“Holothuroidea” and “007”

Palm Beach Lakes Community High School ROV Club
Team Piranha

Team Members:

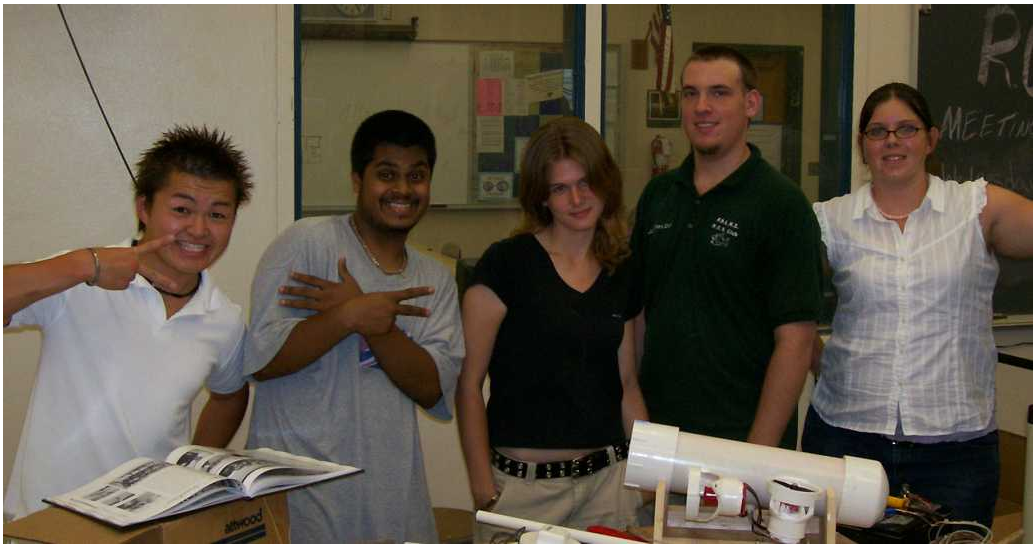
Jodie Boisvert	Class of 2006
Laura Edie	Class of 2006
Erin Engler	Class of 2006
Munetaka Hayakawa	Class of 2006
Akash Patel	Class of 2006
John-Marc Diot	Class of 2007
Amanda Roberts	Class of 2008

Instructors:
Mr. Joseph Shewmaker
Mr. George Bradbury
Captain Gidget Greco

Mentors:
Perry Slingsby Systems

Abstract

The Palm Beach Lakes High School ROV Club began the year with many team members and a variety of design prospects. After the hurricanes disrupted the school schedule, the team lost several members and was forced to reformat the design of the ROV. The team chose a cylindrical shape for the main ROV in order to aid in water proofing and increase pressure resistance. One member of the team skilled in electronics led the team in the implementation of microprocessors into the control of the ROV. In order to limit the stress placed on the ROV, a companion vehicle nicknamed “007” was created. This vehicle houses a camera that will allow the team to have increased visibility of the competition field. This vehicle also accommodates a winch system that will be used to lift the box during competition. The amount of buoyancy needed for each vehicle was determined before the vehicle entered the water by using a test chamber to calculate the amount of buoyant force each component had.



Members of the Palm Beach Lakes ROV Team

2003 MATE/MTS ROV Committee Student Competition

Budget/Expense Sheet

School Name: Palm Beach Lakes High School

Instructor/Sponsor: Capt. Greco, Mr. Bradbury, Mr. Shewmaker

Period:

From: 8/15/2005

To: 5/23/2006

Funds

Date	Deposit or Expense	Description	Notes	Amount	Balance
8/15/2005	deposit	balance carry over		$ 1,736.82	$ 1,736.82
8/30/2005	expense	vehicle materials		$ 179.77	$ 1,557.05
9/6/2005	expense	team shirts		$ 104.00	$ 1,453.05
########	deposit	donation for Amanda Roberts: Lookout Shutters		$ 100.00	$ 1,553.05
1/23/2006	deposit	ɔnation for Amanda Roberts: Auto Nation & Roberts		$ 200.00	$ 1,753.05
2/28/2006	expense	vehicle materials		$ 103.91	$ 1,649.14
2/28/2006	expense	supplies for poster/display/etc.		$ 23.89	$ 1,625.25
3/9/2006	deposit	donation		$ 58.09	$ 1,683.34
3/14/2006	expense	vehicle materials: PVC, etc.		$ 42.36	$ 1,640.98
3/30/2006	deposit	donation for Katrina Ginnochio		$ 50.00	$ 1,690.98
3/30/2006	deposit	donation for Amada Roberts		$ 250.00	$ 1,940.98
4/12/2006	expense	vehicle materials: underwater camera		$ 109.39	$ 1,831.59
4/25/2006	expense	vehicle materials: PVC, etc.		$ 16.41	$ 1,815.18
5/10/2006	deposit	donation for Laura Eadie: Ewing & Ewing A/C		$ 200.00	$ 2,015.18
5/10/2006	deposit	donation for Akash Patel		$ 200.00	$ 2,215.18
5/11/2006	deposit	donation for Laura Eadie		$ 100.00	$ 2,315.18
5/15/2006	deposit	donation for John-Marc Diot		$ 130.00	$ 2,445.18
5/16/2006	deposit	donation: Coach Shanley (skiff sale)		$ 250.00	$ 2,695.18
5/17/2006	deposit	donation: Mr. Kahle (skiff sale)		$ 100.00	$ 2,795.18
5/17/2006	deposit	catalog sales profit		$ 403.94	$ 3,199.12
5/18/2006	deposit	donation: Mr. Fetterly (skiff sale)		$ 300.00	$ 3,499.12
5/20/2006	deposit	donation:Mr. Kahle		$ 100.00	$ 3,599.12
5/22/2006	deposit	donation: Mr. Smith (skiff sale)		$ 300.00	$ 3,899.12
5/23/2006	deposit	donation: Mr. Shewmaker (skiff sales)		$ 250.00	$ 4,149.12
5/23/2006	expense	Continental Airlines		$ 3,572.40	$ 576.72
5/23/2006	deposit	donation: Akash Patel Jay's ABC A/C		$ 328.00	$ 904.72
5/25/2006	deposit	donation: Coach Shanley		$ 25.00	$ 929.72
5/25/2006	deposit	donation:skiff sales Mr. Oyola		$ 475.00	$ 1,404.72
5/30/2006	expense	ROV supplies, wire		$ 25.33	$ 1,379.39
Jun-06	deposit	MATE Travel donation		$ 1,000.00	$ 2,379.39

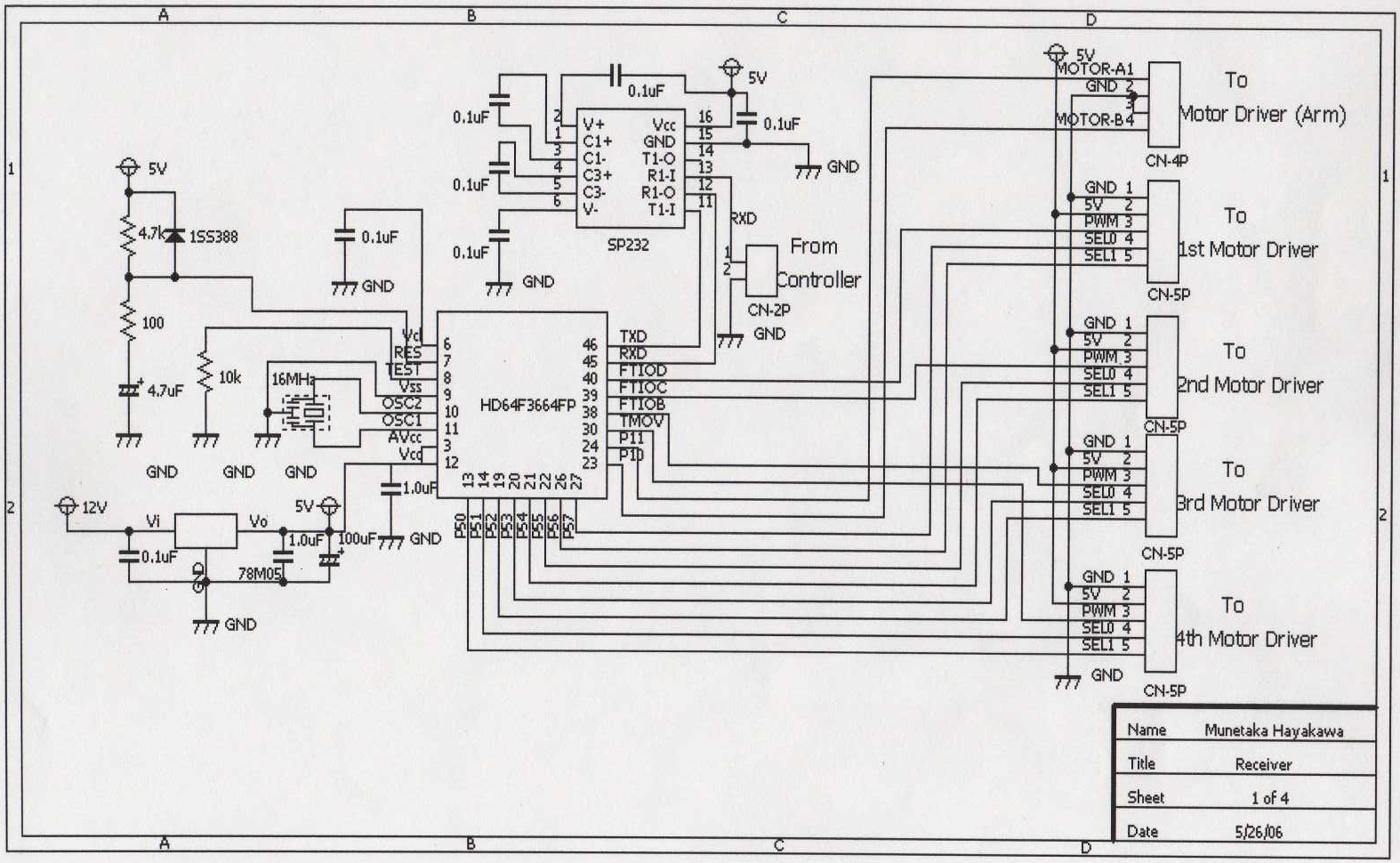
2003 MATE/MTS ROV Committee Student Competition

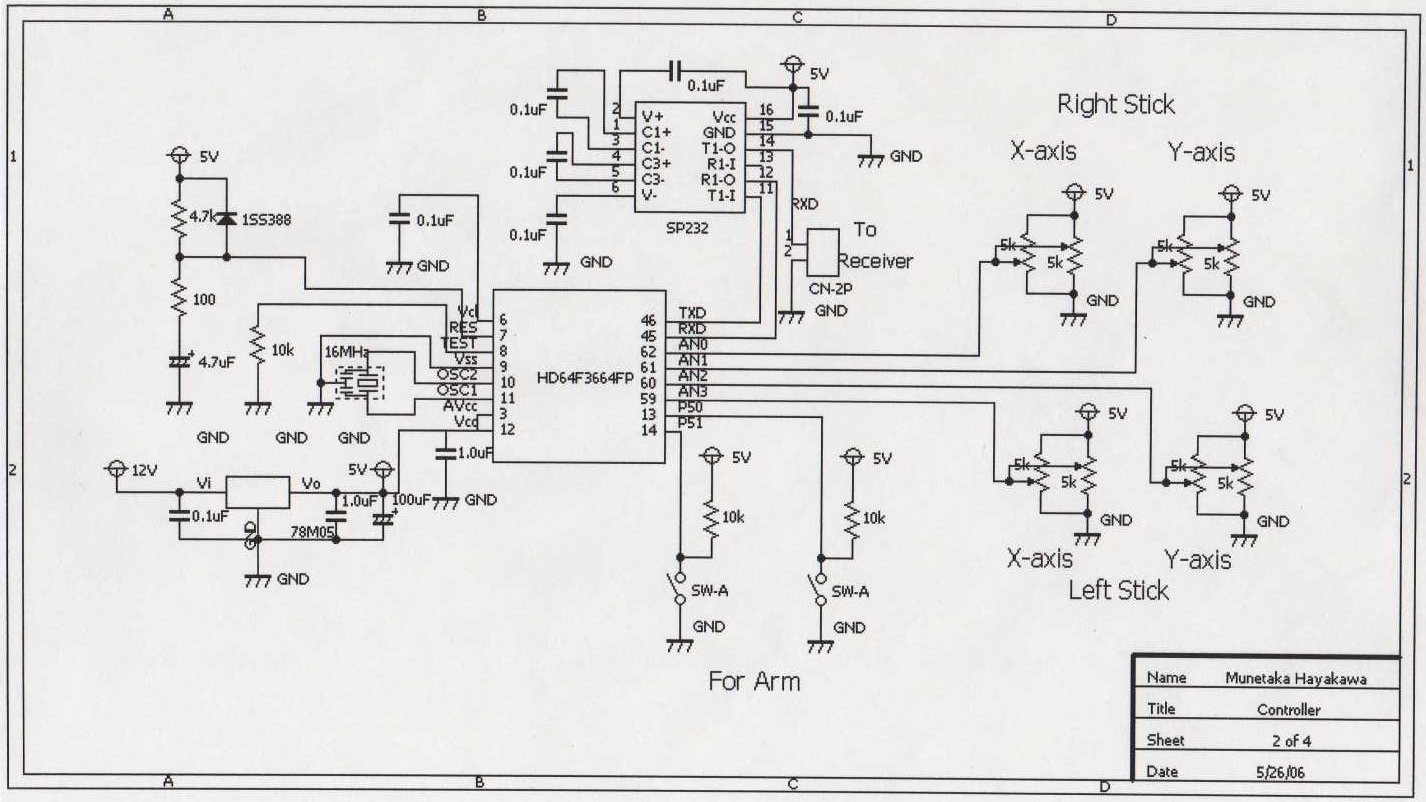
Budget/Expense Sheet

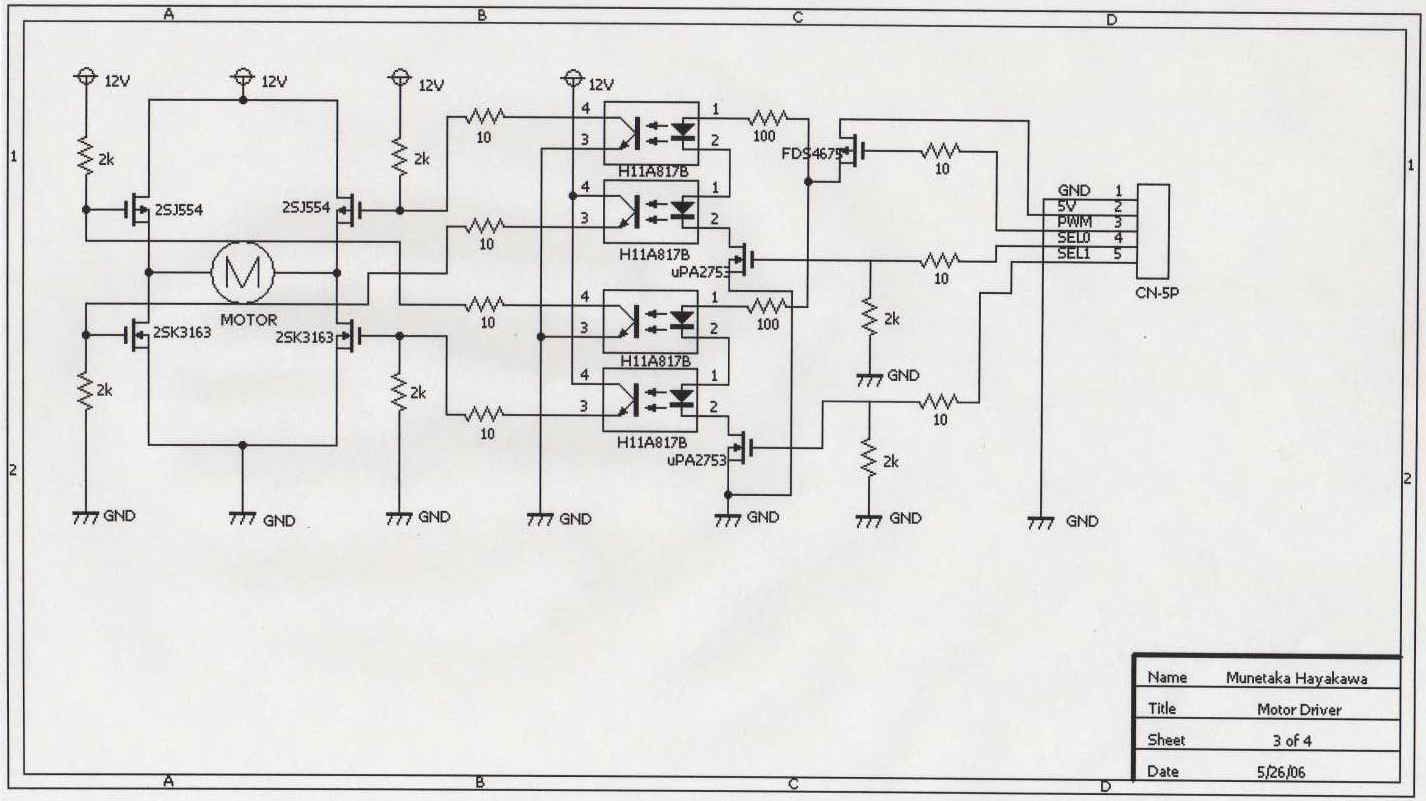
		Period:	
School Name:	Palm Beach Lakes High School	From:	6/6/2006
Instructor/Sponsor:	Capt. Greco, Mr. Bradbury, Mr. Shewmaker	To:	6/26/2006

Funds

Date	Deposit or Expense	Description	Notes	Amount	Balance
6/1/2006	expense	Hotel expense: Homewood Suites		$ 1,572.48	$ 806.91
6/6/2006	deposit	Amanda balance		$ 80.00	$ 886.91
6/6/2006	deposit	Laura balance		$ 250.00	$ 1,136.91
6/6/2006	deposit	Erin balance		$ 550.00	$ 1,686.91
6/6/2006	deposit	John-Marc balance		$ 408.00	$ 2,094.91
6/6/2006	expense	Avis 2 mini-vans rental		$ 560.00	$ 1,534.91
6/6/2006	expense	FedEx Shipping ROV to & from NASA		$ 200.00	$ 1,334.91
6/6/2006	expense	fuel for 2 mini-vans		$ 100.00	$ 1,234.91
6/6/2006	expense	dinner for our team Saturday night		$ 200.00	$ 1,034.91


A
B
C
D
5V
4.7k
1SS388
100
4.7uF
10k
16MHz
0.1uF
GND
HD64F3664FP
Vcl
RES
TEST
Vss
OSC2
OSC1
AVcc
Vcc
TXD
RXD
FTIOD
FTIOC
FTIOB
TMOV
PI1
PI0
P50
P51
P52
P53
P54
P55
P56
P57
SP232
V+
C1+
C1-
C3+
C3-
V-
Vcc
GND
T1-O
R1-I
R1-O
T1-I
RXD
From
Controller
CN-2P
12V
Vi
Vo
78M05
1.0uF
100uF
MOTOR-A1
MOTOR-B
To
Motor Driver (Arm)
CN-4P
GND
5V
PWM
SEL0
SEL1
1st Motor Driver
2nd Motor Driver
3rd Motor Driver
4th Motor Driver
CN-5P
Name
Munetaka Hayakawa
Title
Receiver
Sheet
1 of 4
Date
5/26/06


Right Stick
X-axis
Y-axis
5V
0.1uF
GND
SP232
V+
C1+
C1-
C3+
C3-
V-
Vcc
GND
T1-O
R1-I
R1-O
T1-I
RXD
To
Receiver
CN-2P
4.7k
1SS388
100
4.7uF
10k
16MHz
HD64F3664FP
RES
TEST
Vss
OSC2
OSC1
AVcc
Vcc
TXD
RXD
AN0
AN1
AN2
AN3
P50
P51
12V
Vi
Vo
78M05
1.0uF
100uF
SW-A
For Arm
Left Stick
5k
Name Munetaka Hayakawa
Title Controller
Sheet 2 of 4
Date 5/26/06


A
B
C
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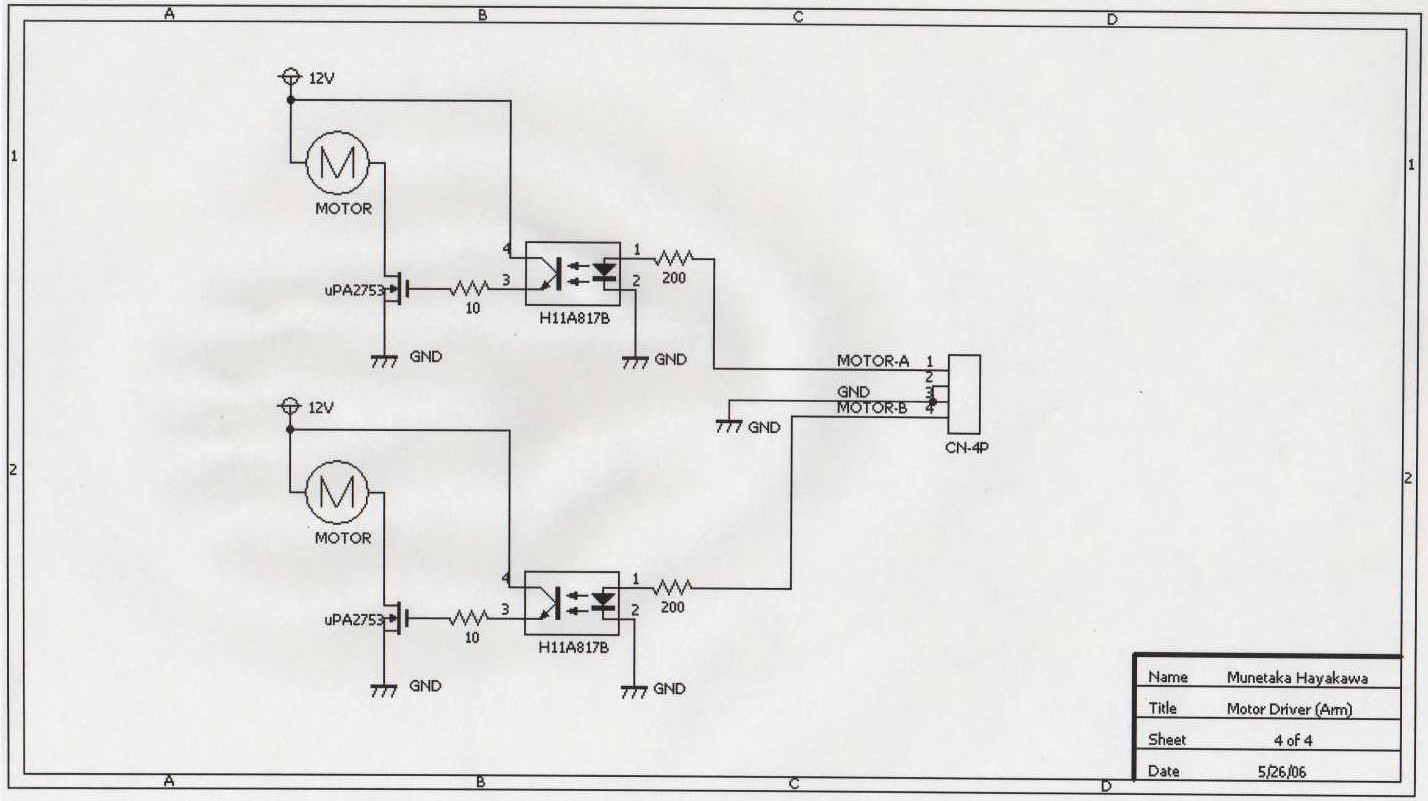
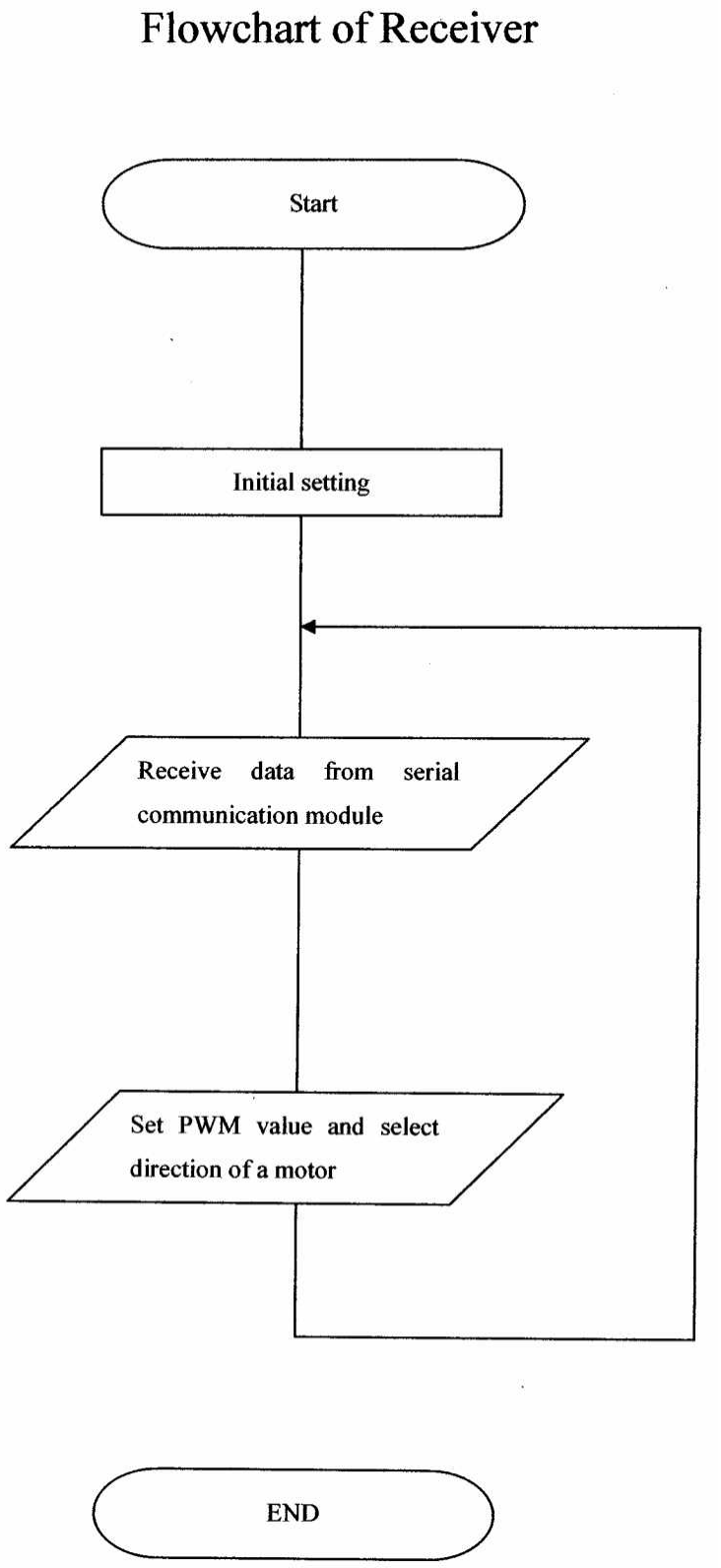
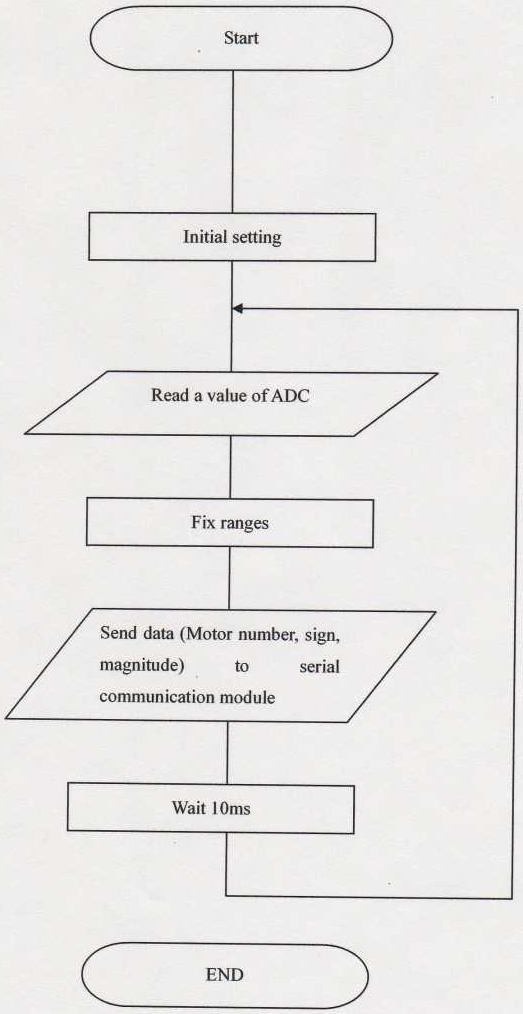
1
2
12V
2k
2SJ554
MOTOR
2SK3163
GND
10
H11A817B
100
FDS4675
uPA2753
GND
5V
PWM
SEL0
SEL1
CN-5P
Name Munetaka Hayakawa
Title Motor Driver
Sheet 3 of 4
Date 5/26/06


A
B
C
D
1
2
12V
MOTOR
uPA2753
10
H11A817B
200
GND
MOTOR-A
GND
MOTOR-B
CN-4P
Name Munetaka Hayakawa
Title Motor Driver (Arm)
Sheet 4 of 4
Date 5/26/06

Flowchart of Receiver



Flowchart of Controller



Design Rational

The shape of the ROV was determined after much research and reflection on last year's observations. After consulting the *Build Your Own Underwater Robot* book which states that a cylinder with domed ends is a good compromise when it comes to pressure resistance, the team decided this would be the best shape to use for the main ROV. This shape also allowed an ease in waterproofing, to prevent damage to the electronic components dwelling inside.

The motors attached to the main vehicle are housed within PVC couplings with holes cut into the sides to allow the water to flow around the propellers. The motors are oriented with two facing the bottom of the ROV, and two facing toward the back of the ROV. This set up will give the most control of the ROV and will also allow the ROV to change its orientation from horizontal to vertical if necessary.

This year the electronics system has been upgraded from last year's simplistic design. Instead of relying on relays to control the vehicle, microprocessors were used to allow for a more refined control of the vehicle. Thanks to this technology, the team now has the option to vary the vehicle's speed.

The companion vehicle, nicknamed "007", was inspired by the vehicles that accompany professional ROV on missions. These vehicles rest on the water's surface, observe the ROV, and can complete any heavy lifting that may be required. The companion vehicle works on the same principal, its downward facing camera allows the team to have a complete view of the competition area below them and the winch system attached to the vehicle will complete the task of lifting the box needed to be placed in the trawl- resistant frame. The hook attached to the winch will be attached to the box and guided by the ROV.

This year, all components of the ROV have their buoyancy calculated before being attached and submerged. The team's goal was slight positive buoyancy. This is to allow for the ROV to reach neutral buoyancy at full depth and to also aide in the ROV's ascension. To accurately measure the buoyancy of each object, the team first measured the volume of each component in a test chamber we created. By measuring the weight of the water displaced by each object and then taking into consideration the force of gravity, we determined the buoyant force of each object. Doing this allowed the team to eliminate the guess and check method used in the past and replaced it with this more accurate measuring technique.

Test Chamber Used for Buoyancy Calculations

Challenges

Many adversities arose this year in ROV. The design was the first barrier demolished. Differences between team personalities and a chaotic school schedule also led to much of the team leaving. Another major issue was skills – many of the team was not up to speed on the newer technologies we wished to bring to the club. In spite of these predicaments all personal demons were conquered.

The design of the ROV was the first addressed. The team's skills were extremely varied, and therefore led to a variety of ideas that changed continuously. The first design consisted of an extremely compact frame that would house very small, specialized devices. At the next meeting, this idea was abandoned in pursuit of a more traditional rectangular design. The large number of ideas became difficult to manage. To remedy this, all designs were collected into a technical notebook. A meeting was then held where each task and characteristic needed to complete the ROV was outlined. All designs were then posted for the members to view and the ideas were revised and refined into one master plan. After reviewing the observations of past ROV competitions, the team came to the conclusion that a simple, yet functional design was the best plan. This in turn made troubleshooting and operating the machine more efficient.

At the beginning of the year, the ROV team consisted of sixteen members. Work began on small projects and the dissection of the previous year's ROV. Unfortunately, the unpredictable school schedule brought on by hurricanes halted the efforts of the team to meet on a regular basis. When the construction of the ROV began again in December, many new members had become preoccupied with other ventures and were forced to leave the ROV club. This left the team with only seven participating members. The team's endeavors were hard to organize due to both the small number and the fact that each was skilled in a different area. The team then focused on a former weak point, electronics. Due to his skill in this area, a new team member was appointed to lead the team in electronics. This member introduced the technology of microprocessors to the

team. This component is utilized on the main ROV. The gains in this area led the team to begin researching other technologies for the ROV in the areas of buoyancy, hull design, and manipulator design.

During the design process, feuds began between team members. Team Building exercises were developed to remedy this problem. These actions led to an understanding of each individual and a more cohesive working environment.

The final challenge was the financial requirements for travel to Houston, Texas for competition. Fundraising began with catalog and candy sales, and progressed into a search for sponsorships. The funds for the ROV were covered via the $250 gift certificate won at competition last year as well as the donated SOSI tether offered to all teams.

Troubleshooting Techniques

The main electrical component to the ROV this year was the microprocessors. One of the difficulties faced was calibrating the motors to turn at the optimal RPMs for the propellers. To address this issue, a variety of codes were used with the microprocessors to create a control system that would allow for variable motor speed.

The buoyancy of the ROV was the next issue faced. The team originally calculated the needed buoyancy to leave the ROV itself slightly positively buoyant. While this would create some resistance to the ROV's original dissention, the team was confident that the power of the motors would be more then enough to conquer this. When devices were later added onto the ROV, the buoyancy was changed and the team was left to compensate for this discrepancy.

Members Troubleshooting Components to the ROV

Lesson Learned/ Skill Gained

The main focus of this year in ROV has been teamwork. This is integral to the formation and day-to-day workings of the club. Soon after the year commenced, it was realized that more effort would be required to unite the ROV team. If it had not been for the ability to work together, the ROV club would have never reached its full potential.

Participation in a local SECME competition, which required the creation of a mousetrap car, technical drawing, essay, banner, and poster, was undertaken by all members in order to gain experience and facilitate team bonding. In addition, meetings were held at casual locations; such as field trips to sponsor locations, team lunches, and test runs. This allowed the team to meld together into an efficient machine. The well being of the club and ROV became the most important theme for the team, and respect for other teams members became commonplace. Each member gained respect and admiration within the team for their individual skills.

The value of physical and mental resources was the next realization of the club. The cost of building an ROV led to all members of the team learning the value of the parts and the skills to reuse materials. The acquisition of parts was a difficult business. The team members learned to research and explore to find the most efficient and cost-effective parts. Another resource utilized often was the skill of our experienced sponsors and older counterparts. Skills such as soldering and forming electrical circuits were quickly taught to the less experienced members of the team. Knowledge about various materials and methods of building were also shared between our sponsors and members.

The final lesson learned was the importance of safety within the workshop. The dangerous nature of the workroom and the tools utilized made the team realize that new practices must be learned. Simple methods to reduce the chances of injury such as, unplugging soldering irons, keeping neat work stations, and creating a method for organizing all tools and parts became used within the club and greatly increase the effectiveness of the build.

Future Improvements

Better marketing of the club within the community will be a priority in the future. This will be accomplished through working closely with community leaders, as well as, with the media. Increased involvement of the community will add more students who can bring a larger number of skills to the table. This will also allow the club to further enhance the overall technical skills of all students involved.

The team will utilize a new shop next year. The new shop will offer newer tools and a more productive work environment. The addition of the new shop will assist in the goal of using advanced technologies and should decrease the production time of the ROV.

The renewal of learning within the club shall also be a high priority. By acquiring more information from other ROV enthusiasts via the internet, the overall knowledge base within the club shall increase. The club is pursuing the possibility of gaining more mentors from the marine technology population during the summer and in the coming years.

Career, Organization or Technology

Oceanic studies are becoming more and more important in understanding vital components of earth and its inhabitants today. Studying the history of the ocean along with observing its patterns today can and will help greatly in understanding “what happens and why” in the future. When most people think of the ocean they think of the

beach. When they thin of ocean observations they think behind the scenes Sea World or some major Floridian or island organization. One organization however, is doing so much in the field of oceanic observation. The Artic Group is a subgroup to Woods Hole Oceanographic Institution in Woods Hole, Massachusetts. With their help scientists can better understand the ocean in a slightly cooler way.

Woods Hole Oceanographic Institution, as a whole, studies the ocean and its correlation with the climate. Interestingly enough the ocean has an immense impact on the climate. And, against common belief that climate takes years upon years to change. Things such as circulation affect the climate. The ocean is also good for the carbon dioxide on earth. Circulation and Carbon Dioxide are just a few things in connection with climate that WHOI is studying (Joyce 1). Global warming: a very controversial issue between scientists is a major thing WHOI is dealing with. And yes, the ocean has a great impact on this theory. According to studies at WHOI the ocean holds heat with the salt and carbon dioxide. Studies say the ocean can hold heat more efficiently then earth's air. The heat in the ocean is transferred to the air, slowly making the climate warmer (Curry 1). Of course this is all just generally speaking. The subgroups to WHOI, such as the Artic Group go into much more detail.

Although continuing to study and research the ocean and its effects on the climate the Artic Group of WHOI takes a new spin on things. The Artic Group is currently working on many projects in the Artic Circle such as the Autonomous Polar Geophysical Explorer or the APOGEE. The APOGEE, much like the ROV, is designed to go under the surface of the ocean. In comparison, APOGEE is designed to go under the polar ice caps of the arctic to make it easier to take measurements and record data needed to study different things such as climate (APOGEE 1). The Artic Group is also currently working on a project in Iceland dealing with the sea particle flux. WHOI has organized a time-series sediment trap in 1986 to collect sea particles and other sediments in the GIN (Greenland, Iceland, and Norwegian) Seas. The project, headed by the Arctic Group of WHOI, assists the scientists with the climate cycles of the Arctic Ocean and region which in turn may also help determine and predict climatic issues such as global warming or freezing (Iceland 1).

Woods Hole Oceanographic Institution working with the Arctic Group of WHOI studies the Arctic Circle and the Arctic Ocean to determine the climate. Studying the ocean in this part of the world gives the scientists a chance to see and study everything.

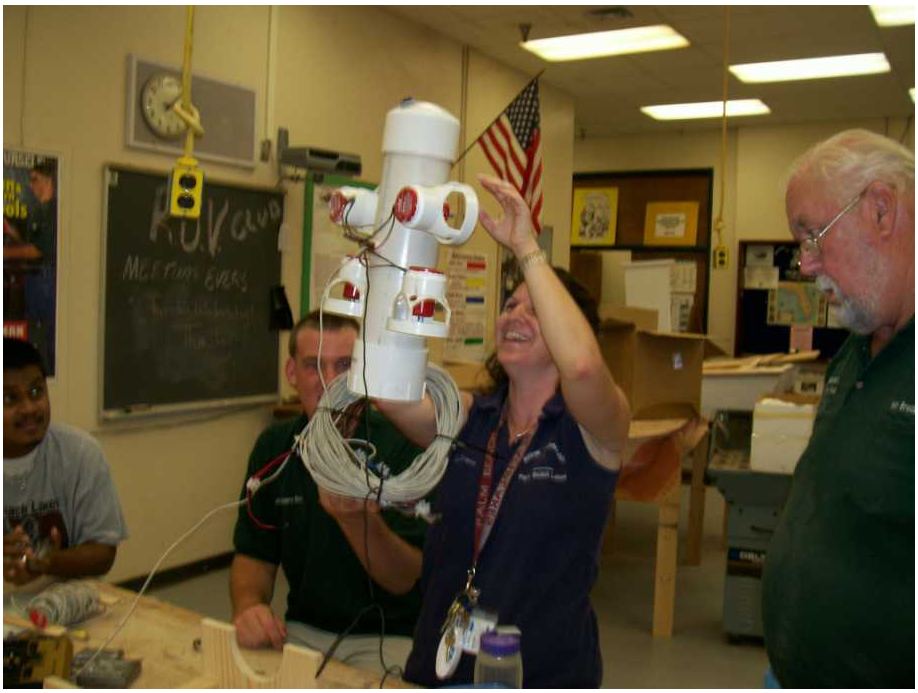
> The processes occurring in the Arctic Ocean affect the rate of deep and bottom water formation in the convective regions of the high North Atlantic and influence ocean circulation across the globe. This fact is highlighted by global climate modeling studies that consistently show the Arctic to be one of the most sensitive regions to climate change (Overview 2).

Both of these amazing organizations spend their lives studying the ocean in the Arctic Circle so they can find patterns in the climate to make life easier for the rest of us. All of the research projects they develop set the precedent for the world. And, just think, it all began with a few people liking to ocean.

Acknowledgements

As this competition year comes to a close, there are many that deserve thanks. The support and tireless dedication given to this year's ROV is greatly appreciated by the entire club. This year's sponsors; Toni Lynn's Baton and Dance, Ewing and Ewing Air Conditioning, Lookout Shutters, Creative Inventions Inc, West Palm Beach Auto Auction, Christine and Jerry Roberts, and Mr. and Mrs. David Ruff, all made our trip to competition possible with their generous donations. Perry Slingsby Systems, the mentors whom donated their time and expertise to advise the club in both the past and present, have the appreciation and thanks of the entire Palm Beach Lakes ROV Team.

Finally, the thanks of all goes to the wonderful teachers at Palm Beach Lakes Community High School, and the principal, Mr. Nate Collins, for the moral support and understanding they provided throughout the year. Specifically, the member of ROV would like to thank their advisors, Mr. Shewmaker, Mr. Bradbury, and Captain Greco, for donating time, effort, and support needed to the ROV club.



Captain Greco Shows Off Holothuroidea to Mr. Bradbury