Electrical Team.

3.5.6 Programming

Programming is responsible for making the robot actually respond to the commands that the driver inputs, they must design, construct, and test their code. Design consists of finding code that will work for controlling the robot. Building involves compiling and configuring the code so that it really does work. Testing is making sure that the code does what it is supposed to when it is supposed to and not at any other time, this too must be completed before ship, so that any and all bugs can be identified and eliminated from the code.

3.5.7 Pit Crew

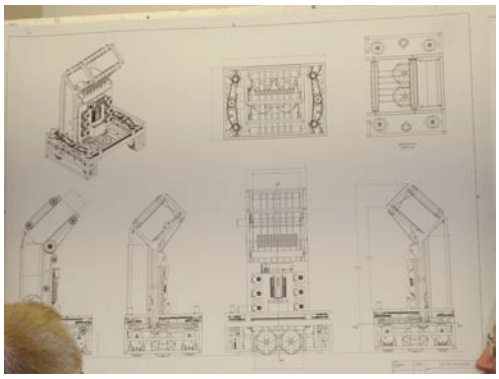
The pit crew is a team that needs to have the capability of repairing any system within the robot in a quick amount of time without many mistakes or much difficulty. Everybody on that team needs to know the robots and its capabilities and know all safety needed to be taken as not to damage the robot or themselves. There is also a student lead for this group called the Pit Crew Chief; this student is responsible for making sure that all members of the Pit Crew are doing their jobs. In the event that a team member is not required for something it is this individual's responsibility to either send said person to the SIT for further directions, or direct them themselves.

3.5.8 Training driver/operator

Drivers and operators for the robot need to be completely prepared and skilled in the ways of robot operations. This will require a training regime of having the drivers and operators practice their skills in different scenarios by going through preset challenges on the practice field. The Driver is responsible for knowing how the robot works and handles to the best of their ability.

3.5.9 CAD Team

The student CAD team is in charge of virtually modeling every major component of the robot. The model is generated by students with mentor guidance and instruction using the Autodesk Inventor computer program. This Design has two purposes, first to provide an accurate blueprint for the Build Team to follow, and second to enter the Team for the Autodesk Design Award.



3.5.10 Webpage Team

The webpage team is essential for building and maintaining the team website. On the team website, we include our plans and documents for any interested teams to read, documentation of our outreach, relevant information about what our team is, and news and events of recent activities that Skunkworks is involved in. The Webpage Team connects our team to our sponsors, Alumni, and fellow teams so we may interact with them and inform them about our progress during the build season.

3.5.11 Marketing Team

Visibility is necessary for any team to spread the word of FIRST to the community. The Marketing Team does this by creating flyers, buttons, apparel and logos for the team to rally team members at both robotics and outreach events. They also create a team practice shirt that Skunks may wear to regional competitions and outreach events to inspire people that Skunk students come into contact with.

4.0 Volunteers and team goals

There are an overwhelming number of challenges to running a *FIRST* FRC team so picking what you will or will not try to accomplish should be one of your first decisions. There are many aspects of *FIRST* that do not need to be done and others that are critical. How much the team chooses to accomplish is dependent on the size and resources available to your team; we set goals in order to meet them early, feel a sense of accomplishment, and be able to look back and see our progress over the season.

4.1 *Resources*

The most important team resource is the parent volunteers. Consider the following:
- Parents are most able to solve team problems as they are committed to helping their child get the most from the *FIRST* experience.
- Parents bring friends and acquaintances in as sponsors and mentors.

However in this day and age getting volunteer support from parents is very difficult because most families are balancing time and financial commitments and are unable to donate time and/or money. In our school, roughly a middle income district, approximately 1 parent for every 10 robotics students is an active participant, attending nearly all the team meetings and accepting major assignments. Approximately another 4 parents for every 10 students will be supporters, attending an occasional meeting and accepting small assignments. So for a 10 student team one parent will be active and 4 more will participate after others have set it up. These are very rough numbers based on our school and are really only an example as demographics of each team will vary greatly and there are other considerations beyond the scope of this discussion. No team should be started without a coach, mentor and parent.

To attract, maintain and motivate supporters parents must be kept apprised of the value of the program, the value of their time and how they can help even at a minimal level. Here are some key methods to help parents become involved:

Establish an email distribution list and send emails out frequently about the team. Get parents and students comfortable with reading them. Have parent leaders prepare their own to continue interesting dialogue and to convey team information.

Hold team meetings with the parents at least monthly. Discuss the team successes, what their kids have learned, show them the value of the program and their time, money and support.

Discuss upcoming events; make it clear that if they do not solve these challenges (money, transportation, etc.) then the benefits will diminish or stop. Tie their time to the student experiences and other benefits.

Seek opportunities to include parents in team events, student presentations, outreach events etc. to help breakdown any perceived barriers to communications between parents and the team leaders.

Identify tasking for parents that fit their life style. Avoid large complex tasking until they are ready and willing.

Get to know their situation so you can better fit tasking to them. Establish personal connections so you can discuss difficult issues and devise solutions.

Establishing a leadership team as soon as possible is important for parent support. Parents will first be looking for a structured program that assures their money, their efforts and student involvement is successfully directed. Key aspects of a leadership team include:

Recognize your leaders; Coach, lead parent, lead mentor. These people will become the conduit for communications and decisions for the team.

Show the parents that the leaders are making decisions via email communications, and team meetings.

Include active parent volunteers in the leadership team decisions. Once parent volunteers feel they can affect the direction of the team they will be more interested in getting involved. When this happens the team will become self supportive; that is, the parents will help define the team direction and get more involved to make it occur bringing in other parents, their friends, family, neighbors and other acquaintances. This is critical to sustain the team as well.

Consider finding a lead mentor or lead parent with program management experience. This person would focus on running the leadership team and focusing on maturing the team resources.

4.2 *Mentors*

Mentors are easily acquired once parents are involved. If the parents do not have the skills themselves they certainly know people that do. Surprisingly many people with engineering and other technical skills are willing to get involved. However to keep them involved is more difficult. The key to keeping them involved is to keep it fun for them as well. It is therefore important to ask them to take on tasks they are interested in. To do this it takes a certain amount of organization to recognize the position you have asked them to take and to support them. The parents, coach, and leadership team need to

recognize how important this is otherwise the mentors simply quit attending the meetings lamenting that there wasn't anything for them to do.

Industry suggests no more than 3 mentees to one mentor, employee to manager about 10 to 1. Robotics needs to be around 5 to 1 however again this will vary greatly. Given many parents are also mentors this is not too difficult to accomplish. The challenge is to give the mentor tasking that keeps their team busy and productive. Again this points back to the leadership of the team.

4.3 *Team Goals*

Every team will evolve differently depending on the support and skills of their volunteers. More and more businesses understand the benefits of *FIRST* in regards to their employee development, employee's children, communities, and future workforce. This is making recruiting mentors much easier. As a result, parent volunteers are the key challenge to establishing, growing and maintaining a team. Table 4.3-1 shows possible team goals based on volunteer resources. This table will vary significantly based on the skills of any given volunteer but is useful to exemplify the decisions regarding team goals.

Volunteers	Team Goals	Considerations
Small - Fewer than 15 students – New teams, establishing		
• 1 Coach • 1 Mentor, with general mechanical design • 1 Active Lead Parent • Up to 7 supporting parents	• Build a robot, shipping crate • Stay Safe: Adopt another teams safety plan and training • Compete in two regional competitions • Budget - $12,000 • Sub-teams: Programming, Design/Build	• The Coach with input from the other leaders should establish the goals of the team • Focus on having fun, participate in as many competitions, workshops and events as possible • Focus on obtaining and maintaining shop support to enable design options that are fun and interesting • Teams of this size will have problems getting sufficient parent volunteers and mentors, get the parents involved • Continue to increase volunteer support through parent meetings • Funding will be limited by volunteer time to raise money outside of team families • Participation in other awards will be limited. If you have kids/parents/mentors that have and are interested target easy options such as image and spirit awards. • Attend outreach activities
Medium - 15 to 35 students – Established teams, growing		
• 1 Coach • 1 Lead Mentor • 2 Mentors, specialized mechanical and programming • 1 Lead Parent • 3 Active Parents	• Budget - $35,000 to $40,000 As above plus: • Attend world competition • Establish a leadership team to	As above plus: • Expand communications to parents, mentors and supporters; keep kids, parents and mentors interested. • Conduct regular meetings, create a newsletter • Create outreach activities • Adult sub-teams include: Parent, Mentor, Fundraising, Travel, Transportation

• Up to 15 supporting parents	determine and implement team goals • Establish sub-teams • Establish and maintain email contact list to coordinate team business • Establish manufacturing support	• Student sub-teams include (as applicable): Programming/Control, CAD/Design, Communications, Pit, Safety, Webpage, Scouting, Systems, Electrical, Pneumatics, Photo/Video
Large - Greater than 35 students - Large established teams, sustaining		
• 1 Coach • 1 Backup Coach/Teacher • 1 Lead Mentor • 6 Mentors • 1 Lead Parent • 5 Active Parents • 15 or more supporting parents	• Budget - $40,000 to $80,000 As above plus: • Expand to 12 month program • Expand curriculum • Establish work agreements with other school organizations/clubs • Establish policies to sustain the club	As above plus: • Plan fundraising in the spring/summer • Contact Sponsors during summer • Over summer develop fall projects: advanced base, lift arm, camera tracking/targeting, transmission • Expand outreach • Use DECA to manage team product sales • Use school journalism club to communicate team business to expand visibility and support for the team • Use school art club to manage team icon and logos • Use school computing club to manage team webpage • Use school booster club to manage team mascot and generate student body support • Identify programming, CAD and webpage design • Prepare a management plan containing team policies, methods and processes

Table 4.3-1 *Team goals vs. Student Participation* - Student participation attracts parent volunteers that directly influence what a team might set as their goals.

The table 4.3-1 follows the premise that:

- Coach provides authority, leads team, interfaces to school and PTSA.
- Parents become volunteers, create/staff the organization, acquire funding, attract mentors, and communicate leadership which establishes objectives and benefits which attracts more parents and volunteers.
- Mentors provide skills, acquire support resources, and implement team technical objectives.

4.3.1 Small Teams

Small teams are characterized by about three key adult leaders; the coach, and two parent/mentors. Their ability to manage the team ends at about 15 students because they are limited in their ability to attract support (sponsors, volunteers), raise money (fundraisers), transport the team (carpools), and manage an orderly environment (student experience, safety, and fun). Small teams are greatly challenged by the basics of team operation due to the lack of volunteers able to lead tasks.

4.3.2 Medium Teams

Medium teams have sufficient support, 3 or more active parent volunteers, to manage their operations. With 3 or more mentors, the team can establish a leadership team and substantially pursue *FIRST* goals and create a great experience for their kids. Leadership will establish the team priorities, working together to solve challenges quickly and support each other on priority items. Things begin to work efficiently. Student sub-teams begin to be properly led by mentors with a shared understanding of the team objectives. As more volunteers participate the participation experience improves. Focus on fun and team goals becomes more difficult because it is easy to extend goals beyond available resources.

4.3.3 Larger Teams

Large teams are able to use their volunteer resources to substantially expand their influence. *FIRST* provides many opportunities for recognition of outreach. Additionally, there are further opportunities to expand *FIRST* goals to other aspects of the schools or community. With approximately 15 active coach's, mentors, and parents, goal setting will be clearly defined; however, logistics of handling becomes a challenge that will require clear team management.

4.4 *Fundraising*

Fundraising is perhaps the second most challenging aspect of running a *FIRST* team. However it is easily solved with volunteer labor. It is important to recognize many industries currently (or will shortly) recognize the value of *FIRST* in regards to their employee development, employee's children, communities, future workforce, and consumer base. Parents will also recognize the value once they understand what *FIRST* is about. This is one of the reasons *FIRST* stresses outreach at the team level: to help teams get the support they need.

The solution to fundraising starts with getting your robotics parents involved: Although they may not have money they do know people and they can volunteer their time to help raise it (see discussion about volunteer support). They can also direct some costs to other sponsors. Also, it is important to keep your whole community in mind: all the students,

teachers, parents and their contacts, businesses in your town, and all the parents businesses and all the *FIRST* teams. You will need to reach outside your local community and get to a broad base that includes higher income sources.

The following are fundraising strategies that have worked with various teams:

- Grant Writing: Several companies will offer grants to a non-profit organization if the organization applies for it. These have the potential to be very successful, but are usually temporary. You can do some research on the internet to find what companies offer grants.

- Corporate Matching: Some companies will match employee hours volunteered to a non-profit organization with a matching donation to the organization. Ask Parents to check with their employers.

- Cold Calling: Contact industries and businesses in your area and let them know you need their help. Have parents contact their business, or have students contact their friends. It is fast, can be very successful, but can take some nerve. All businesses like to give in order to improve their community. With the right message it can work very well!!!

- Solicitations: Have parents visit each business they frequent, grocery stores, Starbucks, McDonalds… in their community and explain the situation and ask for their help. This might overlap the others a bit so you will need to keep track.

- Letter Writing: Prepare a form letter, have each kid add a personal note and have each student send to grandparents, extended families, uncles/aunts, professionals they know (dentist, pediatrician, hair dresser), and their parents' businesses and associates (parents can pre-coordinate this). Most of these add up to $25 a piece, but you might find one big supporter. This is a little slow but modestly successful, and can take time. This is similar to kids raising money for sports gear. Keep track of where the letters are sent, have the kids give you a list, then after the season is over have the kids write thank you letters. This is a good experience for the kids!!!

- Local Media: Get a local newspaper to advertise your needs (or plight if it is your rookie year) and to call to donate support. This may not yield results by itself however it may lay ground work for cold calling, letter writing and other strategies. Have the article outline the benefits of *FIRST* and how challenging it is to start a team.

- Spaghetti Dinner: Hold a spaghetti dinner and dessert auction. Invite the whole school, other robotics teams, extended families and friends. Ask local restaurants to cater the dinner with parent help or have your parents prepare it. Ask parents, teachers, students to donate desserts. Ask local businesses to donate dessert. Sell dinner tickets, serve dinner buffet style for a little above cost, or if donated pocket the profits, and auction the desserts as dinner wraps up and eat during the auction. Encourage kids to pool pocket change and buy a cake or plate of cookies for 25, 30, 50, or $100. Only sell about 30 to 40 desserts as is takes 2 to 4 minutes to auction each and you are limited to about two hours for the auction.

- Cookie Dough, Butter Braid, Car Wash, Garage Sale, etc.: There are a variety of ways to raise money selling products. The net money raised can be limited but is easy and requires very little volunteer time. Scale can sometimes be greatly increased with volunteer help.

To implement each strategy call a parent meeting with all your supporters, tell them the good angles, and the bad ones. Make it clear that they are the resource that must solve this, and then give them the challenge, or the team will only go so far. *FIRST* is a difficult program to understand because it is about so much more than the robot. It might help to motivate some of your parents to bring them to a team that is working and has a good student experience. Checkout your local teams, you will always be welcome.

Appendix A- Team Alumni Directory

Team 1983 Alumni Contact Information

Class of 2008

Name	College	# of Years On Team
Stephanie Hoag	Worchester Polytechnic Institute	2
Jason Bock	Highline Community College	1
Justin O`Keefe	Highline Community College	2
Tony Nordholm	Embry Riddle Aeronautical University	1
Anthony Nguyen	Embry Riddle Aeronautical University	1
Daniel Nguyen	Embry Riddle Aeronautical University	2
Crystalyn Wolfe	International Academy of Design & Technology	2
Keiko Hiranaka	Harvey Mudd University	1
Zach Wydick	University of Washington	2
Tedrick Mealy	Embry Riddle Aeronautical University	2
Matt Kastner	Washington State University	1

Class of 2009

Name	College	# of Years on Team
Dave McLaughlin	Worcester Polytechnic Institute	3
Jay Weeks	Washington State University	2
Shawn Stern	University of Washington	1
Sebastian Hill	Embry-Riddle Aeronautical University	2
Cole Miller	Washington State University	2
Anthony Nguyen	Embry-Riddle Aeronautical University	
Ana Zapata		1
Brian Richards	Highline Community College	2
Branden Gee	Digipen Institute of Technology	3
Kim Truong	University of Washington	2

Class of 2010

Name	College	# of Years on Team
Isaac Ackerman	University of Washington	4
Griffin Nicoll	University of Idaho	4
Alex Campisteguy	South Seattle Community College	4
Sam Swan	University of Portland	4
Lamond Le	University of Washington	4
Kyle Edwards	University of Victoria	3
Rebecca Ly	Washington State University	1
Shawn Moes	Worcester Polytechnic Institute	3
Loki White	University of Washington	2
Mike Davis		2
Jamie Wallin		1
Scott Totten		1
Pat Chindasiriphan		1
Andrew Reece	California Polytechnic State University	1

Class of 2011

Name	College	# of Years on Team
Scott Anderson	Highline Community College	3
Alex Cox	Neumont University	2
Jordan Cross	Seattle Pacific University	2
Max Cullinan	Ecola Bible School	1
Thomas DeSilva	Worcester Polytechnic University	3
Lydia Johnston	Worcester Polytechnic University	3
Hal Middleton		3
Jennifer Minar	University of Evansville	3
Spencer Noble	Seattle Pacific University	1
Olivia Pham	Williams College	3
RoxAnn Roque	Embry Riddle Aeronautical University	3
Navid Shafa	Embry Riddle Aeronautical University	4
Danny Zaballos	Washington State University	3

Class of 2012

Name	College	# of Years on Team
Curtis Campisteguy		4
Kirk Cieszkiewicz		2
Austin Chick		4
Treyce Hart		4
Rashil Koli		1
Sydney Miller		3
Jared Sharp		2
Quinn Walters		1
Davis Yoshida		2

Class of 2013

Name	College	# of Years on Team
Liam Burke		3
Alex Cail		3
Aaliah Carmona		2
Paula Cieszkiewicz		2
Barrett Estep		1
Aiden Fellers		1
Ian Gibson		1
Jake Hecla		2
Hunter McSwain		3
Reilly Mulligan		3
Alex Ong		3
Michael Pascua		3
Morgen Sellier		3
Drew Wall		3
Wendy Zaballos		3
Robyn Zaches		2
Gary Zayas-Trujillo		3

Class of 2014

Name	College	# of Years on Team
Brian Gonzalez		2
Grace Cieszkiewicz		2
Teal Dowd		2
Jordan Gardner		2
Camila Palacio		2
Matt Smith		2
Qing rou deng		1
Westin Miller		1

Class of 2015

Name	College	# of Years on Team
Thomas Adamson		1
Connor Barlow		1
Austin Coleman		1
Ethan Hunt		1
Kirsten Noble		1
Quinn Schiller		1
Edson Smith		1
Joshua Stueck		1
Kira Walters		1
Madeline Warnes		1

Class of 2016

Name	College	# of Years on Team
Maryam Shafa		1

Appendix B- Team Competition Participation History

2011

Highest Achieved Rank: 1st out of all teams in Curie Field at the end of the day
St. Louis National Championship

Game: Logomotion
Objective: Drive around scoring tubes on pegs and racing minibots

Features:
6 wheel drive, Pneumatic end-effecter (popper), deployment system, minibot attachment and minibot

2011 Robot: Skunk. i. am

Awards

- Dean's List Winner, Lydia Johnston - World Championship, St. Louis
- Creativity Award - World Championship, St. Louis
- Underwriters Laboratories Industrial Safety Award - Autodesk Oregon Regional Competition
- Best Website Award - Autodesk Oregon Regional Competition
- Engineering Excellence Award sponsored by Delphi - Autodesk Oregon Regional Competition
- Engineering Inspiration Award - Seattle Cascade Regional Competition
- Engineering Excellence Award sponsored by Delphi - Seattle Cascade Regional Competition
- Lydia Johnston, Dean's List Finalist - Seattle Cascade Regional Competition
- Coach Robert Steele, Woodie Flowers Award - Seattle Cascade Regional Competition
- Coach Robert Steele, Volunteer of the Year Award - Seattle Cascade Regional Competition

---

2010

Highest Achieved Rank: 12th out of 64, Microsoft Seattle Regional

Game: Breakaway
Objective: Navigate varying terrain while scoring soccer balls into goals

Features:
Mecanum drive, Pneumatic kicker, camera tracking, grappling hooks

2010 Robot: Pepe Le Pew

Awards
- Chairman's Award, Microsoft Seattle Regional
- Kleiner Perkins Coalfield & Byers Entrepreneurship Award, Autodesk Oregon Regional Underwriters Laboratories Industrial Safety Award, Autodesk Oregon Regional
- Best Website Award, Autodesk Oregon Regional

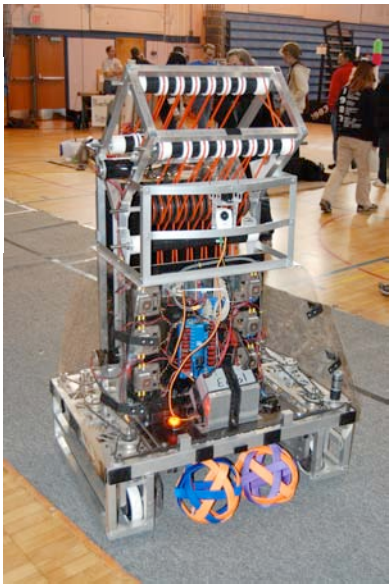
2009

Highest Achieved Rank: 12th out of 87, Curie Field, Atlanta National Finals

Game: Lunacy
Objective: Drive around slick field and score into opponents trailers

Features:
Swerve drive, conveyor ball collect/launch, camera tracking

Awards:
- Regional Champions, Autodesk Oregon Regional
- Delphi "Driving Tomorrows Technology" Award, Autodesk Oregon Regional
- Motorola Quality Award, Microsoft Seattle Regional



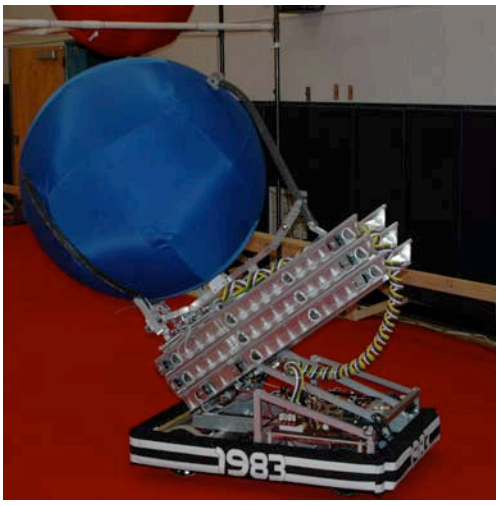
2009 Robot: The Stench

2008

Highest Achieved Rank: 5th of 90, Galileo Field, Atlanta National Finals

Game: Overdrive
Objective: make laps around track, maneuver large track balls over overpasses

Features:
Incorporated tilt mechanism, carbon fiber claws, and lift system to manipulate ball, placed highest of any Washington State team in the national finals.



2008 Robot: Das Uber Stinktier

Awards:
- Engineering Inspiration Award, Microsoft Seattle Regional
- Regional Champions, Microsoft Seattle Regional
- Delphi "Driving Tomorrows Technology" Award, Microsoft Seattle Regional
- Kleiner, Perkins, Caufeild, and Byers Entrepreneurship Award, Oregon Regional

- Underwriters Laboratories Industrial Safety Award, Oregon State Regional

---

2007
Highest Achieved Rank: Las Vegas Regional Champions

Game: Rack n' Roll
Objective: Hand inner tubes on a large rack in the center of the field

Features:
Construction completed at the Portland Regional, good defensive player

Awards:
- Rookie All-Star Award, Nevada Regional
- Regional Champion, Nevada Regional
- Imagery Award, Oregon Regional

2007 Robot: Corsair

Appendix C – Grant Sales Pitch

We Value Your Support

FIRST Team 1983 - Skunkworks

We are a group of High School students and professional mentors interested in

- Becoming leaders in engineering and business
- Sharing our skills and passion for engineering with the community
- Using technology to solve real world problems
- Working together as a team.

What we are asking you to help us with

- Providing monetary and corporate sponsorship
- Providing materials to assist us in building our robots
- To encourage your staff to volunteer time and expertise as mentors and technical advisers to our team.
- Opportunities for our students to visit your company and see the practical applications of mathematics, engineering, robotics, and business that they are learning with the Skunkworks.

Our Value to You

1. Visibility
   - Your logo will be displayed on our competition robot. That robot will be playing at local, regional, and national competitions that will all be televised (local news, NASA channel, and the Internet).
   - The robot with your logo on it will also be touring for road show demos at other companies, schools, community non-profit events, and technology conventions.
   - Your sponsorship will be featured and recognized in our Skunkworks newsletters.

2. Future Employees and Interns
   - We are a STEM school, with high achieving students capable of entering your work/team environment.
   - Our students are learning how to apply robotics, mechanics, programming, and business skills to real world challenges.

3. Monetary
   - Your financial contributions are tax deductible
   - We promise to be efficient and transparent in the use of your financial support for the team

4. Employee/business enhancement
   - Your assistance can show company support of the local community and education.
   - Your employees as volunteers will feel the excitement of FIRST and Skunkworks.

Additional Information

Website links

- Skunkworks team website: http://ahsrobotics.us
- Aviation High School website: http://www.aviationhs.org
- FIRST: http://www.usfirst.org/roboticsprograms/frc/default.aspx?id=966

Management Plan Revision Sheet

Rev #	Changes	Author	Mentor	Date
Rev New	Original Document	Cole M	Gary M	1/18/10
Rev 1	Updated for this year, added summary for 2010, added Team Competition History	Drew W	Gary M	1/10/11
Rev 2	Added Web/Marketing Teams, Outreach under SI Team, added Alumni Sheet	Drew W	Gary M	1/16/11
Rev 3	Names of Robots, formatting, added corporate matchmaking, added rev sheet	Drew W	Gary M	1/27/11
Rev 4	Additional Formatting, added colleges for the class of 2010	Drew W Lydia J Roxie R	Gary M	1/29/11