

**Skunkworks Robotics  
Business Plan  
2007-2008**



**Aviation High School  
Team 1983**

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## ABSTRACT

This document sets forth the business plan for the Aviation High School (AHS) robotics team. The AHS robotics team is registered as Team #1983 Skunkworks under *FIRST* (For Inspiration and Recognition of Science and Technology), a non-profit foundation formed for the purpose of stimulating academia in the youth of the world. This business plan summarizes the purpose of Team 1983; its connection to AHS and the surrounding community, its influence on surrounding teams, schools, and businesses as well as lays down the structure with which the team follows. This document also harbors important information and sub-documents regarding resources, budget, sponsorship details, balance, management and fund raising tactics. Throughout this document it is made clear the importance of Team 1983 within AHS and the community through a common vision and goal to instill within the youth of the United States a new excitement of technology, innovation, and education.

# 1 Introduction

Aviation High School (AHS) is a small, technology based high school in Des Moines, Washington, just south of Seattle established in 2004. While AHS is a public school within the Highline School District, students must go through an admission process in order to attend. This process includes an application similar to applying for college, as well as an interview with the principal and a small number of students. Approximately one hundred students are admitted each year, resulting in the total student population remaining at approximately four hundred students.

The robotics team at AHS participates in a non-profit program known as *FIRST* (For Inspiration and Recognition of Science and Technology) in the high school division known as FRC (*FIRST* Robotics Competition) as well as FTC (First Tech Challenge). Founded in 1992 by inventor Dean Kamen, *FIRST* has quickly grown to be a worldwide, prestigious, competitive robotics experience for all ages. Between the elementary level *FIRST* Lego League division (FLL), FTC and FRC, thousands of students and adults participate in competitions across the globe each year; culminating in a large, championship competition currently held in the Georgia Dome in Atlanta, Georgia.

Students apply for membership with the AHS robotics team by completing an application each fall which consists of short answer questions and inquiry of time commitment, in addition to participating in an interview with the coach and student team leaders. Admission to the team is based on grades and commitment. Freshmen and sophomore class students participate on the FTC team, along with a number of older students who serve as mentors. Before the FTC team makes a decision about a final design for the challenge, they are required to make a presentation to the entire team, including the veteran junior and senior class members. These junior and senior class members participate on the FRC team, given team number 1983, and are also known as The Skunkworks. This is the team that will be primarily discussed throughout this business plan.

This document is to serve as organization and documentation of the logistics and business aspects of the AHS robotics team as well as a guide for the future development of Team 1983.

## 1.1 Vision

Aviation High School was created as a science, math and technology, college and career preparation high school. The mission of AHS 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.”<sup>1</sup> In order to align with this mission, as well as the vision “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,”<sup>2</sup> the school works closely with members of the aviation and engineering communities. Students are exposed to the world of business and engineering early in their freshman year, and this continues until their graduation. Hands on projects dealing with real life engineering issues culminate in student presentations reviewed by actual business professionals and engineers from companies such as Boeing, Blue Origin, Galvin Flying Service, and more.

The *FIRST* program strives to create a similar environment where students and engineers can work side-by-side. The goal is not simply to have students design and create a competitive robot in six weeks, but to bring together students and professional engineers of all backgrounds in an environment of learning that allows the students to get excited about engineering. Since its inception in 1992, *FIRST* has grown into a nationally renowned, prestigious competition. The experiences that students have are unmatched by any other program in the world. *FIRST* founders are convinced that “the probability that one of [these students] is going to do something spectacular that they would not have done without *FIRST* is almost a guarantee.”<sup>3</sup>

Gracious Professionalism (GP) is a concept founded by *FIRST* that promotes a new meaning for sportsmanship. This idea of generosity stresses helping anyone and everyone, even if they are your opponents in the competition. One of the primary sayings is that winning is good, but even better if the match is close.

AHS Skunkworks bases its objectives on the *FIRST* vision 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’ objectives truly align with *FIRST* in that they both seek to set high academic standards to assure that students are well prepared for college, and a math or science intensive career.

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<sup>1</sup> [www.aviationhs.org](http://www.aviationhs.org)

<sup>2</sup> [www.aviationhs.org](http://www.aviationhs.org)

<sup>3</sup> *FIRST* Promotional Video, [www.usfirst.org](http://www.usfirst.org)

## **1.2 Team 1983**

An overview of Team 1983 – The Skunkworks; who we are, our accomplishments, goals, and struggles.

### **1.2.1 Past**

In 2006, our team began with 18 students. Our coach had previous experience with FRC and we (the students and parents) looked to him for guidance. Stephanie Hoag said, “I entered the world of *FIRST* expecting it to be the same as a math team, or Science Olympiad, but I was in for a big surprise.” Late nights, few tools, fewer mentors, learning from each other and making new friends, we soon found ourselves packing an un-finished robot into a crate and sending it on its way to the Portland regional. We came away not only with the Imagery Award, but we were introduced to the *FIRST* ideals in action; gracious professionalism became relevant to the whole team. This was truly different than any other sporting event any of us had participated in before.

From there we traveled to Las Vegas, where we were caught up in the pure spirit and fun of the competition. We sprayed white skunk stripes in our hair, helped other teams in the pits, cheered, and made friends with teams from other parts of the country. Success followed us to Las Vegas as we won the Rookie All Star award and were part of the winning alliance. Now we were qualified for Atlanta, something we had never dreamed about! Our friends from Team 488 demonstrated gracious professionalism when they greeted us at midnight at the airport to congratulate us on our win! In 3 days, our parent group organized all of the funds necessary to send all of the team members and 12 parents to Atlanta.

The Championship was vastly different than the regional competitions, and while we didn’t win any awards, as Dave McLaughlin realized, “we had become a team, and I think that even a national title wouldn’t be an even trade for what we have accomplished”. When we returned, no one wanted the season to end. As Michelle McLaughlin, parent, stated, “The *FIRST* organization is a leader in excellence, encouraging our kids to take their knowledge and spirit, and made a difference in the lives of their teammates, communities, and futures.”

We began to look for ways to keep our team together and the spirit of *FIRST* alive as the summer neared. We took our robot to Challenge Air at Paine Field where physically challenged children and youth had the opportunity to fly with a pilot. The smiles and laughs from the children and us told us we were in the right place doing the right thing. Fourth of July found us a participant in the local parade.

### 1.2.2 Present

During the transition from a first year team, to a second year team, Team 1983 has only flourished. Of the 18 participating students during the first year, 15 have returned for another season, and more than 20 new members were added. Community and parent support has grown as well. More parents, of both returning and new members, have decided to become consistent participants, and many engineers from local firms have embraced working with our student members.

Due to the increasing amount of mentor support, the structure and organization of our team has increased tremendously. We currently operate in a number of sub-teams, including electrical, drive base, lift system, claw mechanism, awards, and systems integration. The newest development within our team is the systems integration aspect of engineering. We now have an entire team dedicated to insuring that our robot abides by every *FIRST* regulation; managing weight, center of gravity, and creation of plans for all aspects of the team such as management, business and fundraising, engineering and safety. Even though our team is still very young, we have reached out to many local elementary and middle schools to convince them to start *FIRST* Lego League (FLL) teams. Currently, we have started two FLL teams at Chinook Middle School and one team at St. Francis of Assisi School. We send student members from our team out to each of these FLL teams each week as mentors to aid and encourage the development of these young students.

Team 1983 is also planning ahead this year for the competitions. Aside from preparing for malfunctions of our own robot, we have thought about problems that other teams encountered in 2007 and how we might be able to prepare ourselves to help them. A design has also been formulated for the appearance and organization of our pit area in order to promote the highest level of safety and efficiency during the competitions.

Community involvement has also become increasingly important to the development of Team 1983. The team strives to involve the community of Aviation High School as well as the local community within the surrounding area. AHS does not have athletic programs; therefore, *FIRST* Robotics is one of the only competitive “sports” available to students. Assemblies and pep rallies are held for the team before competitions, and the entire school plans to attend the Microsoft-Seattle Regional in Tacoma, Washington this March. Team 1983 is the source of spirit and school pride for Aviation High School.

Located in Seattle, close to the large Boeing plants and many other engineering firms, AHS, and more specifically Team 1983, attracts many engineers who are interested in what we do. It is not exceedingly difficult for us to find mentors who are willing to spend their time coaching students on engineering techniques. Now that we have actively pursued acquiring mentors, we have sufficient support to create an incredible robot with highly elevated educational benefits each year.

As a result of observing a slight downward trend of students’ grades during Team 1983’s rookie season, a team study group has been established. Students are required to attend a pre-determined percentage of these study group meetings in correlation with their current grade earnings. If a student is failing any classes, they are required to attend four study

group nights each week. These students are only allowed to attend the weekend meetings and must study at home during the remainder of the team meetings until their grades have been brought up to C's<sup>4</sup>. Grades are checked every two weeks, and students with a failing grade before a competition are not allowed to travel with the team. Education is the most important thing on Team 1983, and therefore, is the primary focus of everything we do. Students with higher grades are encouraged to help the other members during these study times.

### **1.2.3 Future**

In the coming years, using our continuous improvement strategy, we will continue to revise and improve the safety program. Safety training will be conducted during the off-season and future robots will be designed with more safety in mind. Newly instituted procedures will become more detailed and more routine as we learn the value of team communication and building student confidence. Our infrastructure has begun to take shape, so continuing to strengthen that important aspect of the organization is essential if we want to work together more efficiently.

We continue to encourage more student-to-student tutoring so that participation in robotics results in raised grades rather than dropped ones. Educational projects will be developed by mentors and veteran team members to familiarize students with tools and jobs before the build season.

We will have more team building activities that include mentors, such as team dinners, movie nights, or paintball outings. Throughout the year it is important to remember that a balance of work and play is needed to stay healthy.

Team 1983 wants to increase the number of FLL and FRC teams that we mentor in our community. We have found tremendous enjoyment in the outreach that we have done and will continue.

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<sup>4</sup> Aviation High School does not give D grades. Students receive an A, B, C or F.

## 2 Objective

### 2.1 Mission

Team 1983 works to develop students strong in math, science and engineering and dedicated to pursuing a rigorous academic college experience. Through mentor, parent and teacher support from both Aviation High School and Team 1983, the students of the AHS Robotics team are pushed towards a rewarding and demanding career. The students are then inspired to continue the mission and spread this inspiration to younger students, so that they may experience even greater motivation and academic opportunities.

### 2.2 Member Benefit

For many of the team members, the experience of *FIRST* has been described as ‘life-changing.’ It made them feel a part of a team, and gave them a new direction in their lives. Most started the program skeptical of what was to be and came away with great anticipation for the next year. Crystalyn Wolfe, one of the student mascots, said, “...it is about working together and trying to do what we can.”

Students are inspired throughout participation in *FIRST* to pursue their education. The emphasis placed on going to college is greater than any other student program offered in high schools today. By allowing students to work side by side with real engineers, they can get a firsthand glimpse of what the real world of engineering is like. This allows students to explore their career options much more, before they are required to make a decision about the path for their future.

Great emphasis is also placed on sportsmanship, safety and fun. The lure of the competition comes in the amount of joy that students experience when they have completed a robot. What keeps them in the competition is level of excitement and understanding of importance of the other aspects, such as the sportsmanship, safety, and education. The students that participate in *FIRST* graduate from high school more mature, ready, and enthusiastic about college. *FIRST* is creating the future and making it exciting in the process.

All of this fits very well with the goals of Aviation High School. Students that have participated in *FIRST* Robotics and have attended AHS seem to get almost a ‘double-dose’ of this education inspiration. Students leaving both of these programs seem to have a much stronger interest in engineering, and a much better idea of exactly what they wish to do with their future than graduates of just one of these programs. AHS and *FIRST* Robotics compliment each other through their inspiration of students very well.

## 2.3 Community Benefit

In our rookie year, our concentration was on building a robot before building our team. But by the time we returned from Atlanta we were extremely excited about *FIRST* and our success. We wanted to continue the growth we had begun as a team and sought ways to stay involved even though the school year was quickly coming to an end. We brainstormed some ideas and soon found it quite easy and fun to become involved with the community. Here are some of our highlights so far.

We took our robot and two VEX robots to Paine Field for *Challenge Air*, (<http://www.challengeair.com/>) an event where pilots volunteer their time and planes to take children with disabilities and life-threatening illnesses for a short ride as co-pilot. While children were waiting their turns, they were able to operate our small VEX robots, as well as give and take ringers from our large FRC robot. We also helped the children into and out of the planes. We had a great time and the smiles told us that the children did, too. We are looking forward to going back in June.

Many of us spent a hot Fourth of July with our robot in the Burien Parade which gave us exposures to our local community. Later in the fall, we invited the public to our first spaghetti dinner and dessert auction.

We hosted the Des Moines Regional for *FIRST* Lego League as well as mentoring local FLL teams. We brought the robot over to the school at the beginning of the year to generate interest in the after school club. We also volunteered at the State *FIRST* Lego League Tournament.

We were asked by a local elementary school to run a class during their 3 early release days. The upper grades worked with K'Nex while the lower grades explored and built with Tinker Toys.

Our robot has had the great pleasure of visiting some of our sponsors and other interested people. Students presented to three of our sponsors, as well as several Rotary clubs. We also went to speak with our legislators in Olympia. Those students not attending the Championship in Atlanta this year will be at Aviation High School's annual dinner and auction with last year's robot and VEX robot. All of these experiences have given us the opportunity to not only talk about our robotics team, but to inform our audiences and community about *FIRST*.

Dignitaries, such as Washington's governor, legislators, the president of Embry-Riddle and several corporate heads, have come to Aviation High School and met our robot and team members. They were interested in what we had learned and what impact the *FIRST* experience has had on us. We were happy to let them know and share some of our stories and aspirations for the future. We have also toured several companies and spoke with some of the workers who found what we were doing exciting and wished us luck.

Our team has spent many hours volunteering at elementary and middle schools, and

running workshops on robotics and *FIRST*. Also all the mentors who support us spread the message of *FIRST* simply by participating in the build season processes, their increased awareness makes others aware of *FIRST*.

## **3 Implementation**

### **3.1 Program Organization**

Team 1983 prides itself on being a student-run organization that develops an overwhelmingly student-built robot. This is an extremely difficult task to undertake in the context of *FIRST*.

Our team is very well organized, all tasks are delegated to sub-teams whose sole job is to build or develop a specific component or document. Everything the team undertakes is delegated and coordinated within the team. All of our mentors are professionals who have massive amounts of experience in the respective fields, and as such, they work to inform students about what exactly they are working on.

The team leader, the coach, finalizes all primary decisions. The coach is informed of the actions of the team, sub-teams, mentors, parents, and anything else that may be within the range of concern for the good of the team. He or she has the authority to make the final decision in any circumstance, and does so at his or her own discretion for the primary purpose of overseeing the big picture and insuring the safety of every team member. The head mentor, head parent, and head team captain communicate between the coach and the mentors, parents, and students respectfully. It is through this model that it is insured that each person involved with the team is informed at all times. The head parent, also, sends email updates to all mentors, parents and students at least one to two times a week regarding schedule, event plans, or any other information pertinent to the team.

Team captains are each twelfth grade student who has completed at least one competition season as a member of the team. This student is responsible for managing as sub-team as well as training a younger student to take over the duties they have performed upon their graduation. This structure ensures that there are no gaps in team organization each year when the seniors graduate. The head captain is a student responsible for the primary communication between mentors, students, and the coaches. This student is very aware of (specifically) what the students are doing at all times, and insuring that they are safe, and on task throughout each meeting. The head mentor is a volunteer who takes on the responsibility for coordinating all mentors, mentor meetings, and communication from the mentors to the coach if needed. The head parent organizes the parent support for the team by assigning parents to be responsible for activities such as team dinners, transportation, apparel, etc. The primary reason for this organization is to emulate the structure of a business so that students can receive some experience in a work-like environment.

### **3.2 Program Execution**

The first week of the build season, following the kick-off, is designated for robot design

and strategy development. The team is dispersed into six even design groups, in no particular arrangement, and each group is expected to develop a concept for a successful strategy and robot concept for the new game. The last meeting of the week is reserved for presentations by each group. During the next meeting the design and strategy is discussed and decided on before the lunch break, after which, the team is dispersed into the sub-teams which will remain for the rest of the build season and into the competitions.

There is a sub-team for each major function of the robot, as well as each major area of the team. These teams vary slightly each year, but generally include a drive base team, electrical team, arm design team, gripper/actuator team, awards team, and media team.

Sub-team leaders, who are generally also team captains, are responsible for the smooth operation and functionality of their group. Each day, sub-teams are required to document their progress, struggles, and plans for the next day. This insures that progress is being made, and also that everyone can find out what is going on and know what needs to be done next. These sub-team leaders are also responsible for training a younger member to be the sub-team leader in the next year. This insures that even as students graduate and move on, the team will continue to grow and mature. Each sub-team is also supervised by a mentor who aids in insuring the safety of all sub-team members when using power tools and acts as a guide and source of information for education of the concepts being used.

### **3.3 Resources**

Some of the resources that Skunkworks uses are its community volunteers. Volunteers include our parent team, our mentor team, our students, and our faculty. The parent team is very useful because they help manage our sub-teams, overall organization and handle affairs such as travel preparations, money acquisition, and team activities.

Many engineers from our local community donate their time and expertise to our team. We also are granted access to their machine shops and/or materials including assistance from professional machinists in the fabrication of the parts for our robot.

Local businesses are generous enough to sponsor our team so that we are able afford to attend two regional competitions as well as the championship competition in Atlanta. We acquire these sponsors by contacting them through email or letter, offering a demonstration and/or presentation at their location, and ask if they would be interested in sponsoring our team. Each year we expand our horizons further to larger companies. With experience, we believe it possible to convince a number of large corporations to sponsor our team through a long-term arrangement.

## 4 Funding

### 4.1 Annual Budget

Item	Annual Cost (approximate)	Description
<i>FIRST</i> Registration Fee	\$6,000	The annual cost required for participation in the <i>FIRST</i> Robotics Competition, this fee includes the Kit of Parts, as well as the entrance fee for one regional competition.
Oregon Regional Entrance Fee	--	Regional competition held in Portland, Oregon on the first weekend of the competition season, March 1-3, 2008.
Oregon Regional Team Travel Expenses	\$3,000	Hotel fees, team dinner costs, and other miscellaneous costs associated with the travel of the members of the team for the regional competition in Portland, Oregon.
Microsoft-Seattle Regional Entrance Fee	\$4,000	The annual cost for participation in a second regional competition. This competition is funded by the Microsoft corporation and is held in Tacoma, Washington.
Microsoft-Seattle Regional Team Travel Expenses	\$1,000	Hotel fees, team dinner costs, and other miscellaneous costs associated with the travel of the members of the team.
Championship Event Entrance Fee	\$5,000	The annual cost for participation in the Championship Event in Atlanta, Georgia.
Championship Event Team Travel Expenses	\$5,000	Hotel fees, team dinner costs, "wrap party" entrance fee and other miscellaneous costs associated with the travel of the members of the team to Atlanta, Georgia. This cost does not include airfare.*
Robot Materials Expenses	\$4,000	Estimate of the annual cost for acquiring necessary materials to build a competitive robot for the 2008 <i>FIRST</i> Robotics Competition.
Miscellaneous Expenses	\$5,000	Other expenses associated with the operation of Team 1983.
Unexpected Expenses	\$2,000	Broken parts, or any other costs that we did not anticipate are provided for here.
<b>Total Annual Budget</b>	<b>\$35,000</b>	

\*The approximate cost for airfare to Atlanta for 20 students (the average number of students who will attend) is \$10,000. Except for extraneous circumstances, the student and his or her family will provide for this cost.

## 4.2 Fund Raising

### 2008 Skunkworks Fundraisers:

<b>Fundraiser</b>	<b>Goal</b>	<b>Description</b>
Spaghetti Dinner	\$10,000	A dinner produced for the local community surrounding Aviation High School, and the locations of its students. Entertainment, food, and a robot demonstration are all included. At the end of the dinner, desserts donated by families and local businesses are auctioned, as well as opportunities to “Fund-A-Skunk” by donating any amount the benefactor may wish.
Student Letter Writing Campaign	\$10,000	Each student member is required to send a letter to at least 5 family members, family friends and/or community members asking for donations, more than 5 is highly recommended.
Coin Drive	300	A small, competitive fundraiser between the AHS grades where coins count as positive points and bills are negative. The winning grade receives a pizza party.
SPEEA	\$5,000	SPEEA sponsored our team for \$5,000 this year.
PTSA Auction	\$10,000	The AHS PTSA annual dinner and auction. A set-aside amount of money is put aside for Team 1983 from the money earned by the PTSA through this function. Team 1983 also receives all of the money that is earned by the items that the team provides for the auction itself.

### Sponsorship Levels:

<b>Sponsor Level</b>	<b>Donation Amount</b>	<b>Benefits</b>
Commander*	\$5,000 and above	Pilot + your organization will be part of the name we use at events. This name is announced when we are on the field.
Pilot*	\$1,000 - \$4,999	Flight Engineer + the name of your organization on our competition ROBOT!!
Flight Engineer*	\$500 - \$999	Ensign + the name of your organization on our Team Banner
Ensign*	\$250 - \$499	The name of your organization on the back of our Team Practice shirts.

*\*Along with other benefits, all donors will receive a summary of the team's accomplishments at the end of the season and the deep gratitude of the entire team for the help.*

### 4.3 Balance sheet

Benefactor or Event	Amount	Description
2007 Spaghetti Dinner	\$12,529.39	A dinner produced for the local community surrounding Aviation High School, and the locations of its students. Entertainment, food, and a robot demonstration are all included. At the end of the dinner, desserts donated by families and local businesses are auctioned, as well as opportunities to “Fund-A-Skunk” by donating any amount the benefactor may wish.
Mr. Peter Anderson-Galvin Flying	\$5,000	This generous donation was presented to the team at the 2007 Spaghetti dinner as a response to a letter written by a student as part of the letter writing campaign.
Burien Honda	\$2,500	After showcasing the robot to Burien Honda, they agreed to sponsor 5 team members.
Aviation High School PTSA	\$5,000	A portion of the Aviation High School PTSA budget is set aside for Team 1983 each year.
SPEEA	\$5,000	
Aerospace Futures Alliance	\$2,000	A portion of the Aerospace Futures Alliance’s budget has been set aside for Team 1983 each year for at least the next four years.
Student Letter Writing Campaign	\$15,000	Each student member is required to send a letter to at least 5 family members, family friends and/or community members asking for donations, more than 5 is highly recommended.
Aviation High School Auction (Projected)	\$10,000	Team 1983 enters items into the Aviation High School Auction each year, and generates revenue from each of these items, which range from t-shirts and robot demos, to clean-up crews.
Team Fee	\$600	Each student member is required to pay a fee. This fee is recommended that it come out of the pocket of the student, not the student’s parents, in order to show dedication and loyalty to the team.
Miscellaneous Student-Acquired Funds	Variable	Money acquired by the students, aside from team organized or team required fundraisers.
<b>Current Balance<sup>5</sup></b>	<b>\$58,000</b>	

<sup>5</sup> This is an approximate balance that is constantly changing.

If there is a surplus of funds, the money will go towards helping students pay for their flight costs to the Championship Competition in Atlanta, Georgia, and the remainder will be set aside for the next year. In the circumstance of fundraising shortfall, it may become necessary for team members and their families to contribute towards their own travel expenses, such as room fees, food and entry costs. Focus for fundraising growth has been placed on community fundraisers that are easily repeatable on an annual or biannual basis as well as acquiring long-term sponsors that will consistently contribute to our team each year. Plans for team expansion include developing enough of these income sources in order to support the primary costs for the younger teams that we currently support by providing student mentors. This will allow the *FIRST* community in our area to continue to grow. Additionally, Team 1983 sets aside approximately \$1500 in need-based scholarships for its members that show significant need of financial aid in acquiring the \$250 per regional attendance, or associated competition travel expenses.