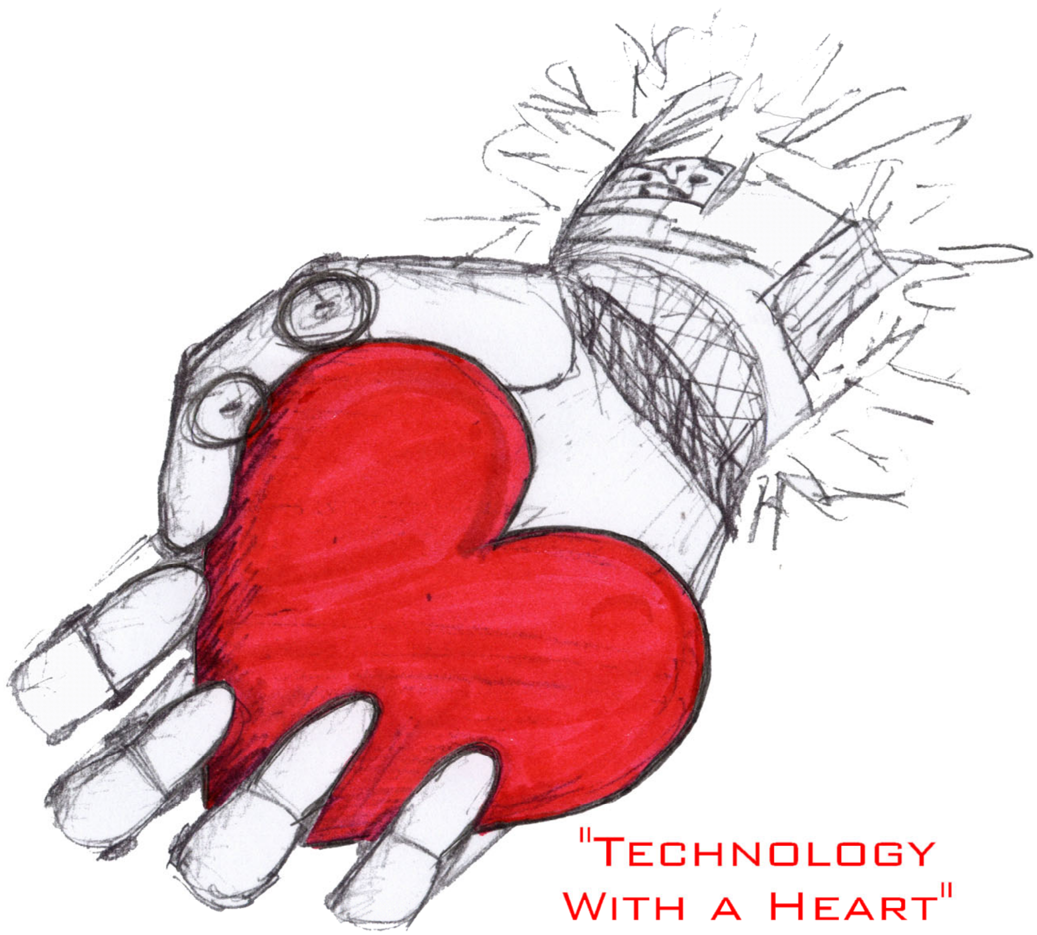
ALAMO AREA HOME SCHOOL
PROJECT SUMMARY NOTEBOOK



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2003 SA BEST Competition
"Transfusion Confusion"

Table of Contents

Application of the Engineering Process

The engineering process is the set of standards which guides the engineer through the design, construction, and testing of a product. Before we began this year's competition, we determined that the application of the engineering process would be one of our highest priorities, and so we outlined a set of 10 steps which defined for us the engineering process (this list is included in Appendix A). Following is a description of each step and an explanation of what we did to satisfy its requirements.

Stage 1: Product Requirement Analysis

The first stage of the engineering process consists of the recognition and analyzation of the challenges in the game scenario. We began this stage by asking ourselves, "What is the task to be accomplished?" "What in general terms must we do to meet the needs of our customer, BEST Inc.?"

We recognized the product requirements and defined them as follows:

1. Activate decontamination switch
2. Retrieve balloon(s) from either arteries or capillaries
3. Transport balloon(s) from either arteries or capillaries to scoring area
4. Deposit balloon(s) in scoring area or outside playing area

After considering the product requirements, we decided upon a project statement: "We need a robot to hit a decontamination switch and transport as many blood cells as possible into our portion of the cell saver within a three minute time limit."

Stage 2: Product System Strategy

As we progressed into the second stage, we began examining the product specifications and determining the strategy necessary to meet the game requirements as determined in Stage 1. We determined exactly what our robot needed to do, the order in which these tasks needed to be done, and the constraints under which the robot must be able to accomplish these objectives.

First, we examined the game rules and recognized all possible scoring methods. This we graphically summarized in tables 2.1 and 2.2.

Table 2.1: Scoring Methods (Regular balloons)

	Blue Cell	Red Cell	White Cell
Upper zone	2	4	6
Lower zone	1	2	3

Table 2.2: Scoring Methods (Miscellaneous)

Decontamination switch	3 points
Green balloon (out of field)	8 points

We then made an examination of game scenario constraints and limitations. The primary limitation, we determined, was the three minute time limit, followed by product limitations such as size and weight. Constraints established by the game scenario included possible congestion or traffic buildup near arteries, capillaries, and/or scoring areas, the necessity of care when handling both field and game pieces, and the available resources and materials for design and construction.

We then used this information to determine our basic product strategy. After a discussion of the possible options, we decided upon the following strategy.

Table 2.3: Strategy		
Number	**Action**	**Points**
1	Activate decontamination switch	3
2	Spread apart the shock cords from the artery closest to our decontamination switch	-
3	Acquire a balloon by allowing several balloons to fall out	-
4	Dependent upon which balloons which fall out:	-
4a	Red balloon-place in upper scoring area of cell saver	4
4b	White balloon-place in upper scoring area of cell saver	6
4c	Green balloon-place outside of playing area	8
5	Retrieve the balloon, and deposit in appropriate scoring area	-
6	Repeat from No. 3 as time allows	?

We realized that, due to the nature of the game, our strategy would vary slightly each round of the competition, but we established the preceding guidelines to assist our drivers.

We also decided to not worry about defensive strategies since we figured that the best defense would be a good offense. However, we still reached a general consensus to build our robot such that, if necessary, we could possibly remove a green balloon from our portion of the cell saver.

After examining all the product requirements, the strategy, and the constraints, we developed our basic design criteria. These criteria were compiled into a list of product design goals which every design under consideration had to meet.

Table 2.4: Basic Design Criteria	
1.	High speed
2.	Good accuracy
3.	Minimal weight
4.	Good vertical reach (32 in.+)
5.	Sturdy base/chassis
6.	Dependable drive mechanism
7.	Long arm
8.	Efficient balloon acquisition system
9.	Sturdy arm design (must be able to spread shock cords)
10.	Ability to activate decontamination switch

Stage 3: Alternative Concept Development

Stage three is probably best summarized as a brainstorming session for design concepts which meet the design criteria and product strategy. Nearly everyone participated and all ideas were given consideration.

Table 3.1: Suggested Designs and General Ideas

Name	*Idea*
Andrew Lovins	Forklift with net
Trey Fawcett	1. Vacuum arm system 2. Hexapod base
Adam Nyenhuis	Forklift with net
Michaelangelo Lovins	Inverted scoop
Nicholas Saulsberry	Basket design
Chris Ehrhart	Padded claw

Tommy Blake	Basket design
Matt Sheehan	Plate and claw mechanism
Gilbert Lovins	Forklift with net and roller
Jeff Stagg	Netted basket with closing action
John Grasso	Vacuum and inverted scoop design
Sarah Nyenhuis	Dual arm system

Each design was drawn and explained by the team member in preparation for analysis in stage four.

Stage 4: Concept Refinement and Evaluation

Under the fourth stage of the engineering process, each design was evaluated and a list of advantages and disadvantages was created for each. This stage, though tedious, provided the basis for all the other stages. Therefore, we worked through this stage meticulously as we examined each design.

Each of the designs was distinctive, but the basic similarities between some of them allowed them to be considered collectively in just a few groups. These three collective designs were known as the VAC, M.A.C., and NET designs.

The first concept, the VAC design, utilized a fan to generate suction in a tube. The beauty of this design was that it could readily acquire balloons without requiring precision on the part of the driver. The suction would attract the balloon as soon

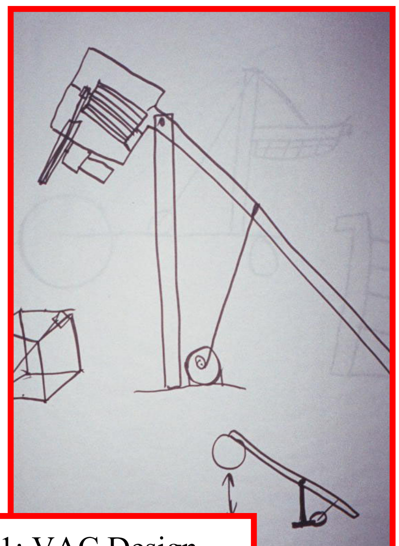


Fig. 4.1: VAC Design

as the vacuum tube was brought into close proximity with the surface of the balloon. An added benefit of this design was its ability to function as both a vacuum and a blower.

However, creating a fan capable of displacing enough air to be effective would have been difficult given that we did not know how to build an efficient unit, and learning how to do so would have required a major learning curve and taken a great deal of trial and error. Some uncertainty also remained as to our ability to machine the components necessary to make this design feasible. The VAC design utilized a very simple design concept, but constructing this design would have proven to be a challenge.

Table 4.1: Analysis of VAC Design	
Advantages	*Disadvantages*
No precision required	Complexity of construction
Good vertical reach	Uncertainty regarding suction strength
Dual functionality: blower and vacuum	

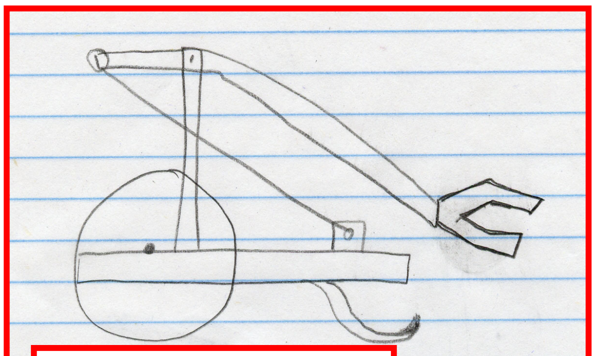


Fig. 4.2: M.A.C. Design

The M.A.C. design was a compilation of several of the designs submitted. This design employed an arm with a claw attached at one end. The arm allowed for a significant vertical range of motion and the claw promised a simple method of acquiring balloons by just grasping them.

While the machining of components for the VAC design was more complicated, the M.A.C. design had an inherently greater design complexity due to the positioning of the components. Unlike the VAC design, which utilized a simple theory but complex construction methods, the M.A.C. utilized a more complex design which, however, would be relatively easy to build.

Table 4.2: Analysis of M.A.C. Design	
Advantages	*Disadvantages*
Low battery consumption	More complex design
Straightforward construction	

The final design, the NET system, was essentially a forklift with a net to cradle the balloon. The design, while simple in its concept, we determined would have had difficulty in retrieving a balloon from the floor and then gaining the necessary vertical clearance required for scoring in the upper scoring zone as our strategy dictated. We also realized that if a green balloon was deposited in our scoring zone, we would be unable to remove it.

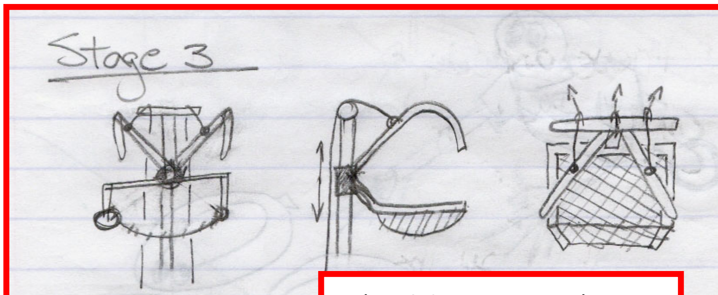


Fig. 4.3: NET Design

Table 4.3: Analysis of NET Design	
Advantages	*Disadvantages*
	Difficulty in retrieving balloons
	Difficulty in depositing balloons
	Difficulty in removing balloons

In a similar fashion, the designs for the bases consisted of two general designs: a HEXAPOD concept and the conventional base-on-wheels. The HEXAPOD design was presented because it was very unique, it was stable, and it was easily reconfigurable to the standard wheel design if it turned out to be unfeasible. As indicated by the image to the right, this design is actually rather straight-forward despite the apparent complexity which such a design might seem to require. Only four separate linkages would be required to connect the legs and the motor on each side. One other interesting thing about this design is that to our knowledge, it has never been used in a BEST competition.

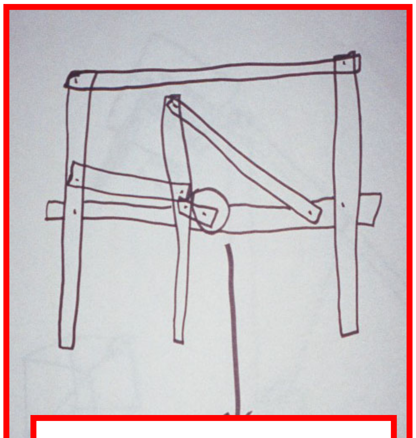


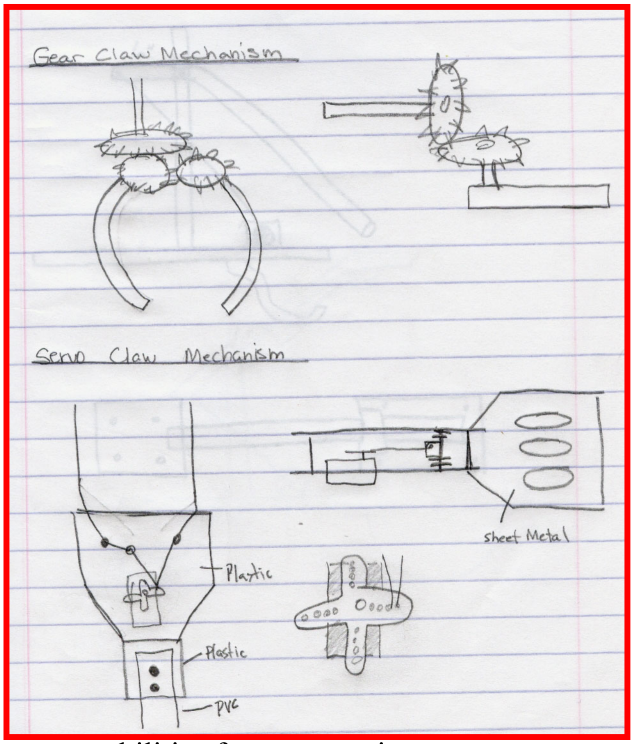
Fig. 4.4: Hexapod

While both the VAC and M.A.C. arm designs and the HEXAPOD and wheel-base platform designs met our product requirements and our game strategy, it was the complexity of the construction coupled with our time constraints which determined our final design. We elected to utilize the M.A.C. design mounted on a wheel-driven base.

Stage 5: Preliminary Detailed Design of Product

Though our team decided upon the M.A.C. design, there were still various subsystems which required detailing. The claw mechanism was the primary subsystem under consideration. There were two designs submitted for the claw: a design employing a motor and gears and a design utilizing a servo.

This matter was discussed at great length. Because the added weight of mounting a motor with the claw at the end of the arm, it was assumed for our analysis that the motor would be mounted at the other end of the arm from the claw to provide a better weight distribution. One

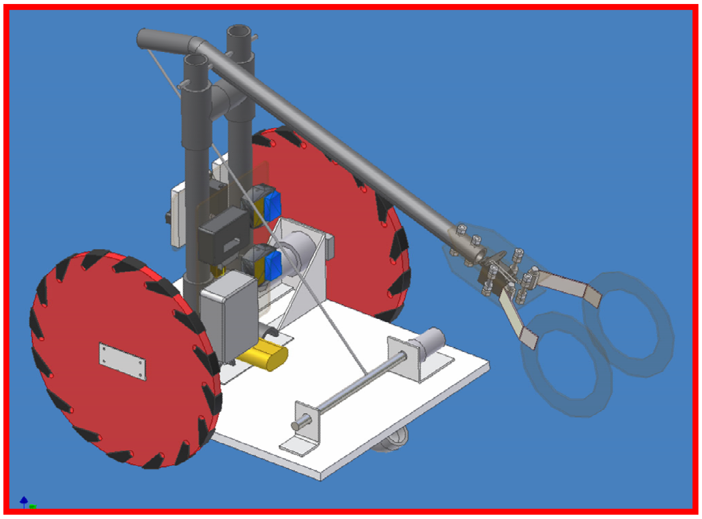


advantage noted by team members was that the gear assembly would provide a great deal of speed and power. However, the gear assembly was much more complex in its construction, and it was restricted because of the limited amount of gears available. Furthermore, keeping the gears meshed during the competition and ensuring that they would not strip out from repeatedly being forced by the motor or external forces seemed to be beyond our capabilities for construction.

The servo assembly, on the other hand, provided the same variable claw size as the motorized gear unit, but it also provided more control to the driver. Furthermore, it had a less complex design, fewer moving parts, and a smaller drain on the battery. Therefore, our team chose to use this design.

Stage 6: Construction of CAD Drawings

In this stage we left the paper drawing board and began modeling our robot on a computer using AutoDesk Inventor 7 Pro. We carefully modeled all of the major components and then fitted them together on the computer to produce a model of the complete robot. The beauty of



using the CAD software was that we were able to test our robot to see if it could reach over the top of the cell saver before we had built the practice cell saver or before we had even begun to construct the robot.

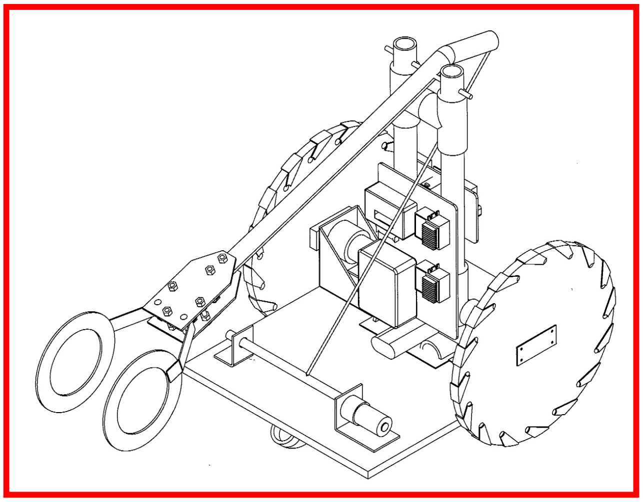
Modeling our robot in CAD software not only gave us real-world experience, as more and more engineers are relying on computer models, but also allowed us the opportunity to test our model mathematically to ensure that our design would perform as expected.

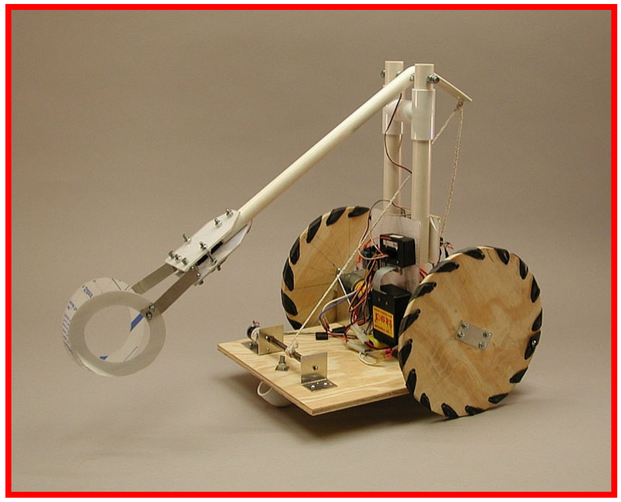
Stage 7: Determination of Required Parts and Dimensions

Once we had detailed out the CAD drawings, we used them to tell us the exact dimensions of each component of the robot. Armed with this information, we were able to avoid many nasty surprises, and we eliminated almost all of the guesswork from the construction process. In some instances, particularly with components made from sheet metal, the CAD drawings were especially helpful since they allowed us to make a template for cutting and bending the metal.

Stage 8: Machining of Individual Components

At this point in time we machined the components of our robot. On account of the hard work we had done in stages six and seven, we had an almost seamless transition from the CAD to the real world; we were able to construct each component almost exactly as planned. Because we knew exactly what we wanted, we were able to spend our time making components of superior craftsmanship instead of wasting our time guessing and rebuilding parts again and again.





Stage 9: Working Model Development

Here we assembled the components we machined in step eight into a working robot. At this time we began tweaking our design as was necessary to construct an optimal robot. For instance, in our original design, we planned to construct a large wooden block through which we would drill holes for mounting the upright pipes for the arm. Once we had built the block, however, we realized that it would weigh far too much to be practical for the robot. We immediately discarded the block idea and set about looking for alternate ideas for mounting the upright posts on our robot. We eventually hit upon the idea of using tees cut in half like the ones used as the base of the wall on the playing field. This proved to be a very rigid and lightweight design.

Stage 10: Analysis and Testing

Our tenth and final stage dealt with the testing and tweaking of our robot.

At about this point in our construction, we discovered that our experimental design for the clamps to hold the wheels to the motors was flawed. To our dismay, we discovered that a sharp blow would easily knock the wheels out of alignment and even pull them off the motor shaft. We returned to the brainstorming phase for a moment and came up with a few solutions to this problem. We proceeded to build a clamp which utilized a set screw, and although this concept is still being tested, it seems to be working quite well.

We have also discovered a few other glitches in the robot, including a servo that turns too far and then jams itself into an incorrect position, and a linkage which sometimes slips out of place in the claw.

At the time of this writing, we have yet to fix these problems, as they were discovered the day before Demo Day. We will proceed to correct the issues by continuing to follow the engineering process.

In the future…

We feel that we have accomplished a great deal in our second year in the BEST competition. However, like last year, we have learned a lot, yet there is always room for improvement. During this process, we learned to keep accurate records of our decisions, meetings, and activities. We engaged in the engineering process, compiling a descriptive notebook containing all of the ideas presented on the project. We used CAD software to model our design before beginning construction, and created a summary report of all our notes, information, and data into one continuous notebook or project presentation.

The engineering process has been challenging, yet rewarding, and has sparked a desire to continue competing in future years. In fact, we are already formulating ideas for next year's competition and planning strategies. We have realized the need to have a distinct pattern of thought and documentation that allows a clear and precise record for future reference.

It was once said that for an expert, there is only one possibility, but for a novice, the possibilities are endless. As we gain more experience, we will create a viable documentation process that can be universally applied to any of our engineering projects. The last five weeks have been a learning experience for all those involved. Our participation this year and the knowledge gained of the engineering process will further our future participation in BEST and our careers.

An Introduction to Nanomedicine: Its Applications, Implications, and Feasibility

Today we are exploring a new frontier in medicine. We are beginning to reach the limits of current medicine, and a few intrepid researchers are pushing the envelope of science to make us healthier, live longer, and increase our quality of life. We may soon be able to repair and maintain our bodies on a cellular level, perform complex and currently impossible surgeries, and even replace or supplement vital life processes. This is made possible by an emerging technology known as nanomedicine.

Nanomedicine is the branch of a much larger field of study known as nanotechnology, the construction and use of molecular machines. The goal of nanotechnology is to be able to manipulate individual atoms to create machines the size of a bacterium. While this may sound far-fetched, nanotechnology has gained support over the past decades as technological barriers are broken down, making way for new innovations. Nanomedicine is the application of nanotechnology to the medical field, the use of miniature devices to improve health.

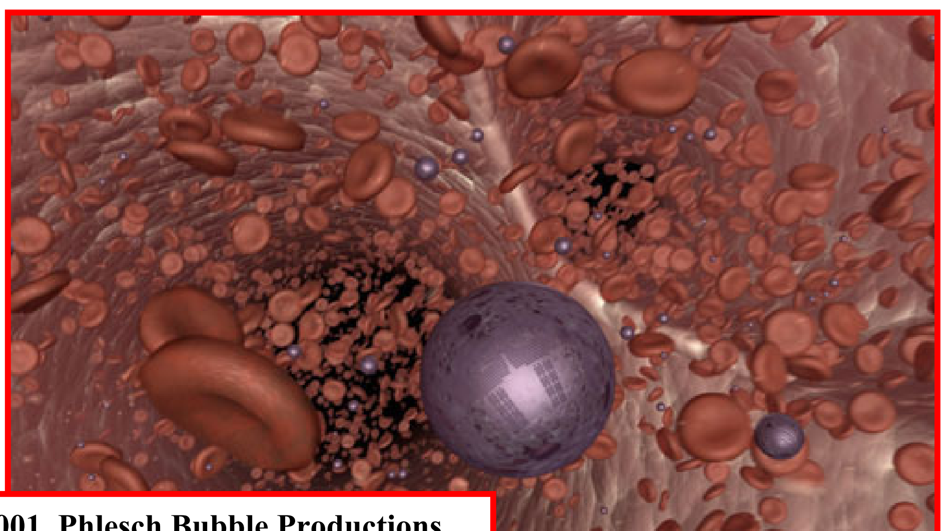
It is important to realize that nanomedicine, as well as nanotechnology, are in the conceptual stage. As of yet, our current technology cannot even approach such a goal. However, should nanomedicine become a reality, there are a number of benefits which could possibly reward us for our hard work and research.

Even the most skilled surgeon, using the best tools, utilizes a crude and destructive method to analyze and correct a problem by surgery. The razor-sharp scalpel tears through hundreds of cells, massacring them in scores. Recuperation is often a tedious, painful process for the patient.

Scientists hope to one day avoid the expense and pain caused by present surgical practices with surgery performed on the cellular level.

Cells become diseased due to genetics, illness, or environmental causes. In any case, to correct the problem, the cell must be repaired. To accomplish this, scientists have proposed the use of nanorobots. These micro-machines would penetrate the affected cell, analyze the cellular activity, and take the appropriate action, whether correcting chemical deficiencies or repairing damaged DNA. This nanosurgical technology could have far reaching impacts. Genetic defects could be corrected and trauma victims could regrow vital tissues. Balding and wrinkling could be reversed, and hair, eye, and skin colors could be altered to improve one's physical appearance.

In addition to nanosurgical procedures, nanotechnology could be applied to the human circulatory system. Respirocytes are hypothetical mechanical blood cells capable of transporting



2001, Phlesch Bubble Productions
Courtesy of www.foresight.org

respiratory gases, waste products, and chemicals. The benefit of these mechanical blood cells would be their ability to carry over 200 times the oxygen of the human red blood cell.

Researchers believe that these devices could supply tissues with the oxygen necessary to sustain them for extended periods of time, even when both the circulatory and respiratory systems are interrupted, such as during a heart attack.

An even more impressive advantage of nanomedicine would be the invention of artificial phagocytes, nanorobots capable of destroying pathogens and correcting diseased cells. These machines could inject cells with drugs, precisely controlling amounts to prevent overdoses and minimize unwanted side effects. Some scientists even see these nanorobots as the cure for cancer, safely removing all cancer cells without damaging surrounding cells.

While nanomedicine holds many promises, it may be some time before the technology is even feasible. There are many obstacles to overcome in reaching the goal. The fuel source for such a small, autonomous machine as well as data storage remains unknown to nanotechnology researchers. Controlling autonomous nanorobots in the bloodstream would require more computational power than is currently available, and all of it on a scale smaller than is currently possible. The main area for concern is the human immune system and uncertainty about its reaction to the foreign nanorobots. Though some scientists have proposed special diamond coated surfaces, chemically inert and therefore theoretically unhampered by immunological reactions, the effectiveness of such contrivances remains unknown. Because the technology necessary for nanomedicine is largely conceptual at this point, much remains to be discovered.

Another unknown factor of nanomedical technology is its economic, social, and ethical impact on society. The development of nanotechnology could cause educational and economical changes, as new jobs are created and new research is conducted. Some scientists see nanotechnology and nanomedicine as the new technological wave bringing with it higher standards of living and less negative environmental impact. Once nanotechnology is developed, however, there is a very real potential for the technology to be used in a fashion other than was intended by the innovators. For example, the ability to split the atom was used destructively, despite the objections of the researchers. In the same way, nanotechnology and nanomedicine have the potential of being used negatively. To put it in the words of L.B. Lave, "there are likely to be some unforeseen, undesirable effects."

The use of nanotechnology in medicine holds many alluring promises—health, longevity, and quality of life. Science and technology have come a long way since William Harvey, an English physician, described and mapped the circulatory system for the first time in 1828. This year's BEST game envisions robots with the capability of movement within the human body and even within the bloodstream. In the near future, we may be mapping the interior of cells as nanorobots maneuver in and around cell components. Although this technology is presently conceptual and much remains unknown, it holds the possibility of improving our lives and the lives of our posterity; however, its feasibility will remain a question only time can answer.

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Project Planning & Management

Participating in the BEST robotics competition can be an overwhelming task. Only six weeks to design, build, and market a functional robot can become stressful as various deadlines are raced to be met. However, because of our team's experience last year, both our successes and our failures, and because of our vision and goal, this year's BEST experience has been much better.

Before the competition even began, our project leaders and several of our team members created a project schedule. This week-by-week schedule identified in a detailed format the various items, such as spirit sticks or brochures, which were due each week. Using this schedule, our team was able to plan exactly which tasks would be occurring and had a clear idea of project deadlines.

In addition to our schedule, the planning efforts included dividing into smaller teams to improve our team effectiveness and efficiency. Seven teams were created and performed the following tasks:

1. **Engineering**—handled the design, construction, testing, and operation of the robot
2. **Promotion**—dealt with media involvement as well as community promotions and school presentations
3. **Spirit**—included cheerleaders and the various items to be given away on game day intended to promote involvement and crowd participation
4. **Graphics and Publications**—produced the team graphics, such as logo and t-shirt design, and team publications, such as brochures and activity booklets.
5. **Notebook**—produced the Project Summary Notebook
6. **Web**—designed and created our team website
7. **Display**—designed and constructed the display

Project Planning & Management

Each team was composed of members whose interests or talents corresponded with the tasks to be performed. A student team leader was responsible for ensuring that the team met its deadlines and for informing team members of their assignments.

Many of the teams had to cooperate to fulfill their assignments because of the nature of this project. For example, the spirit team developed support packages to be given to those family and friends who came to support our team on game day. They planned to place brochures, programs, and keychains in the packages. The spirit team needed these items produced by the graphics/publications team before it could complete its task. This is an example of how inter-team cooperation was practiced.

BEST is a competition focused primarily on engineering, but its scope reaches far beyond just designing and building a robot. To be successful, our team had to plan well and work hard to reach our goals. From our experience this year, we believe that we have implemented the various long-term planning and leadership skills necessary.

Promotion

In an effort to promote engineering, science and technology, our team purposed to share our project with the community. We accomplished this through various demonstrations to both public and private organizations and through community presentations.

In February of 2003, the San Antonio Livestock Exposition and Rodeo was held at the SBC Center grounds in San Antonio. Our team had our 2002 SA BEST competition display set up at the Texas Trails tent for the duration of the Rodeo. At this display, team members told the passing crowds about BEST and robotics and showed them our team display.

Our team also conducted two demonstrations at 4-H clubs. In April 2003, our club gave a demonstration to the Leon Valley 4-H club. We gave our team's 2002 Texas BEST oral presentation, showed our team's 2002 Warp X video, and answered questions from interested students and adults. On October 17, 2003, we gave a demonstration to the Alamo-Metro 4-H club. Along with the San Antonio Home School robotics team, we displayed our robots, discussed this year's game, and held a mock competition to demonstrate the abilities of our robots.

Alamo-Metro Demonstration

On October 15, 2003, the City of San Antonio held its annual Youth Worker's Fair at the Alamodome in downtown San Antonio. Our team was invited to attend and display our robot, video, and notebook. At the fair, several of our team members answered questions from visitors and demonstrated the mechanics of our robot.

Promotion

Our library display

Another way we promoted BEST to the community was through a display at the Forrest Hills Public Library. In this display we included photographs of robot design and construction, the BEST "This is a robot" poster, and an invitation to attend the competition at St. Mary's University.

During the last week before the local competition, our team has planned and arranged several demonstrations with the following organizations:

Boysville

Covenant Classical Christian School

Blanco Homeschool Group

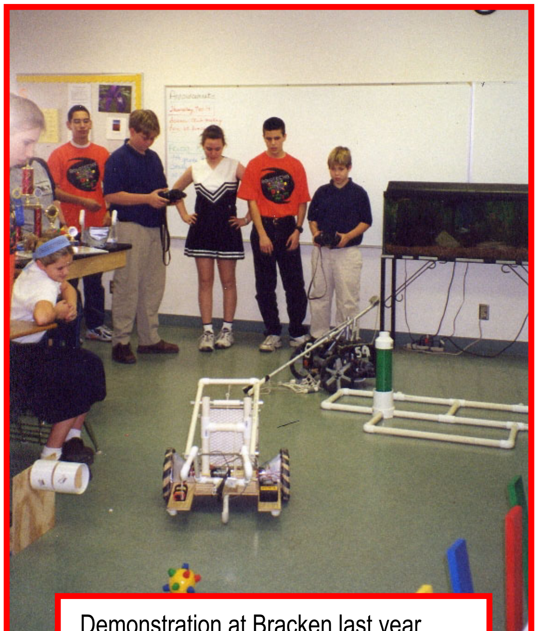
Mary Michael Elementary School

In addition to demonstrations, our team has informed the public about BEST through the media. Radio Disney, a national radio station, allowed one of our team members to be on the air and speak about the BEST competition.

Sharing our project with our community has been a fulfilling and rewarding experience. Not only did we increase awareness of the BEST program, but also encouraged children to learn more about science and technology.

School Recruitment

During our school demonstrations last year, we visited Bracken Christian School and acquainted them with the world of robotics and the BEST competition. They were fascinated with every aspect of the competition and decided to participate in BEST this year. We were excited they were venturing out into the world of robotics and met with them, showing our video and notebook and answering as many questions as we could. They have formed construction, notebook, and video teams and are optimistic about the competition. It was rewarding to be part of Bracken Christian School Robotics Team's foundation, and we look forward to working with them and helping them in the future. We wish them the best for the competition.



Demonstration at Bracken last year

Sponsors & Fundraising

Because each team is required to raise its own funds, fundraising was an important part of our team's activities. Our team planned our fundraising strategy before kickoff. In order to raise funds, we decided we would ask individuals and businesses for sponsorship. Each team member was given several copies of a business solicitation letter to raise money from individual sponsors. This letter explained the purpose of BEST, described our team, and asked for funds. Team members would then approach businesses which they frequently patronized and ask for their support.

Our team also utilized fundraisers at local businesses to raise money. We organized two benefit nights at Taco Cabana restaurants and invited friends, family, and colleagues to attend. Both evenings turned out to be enjoyable experiences and allowed our team to raise a portion of the money we would need. In addition, Cici's Pizza provided our team with coupon booklets used for fundraising. Each booklet had our school name printed on it and was sold to friends and family. Auto Zone also supported us by allowing us to use their facilities to hold a team fundraiser carwash.

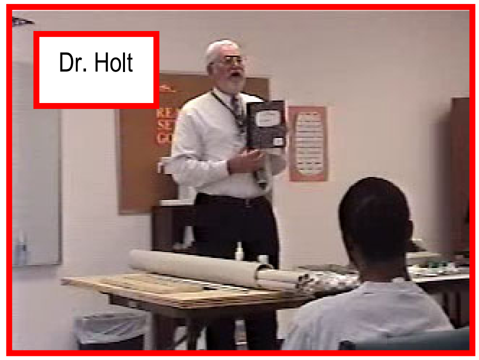
Benefit Night at Taco Cabana

Several businesses in particular have been very supportive of our team's efforts. Dorazio Enterprises, a contracting company owned by Mark Dorazio, provided us with the use of a shop, tools, and equipment to build our robot and our display. Impulse Images and Animations Inc., a 3D computer graphics design company owned by David Nobles, lent us digital photographic equipment, computers, and software for 3D modeling and animation of our robot. Finally, we are very grateful to Home Depot for supporting us by supplying our team with some of the materials used for the field.

Mentors

Our team has been very fortunate to have several adult mentors come along side of us and coach us in the process of learning about the engineering process and how engineering is used in the creation of robots.

Dr. Amos Holt from Southwest Research Institute visited our team at one of our meetings and spoke about the process and guidelines engineers must follow when working on a project. He emphasized the importance of documentation, following product specifications, and brainstorming techniques.



Dr. Holt

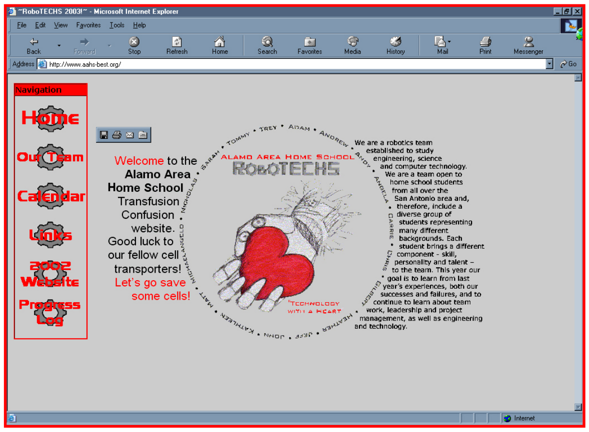
Another invaluable mentor, Dr. Stephen Springer from Texas State University, spoke to our team about the keys to success and the use of robotics in the military. He described several robots used for espionage and security inspection. During his presentation, he emphasized the need to follow specifications, to plan well, and to work diligently to accomplish one's goals.

Dr. Springer

In addition to our two doctorate mentors, Jacqueline Garcia, a former team member and graphics art major, assisted our team members as they designed and created our team's webpage. Rob McNicol, a mechanical engineer at the University of Texas Health and Science Center, attended our engineering team meetings and provided insightful advice as we designed our robot.

Finally, our team was privileged to have several parental supervisors who helped our team members to set goals and stay on track. These parent-mentors also provided transportation, meals, and guidance throughout the six weeks.

Website



Building a website for the Alamo Area Home School team was an exciting and challenging task. This year, our website team consisted of two members, Andrew Blake and Chris Ehrhart, and one mentor, Jacqueline Garcia. After the members of the website team had been determined, we met to decide on a basic design and content. We agreed upon using the sketches of our preliminary logo and t-shirt designs with the colors of our logo: red, white, and gray. After deciding to use HTML (HyperText Markup Language) instead of PHP (Hypertext Preprocessor), we delegated the tasks associated with the different parts of the construction of the website. Chris built the basic structure and Andrew designed the graphics. When we were finished with our assignments, we combined our work to make a complete web page. We included pictures and information about our team, our robot, and our sponsors. Also included are links to both the SA BEST and Texas BEST websites, our website from last year, and an online calendar that we used to display the times and locations of our group meetings.

Our team website can be found at
http://www.aahs-best.org

Spirit & Sportsmanship

An important part of BEST, Spirit, was fulfilled through the hard work and dedication of our teammates John Grasso, Andrew Lovins, Michaelangelo Lovins, Sarah Nyenhuis, and Kathleen Garcia. They put together our support packages that include heart clappers, buttons, programs, key chains, and pencils to show our tremendous appreciation to our supporters. In an effort to promote crowd participation, we will have a game at our display. Winners of the game are rewarded with a Robobuck, which they can then exchange for key chains, bracelets, buttons, and/or heart stickers. Hopefully the porcupine balls and candy bombs, specially chosen to help inspire crowd participation, will please the crowd. Our spirited cheerleaders, Sarah Nyenhuis and Kathleen Garcia, made their own costumes, procured pom-poms and even megaphones in order to better support all of the teams participating. A spirit stick is being planned and decorated to help rally our supporters, and several posters and banners have been designed so our team can be easily noticed in the crowd. We anticipate plenty of excitement when our mascot "Harry the Drop" arrives.

Our spirit team assembling bracelets

Cheerleader practice

Appendix A: The Engineering Process

1. Product Requirement Analysis

In stage one, the situation and the needs of the customer are determined, and the general requirements of the situation are outlined. The task is identified and thoroughly analyzed.

2. Product System Strategy

Based upon the information gathered in stage one, stage two establishes the specifications of the product. The task is considered as a product strategy is developed. Goals are developed and limiting factors and design criterion are given consideration.

3. Alternative Concept Development

Solutions are proposed in a general brainstorming session. Ideas for meeting some or all of the strategy criteria are developed and presented. All ideas are accepted, sketched, and documented without exception.

4. Concept Refinement Evaluation

The best designs yielded from stage three proceed to stage four to be critiqued. Specific disadvantages and advantages are considered. Consideration is given to available materials and engineering principles. The designs are refined and reworked to eliminate any existing problems. If the design is not the best solution, it may be necessary to reevaluate preliminary ideas or redefine the product strategy. Develop a finalized design.

5. Preliminary Detailed Design of Product

The subsystems of the finalized design are listed and designed using a CAD system.

6. Construction of CAD Drawings

Detailed designs for the CAD model are developed and refined.

7. Determination of Required Parts and Dimensions

The product design is finalized with the CAD system to produce a complete set of construction drawings along with a list of necessary materials and components.

8. Machining of Individual Components

Based upon the specifications from the CAD drawings, individual components for the model are built. Subsystems are machined and checked for compliance and compatibility.

9. Working Model Development

From the CAD drawings and the prepared components, a functional model is constructed. Subsystems and components are assembled to produce a semblance of a final design for test purposes.

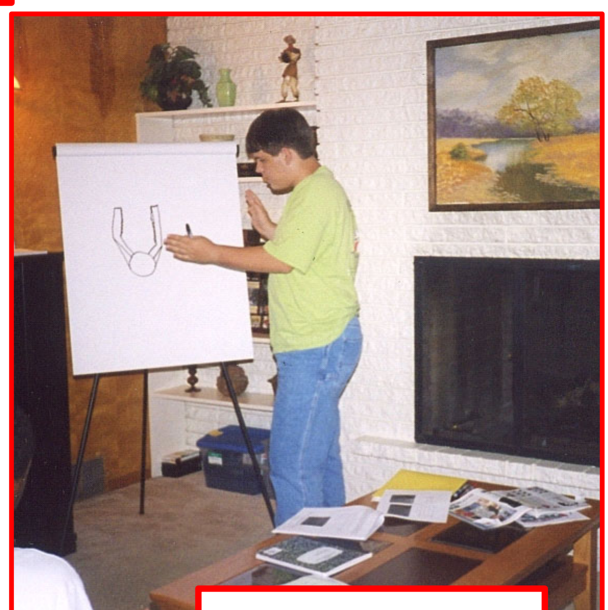
10. Analysis and Testing

The model is tested to assess its ability to meet the product requirements. Its strengths and/or weaknesses are analyzed and any necessary components are redesigned and reproduced. As changes are made, the CAD designs are updated and the model is re-tested.

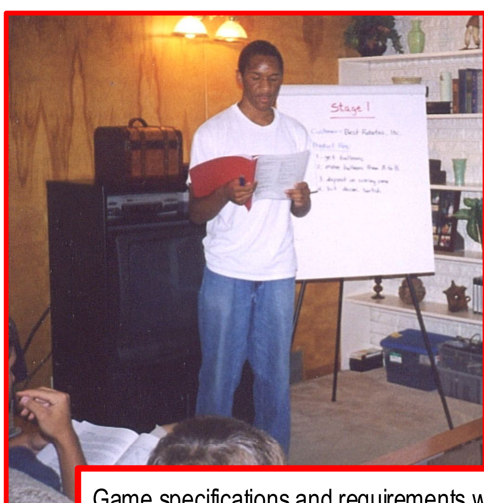
Appendix B: The Design & Construction of Micron

Kickoff Day team meeting where we briefly discussed the game.

Team members kept notes as we progressed through the brainstorming and strategy development stages.



Brainstorming session

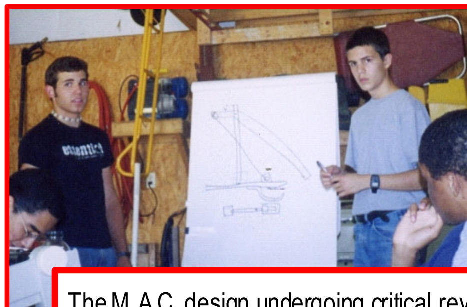


Game specifications and requirements were examined closely by team members.

Appendix B: The Design & Construction of Micron

Team meetings don't have to be boring!

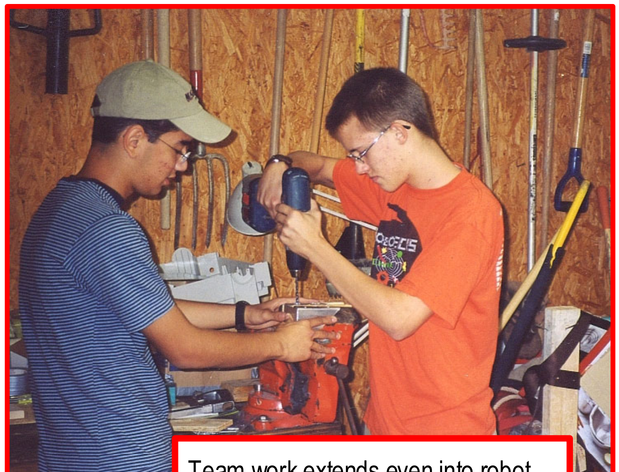
Our model prototype and our CAD drawings were taken into consideration as we determined our design measurements.



The M.A.C. design undergoing critical review

The claw mechanism required much discussion.

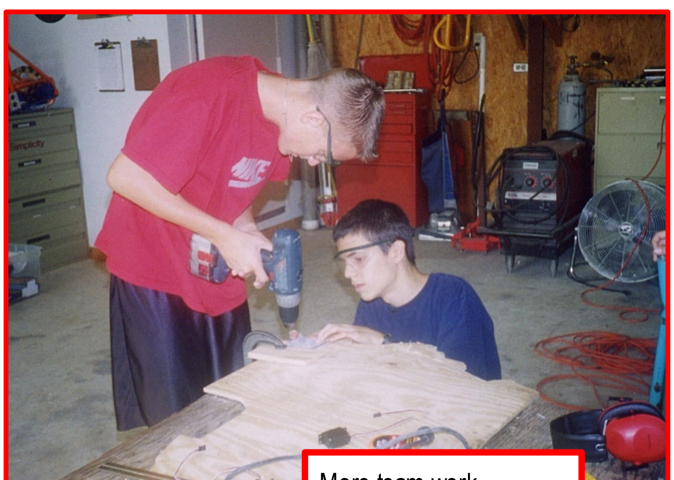
Appendix B: The Design & Construction of Micron



Team work extends even into robot construction.

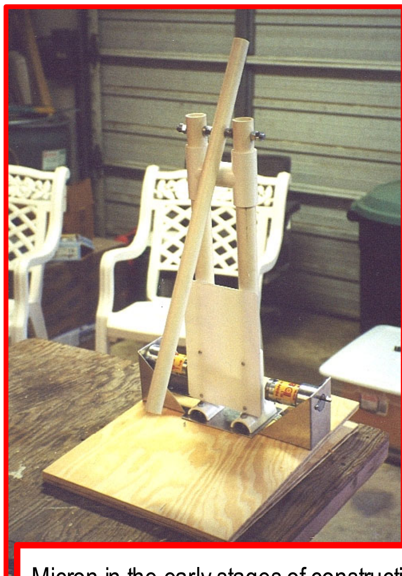
Having the right tools for the job always helps.

Precision machining requires a steady hand and concentration.



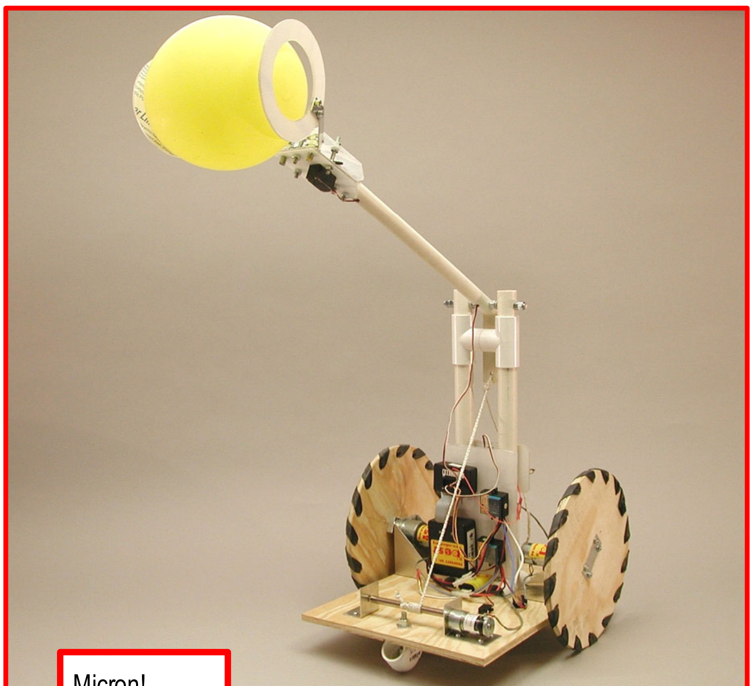
More team work...

Appendix B: The Design & Construction of Micron



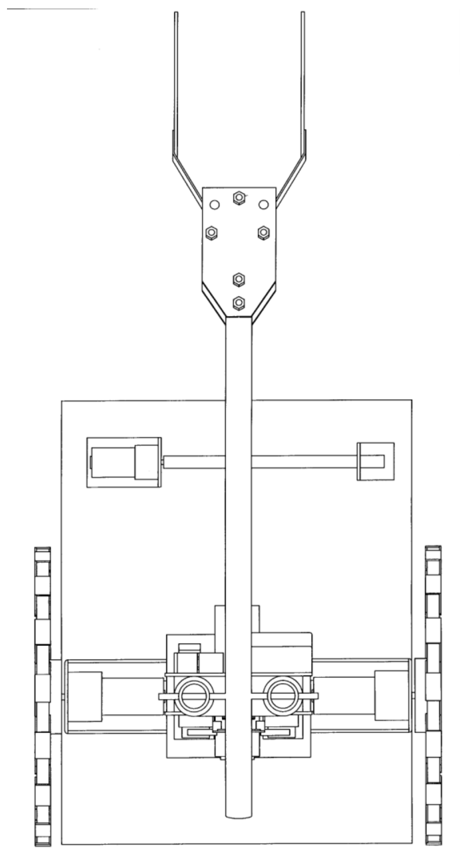
Micron in the early stages of construction

Our claw mechanism underwent much testing and tweaking

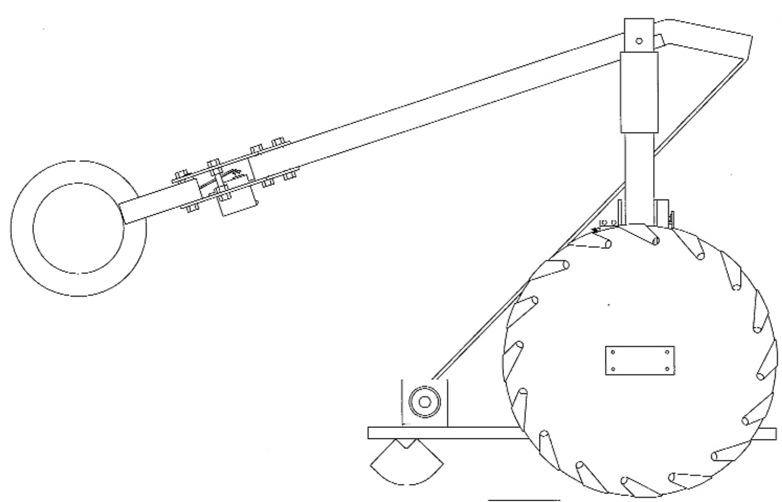


Micron!

Appendix C: CAD and 3-D Images

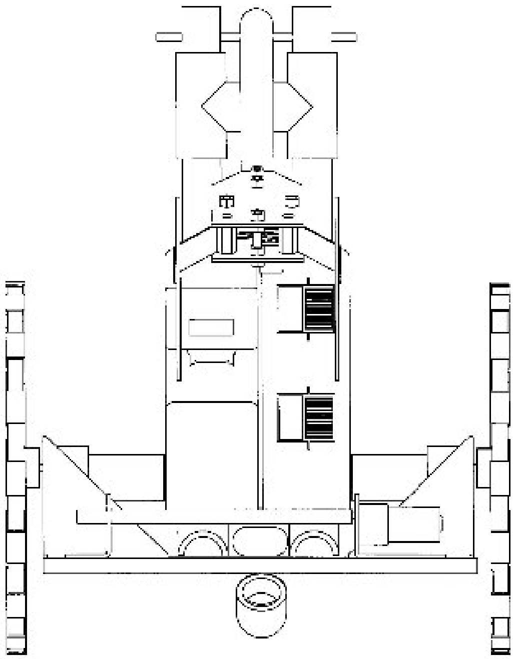


Micron
Top View

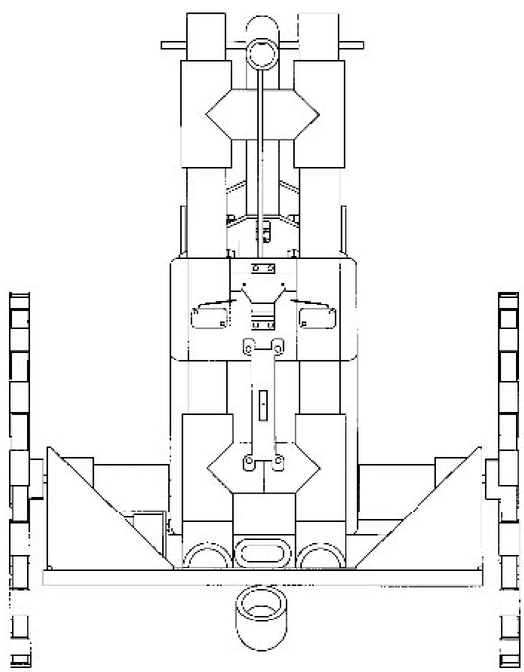


Micron
Side View

Appendix C: CAD and 3-D Images

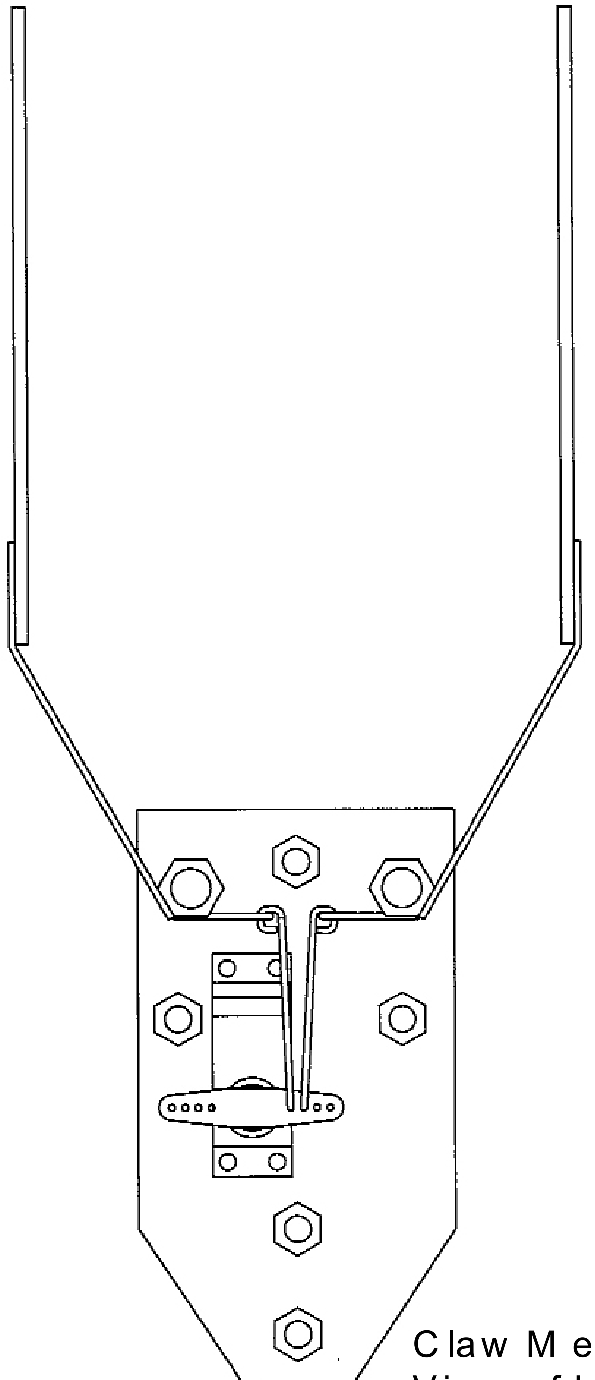


Micron
Front View



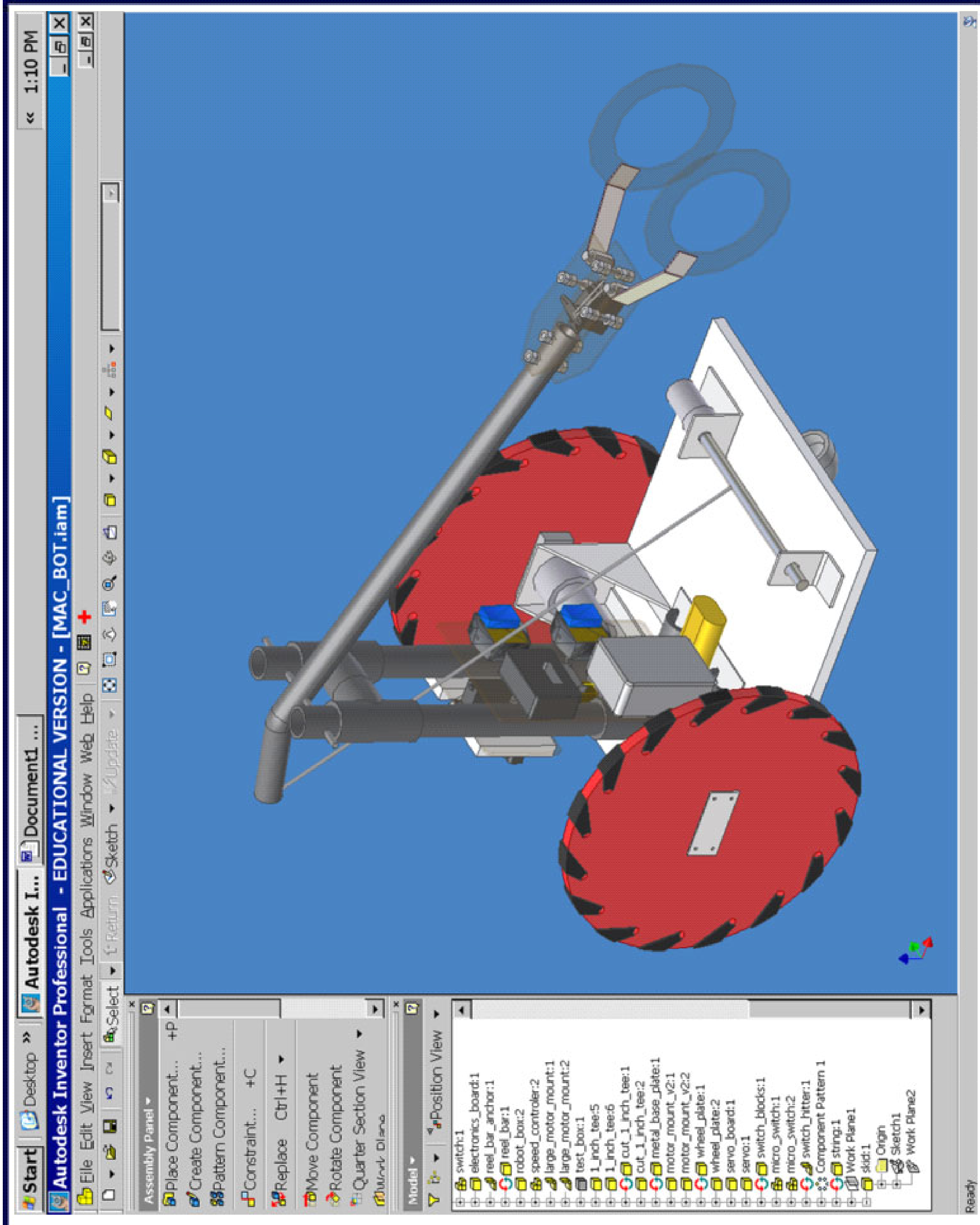
Micron
Rear View

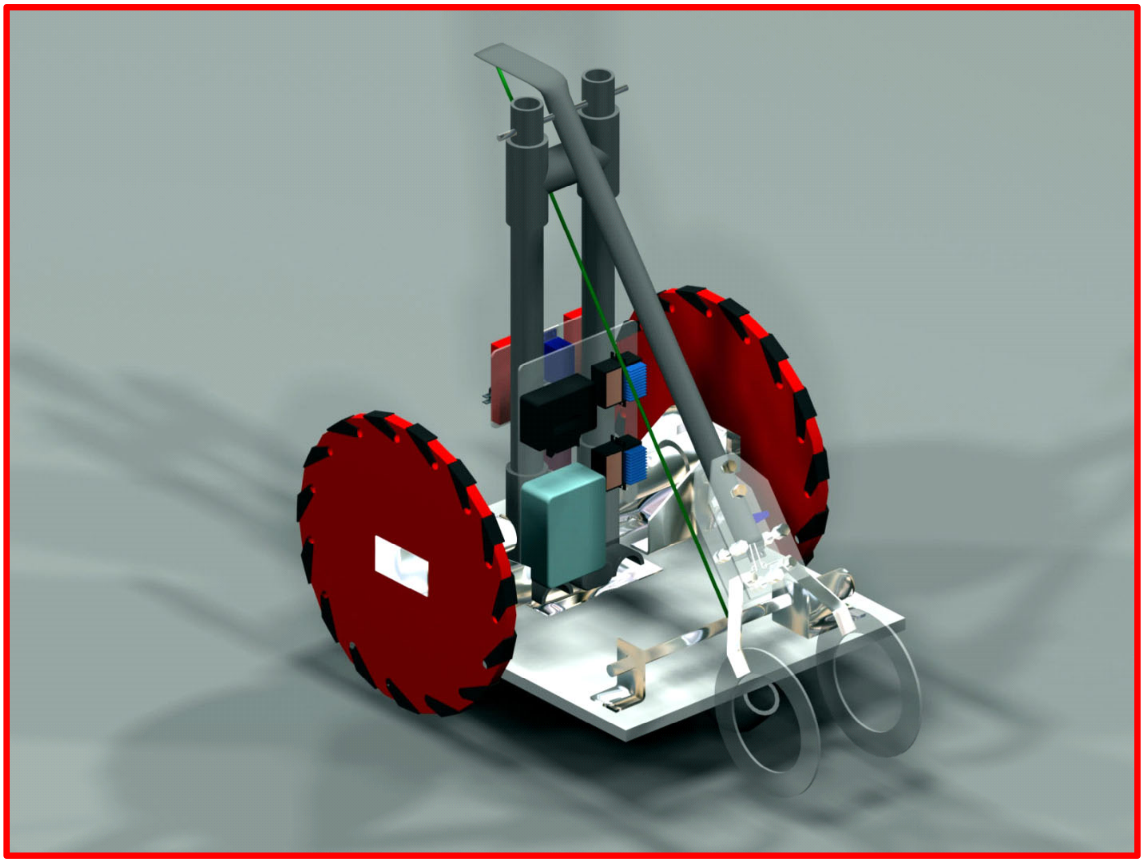
Appendix C: CAD and 3-D Images



Claw Mechanism
View of Linkage

Appendix C: CAD and 3-D Images





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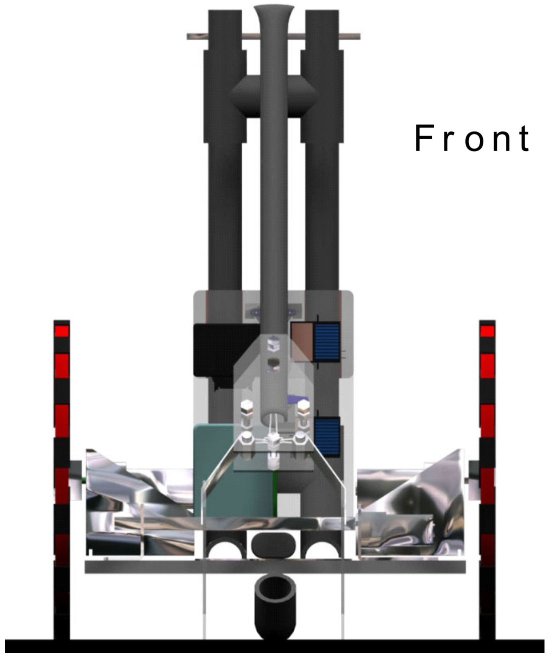
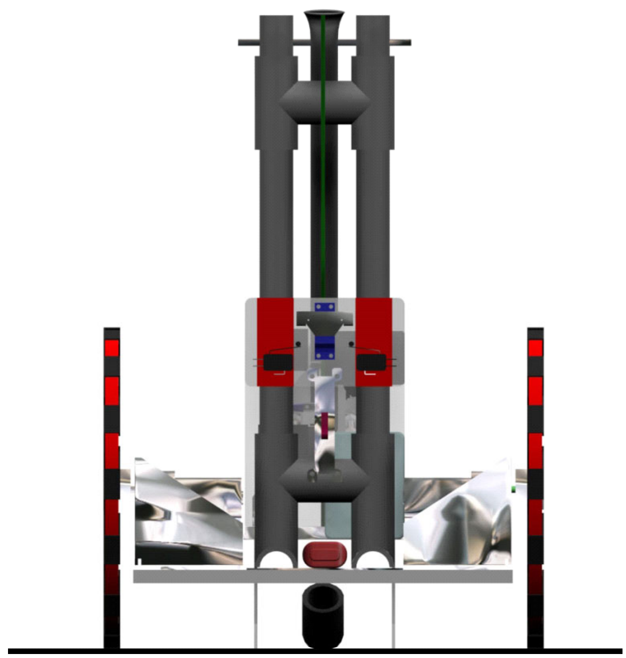
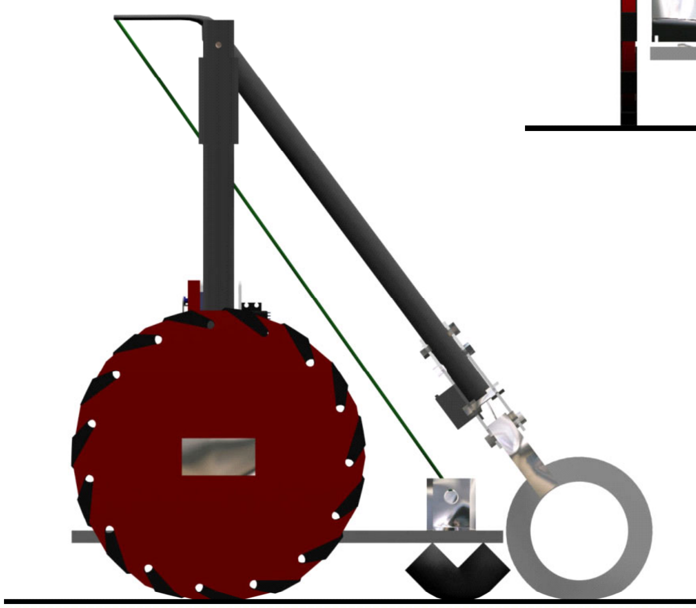


Front View



Rear View



Side View