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NASA LANGLEY RESEARCH CENTER(LaRC)

RESEARCH GRANT NAG-1-1893

SUMMARY OF RESEARCH

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Enclosed please find the final report for the NASA research grant NAG-1-1893 and excuse any misunderstanding on our part for the completion of the report.

In keeping with the structure of the Robotic's class this report was written by students and approved by the principal investigator.

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SUMMARY OF RESEARCH

The Center for High Technology's journey to the competition named For Inspiration of Science and Technology, or FIRST began on Monday December 16, 1996 when there was a meeting with officials and engineers to discuss the FIRST competition. The officials and engineers included Mr. Ansel Butterfield, Mr. Mike Little, Mr. Philip May, Mrs. Phyllis Henry, Mr. Clayton Washington, Mr. Dave Levery, and Mr. Jeff Seaton. After deciding to participate in the competition discussion led towards what could be done before the team got the kit on kickoff day, and what would happen when the team went to both the regional competition in New Jersey and the national competition in Florida. This meeting was repeated for the benefit of the students involved, later in the month.

The next major event was the kickoff meeting attended by Mr. Ian Bilyj, Mr. Philip May, and Mr. Jeff Seaton. The team received at the kickoff, the rules, information about the competition, and a box with about 70 pounds of equipment. The rules listed that the competition consisted of approximately 200 teams trying to complete a task that would make them compete in the playing field with three robots, human players, and remote operators. The task was to research, design, and construct a robot to take inner tubes from designated places or the human player and place the inner tubes on a goal during a two minute period. The goal had nine branches and a place on the top for the inner tubes and was later described as looking like a giant coat hanger. The human player, who could either hand the robot inner tubes or could throw the inner tubes on the goal, had to stand in a certain area during the competition and could only move in a certain parameter. The playing field which was described by the rules, was a carpeted, hexagon shaped area and allowed each team to have one side between them. Around the perimeter were the stations for the robot, the robot's controller, and the other human player. The

robot was controlled by a human via a remote radio. The robots for each team would be designed and built by teams, which had to consist of students and engineers, during a period of about six weeks. Materials were specifically listed in the rules and included aluminum, fiberglass, plywood, PVC pipe, structural foam and much more. Teams were allowed to buy certain additional material described by the rules. The robots could weigh up to 120 pounds and had to be able to fit inside a 3 x 3 x 4 box.

Once the task was known to the team, we began to strategize, create designs for the robot, and break up into different groups. Assistance was generously given by both active engineers and retired engineers from NASA and Dynamic Engineering including Mr. Jeff Seaton, Mr. Bill Reed, Mr. Israel Taback, and Richard Mangum. After discussing several different strategies the team decided to have our human player to shoot three inner tubes and have the robot place the other tubes on the top. The team spent a couple of days to a week researching the best possible design. We decided that since we wanted to place inner tubes on the top that we would need an extendable arm. After looking at several ideas, we decided to build an arm that would have two beams that would fold over. To make the arm extend, we had two ideas. First of all, we tried a spring loaded arm. However after experimenting for a while we decided to use a dead weight to help extend and balance the arm. For a gripper we decided to use a closed finger gripper with fixed fingers and a movable opposing thumb. These two elements proved to be unique to the contest.

Next was the actual construction of the robot. The team divided the construction of the robot into three groups: gripper, base, and goal. This was definitely the longest and the most frustrating part of the project. However we learned a lot. First of all we had to

do a lot of research to figure out how to make certain parts of the construction work. Webecame skilled at working with tools, constructing parts, and got a lot of hands on experience. We also learned how to be patient and how to work with one another. But, one of the most important lessons we learned was that if at first you don't succeed, try and try again.

In addition to the construction, we also had several other tasks that were broken up into small groups. These groups included logistics, spirit, and video production. Logistics handled all travel plans and paperwork. The spirit group was to promote momentum and morale. Video production was to produce a fifteen minute video showing how the robot was assembled. We also had to come up with a name for our team. After discussing it, we decided to name it after the ALS patient, Michael Fontaine who we are presently trying to assist by building an ocular tracking system. So we named ourselves Michael's Team.

After getting most of the things sorted out, it was then time for the Johnson & Johnson Mid-Atlantic Regional Competition in New Brunswick, New Jersey on March 21-22, 1997. This competition could not eliminate you from the national competition, but rather affected the seedings for the national competition. On Friday, we practiced with the robot in preparation for the competition. On Saturday we participated in several competitions.

After we got back, we had to deal with the final preparation and practice for the big competition. As with anything we ran into a few problems. One major problem had to do with our planning for the trip to Florida. We knew that we needed to makereservations

early because it was the 25th anniversary of Walt Disney World and the hotels would be packed. On the other hand if we made reservations to early and took to many people and underestimated the cost of the robot, then we would be there with no robot. So we had to wait late into the production process before making reservations. And we still had to go a little over budget and get assistance from the school superintendent Dr. Billy Cannaday.

Finally all of our work payed off and we were on our way to Florida to the national competition. The first day we got there we received our robot which had been packaged and sent. We then tested and practiced with it some. We also took a look at some of the other robots at the competition. One interesting thing is that the design of every robot we saw with the exception of one, we had discussed doing during our design phase. As previously stated our dead weight and our gripper were unique to the contest and many of the other teams took photographs of these two elements of our robot.

During the first day of the competition, we placed first twice, second, and third once each. This combined with matches at the regional, put us in the 37th seed out of 150 teams for the national competition. During the competition we realized several things we should have done, like give our operators more practice. However, in spite of the unexpectable things that can occur, we still managed to place in the top third of the teams and at the same time learned a lot of hands on skills through applied research.