Mulco Hipperus

(Thrashing Goldfish)

Palm Beach Lakes High School

Team Piranha

Members:

President: Peter Ferrandino
Vice President: Cherish Cook
Secretary: Jennifer Koury
Treasurer: Erin Engler
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Mentors:

Steve Barrow
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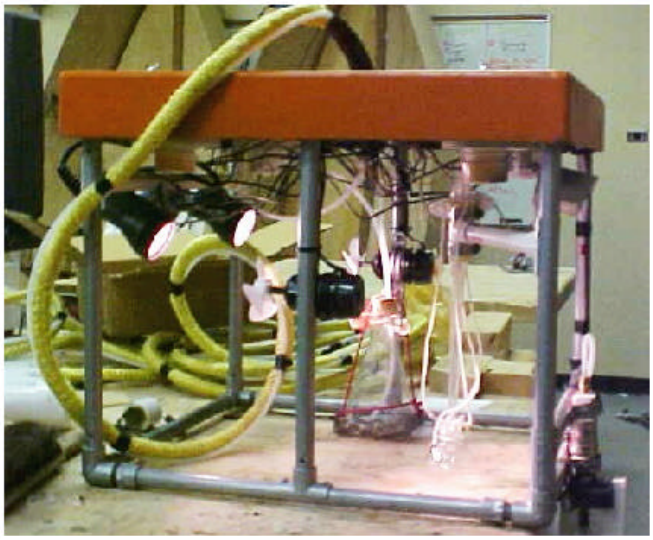
Abstract

The name of our ROV is Mulco Hipperus. There are four thrusters for ascending and descending, and two more thrusters for left and right movement. To accomplish all tasks given, several instruments will be used. For the measurement tasks, a few items will be implemented for depth and temperature. A special dive watch will be mounted and viewed by the black and white camera. A measuring tape will be used for measuring the U-boat's length.

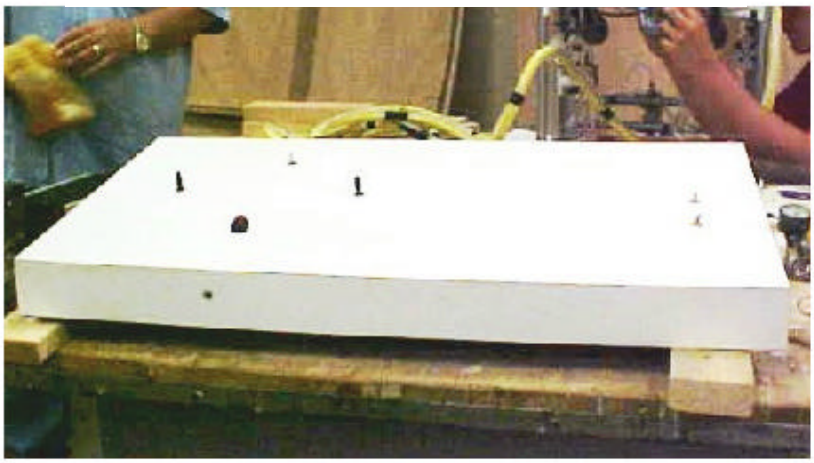
The other pieces of equipment will be used for retrieval tasks. To locate the pinger, a hydrophone will be mounted next to the claw so that the rear black and white camera can view it. To retrieve the pinger and captain's bell, the claw that is mounted on the front of the ROV will be used. It is air operated by a pneumatic line that goes up the tether and is connected to a scuba tank that will supply the air needed for its operation. To retrieve the towfish, a latch tool will be attached and carried by the claw. When attached, the claw will open, releasing the latch and a line that is attached to the latch will pull up the towfish.

As for taking the saline sample, a special pump will be used. A probe will be inserted into the container then the hand pump will be pushed to activate the suction. The second pneumatic hose is for retrieving the sample of fluid from the leaking barrel. It runs down the tether to a beaker that will hold the fluid form the barrel. Another tube runs form the beaker to a syringe that will be inserted into the pipe protruding from the barrel. Mulco Hipperus has a simple square structure to promote easy maneuverability and access to all components of the ROV.

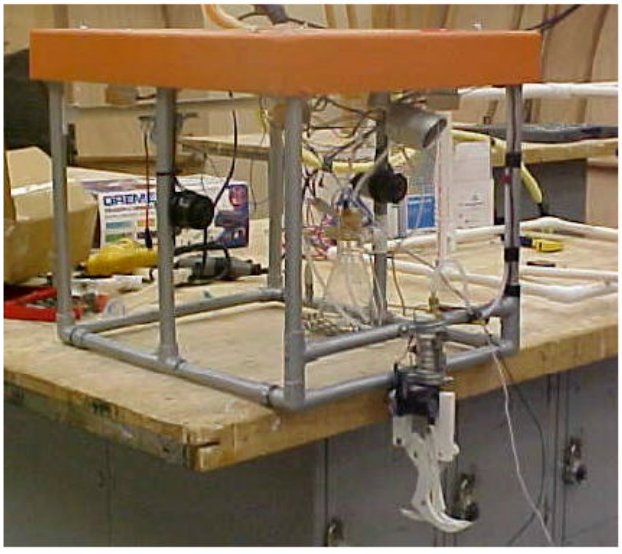
Photographs



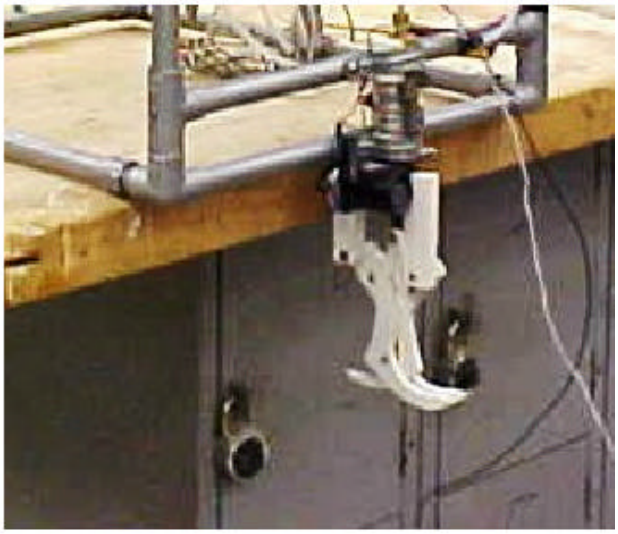
Mulco Hipperus



Top Panel



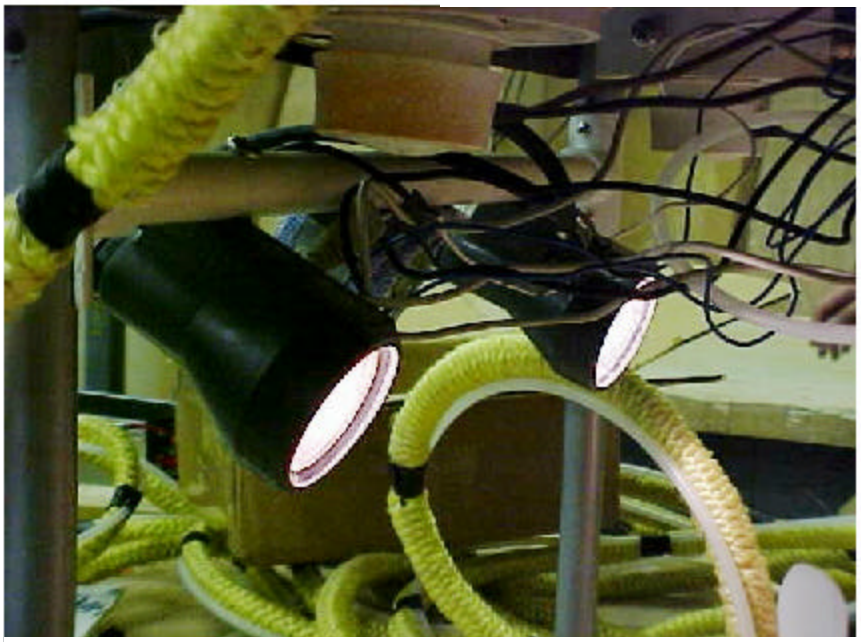
ROV Frame and Gripper



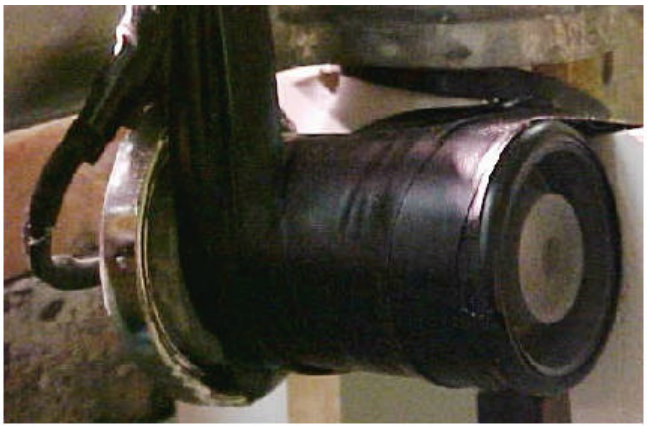
Gripper Close-Up

Color Camera

Black & White Camera

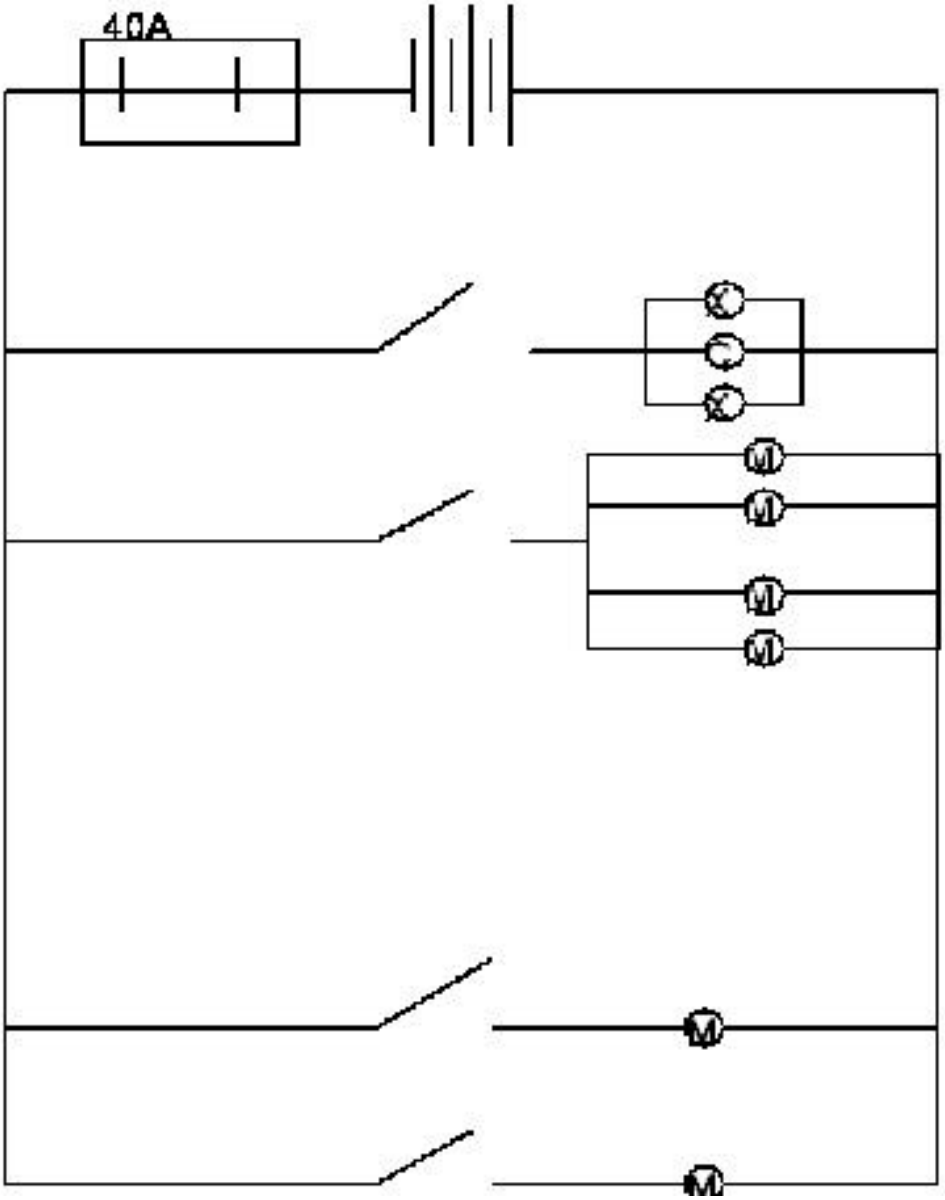


Lights



Hydrophone

Electrical Schematic



Design Rationale

Mulco Hipperus was designed to be efficient as well as aesthetically pleasing. When we began to build our R.O.V., we wanted it to look professional, not as though a group of high school students had spent a few days and thrown PVC pipes together, saying that it was an R.O.V. In order to do this our first step was to ensure that each task of the mission could get its necessary attention; members were split into five groups that handled an individual task. While the groups were together, the PVC frame was cut and cemented together. To handle the question of floatation, it was decided that instead of last year's use of foam taped to the sides, a fiberglass mold would be constructed and then filled with foam after the wiring had been finished.

Our vertical thrust motors were placed in the mold to have a secure placement. The forward thrust motors are mounted on two pieces of PVC on the port and starboard side of the R.O.V. For the tasks of retrieving the pinger, and the captain's bell, we built a manipulator claw out of PVC board that can accomplish both of the tasks. In order to retrieve the towfish, another claw was built that is held in the main claw and released when the towfish has been picked up. The main claw is mounted on the forward portion of the R.O.V. on a crossbeam. The hydrophone, which is constructed out of a film canister and filled with vegetable oil, is mounted on the stationary piece to the claw so that it is in the best position to hear the pinger.

To retrieve the fluid from the leaking barrel, we are using a syringe that will be inserted into the PVC pipe protruding from the top of the barrel. The syringe will be mounted on the right, forward frame piece by piece of PVC. On the tip of the syringe, there is a funnel that will be attached to the syringe to make the task of inserting the syringe into the pipe much easier. The fluid will be stored in a 500ml flask mounted on a square platform of expanded metal.

To measure the length of the U-boat, we will use a tape measurer that will be mounted on the forward-starboard corner of the R.O.V., it has a loop on the end of it to hook around the protruding piece of PVC pipe that it is horizontally mounted on the U-boat. To measure the temperature of the cold-water spring, we will be using a scuba diving watch mounted next to the claw in the view of our black and white camera so that the readout can be seen, this also will be used to measure the depth of the mark on the periscope.

There are two cameras, our black and white camera is mounted on a P.V.C. cross beam in the top-aft portion of the R.O.V. We determined the position so that we will be able to view the syringe, beaker, claw, and the watch that is mounted inside of the R.O.V. The colored camera is mounted on the forward portion of the R.O.V. in order for us to be able to navigate through the reef and perform the assigned tasks. The tether contains two pneumatic hoses and two wire bundles. The first pneumatic hose will be used to operate; the second hose is attached to the syringe and beaker for the task of obtaining the fluid sample from the leaking barrel. Mulco Hipperus's structure allows for easy repair and maneuverability.

Challenge

A major challenge we faced was a lack of money. We didn't have enough money for supplies or the transportation to the competition. So the first few weeks we were mainly doing fundraisers. As it turned out we still did not get as much money as we needed. That's when we started applying for scholarships and sponsors. We eventually obtained a substantial amount of money. This then led to another big problem, misdirection of focus. We were all so worried about not making enough money to construct Mulco Hipperus that nothing was getting done to design the ROV. We eventually obtained more mentors who sat us down and for a long discussion that snapped us back to reality.

Personality traits were our next big issue. Obviously we were not all expecting everyone to get along all the time, but the animosity was getting in the way of successfully completing the construction of Mulco Hipperus. All of us had to sit down and discuss what to do. The conclusion we came to was that everyone needed to make an effort to get along, they did not have to like each other but we needed to be able to work together in order to accomplish a task such as building a functional ROV. We also used some of the traits to get more accomplished. For example Cherish Cook, the Vice-President, is very straight forward and demanding so she became sort of a sergeant general insuring things got done.

The many challenges we have faced the above challenges stood out the most. These are the experiences we can learn from, and they were an important part of what we accomplished. Without them our ROV would not have turned out the way it has. But the most important part is that they did not stop us from achieving our goal, Mulco Hipperus.

Troubleshooting

The technical problems we faced were solved by trial and error. We had problems with many things, some were minor and others were major. Some examples are the hydrophone, claw, syringe, and flotation. All of these components are needed to complete the given tasks. During the testing all of the kinks needed to be worked out.

Starting with the hydrophone, this was mainly built by Cherish, the Vice-President. The first problem we encountered was having the wires break off the microphone membrane. We attempted to solder the wires back on but there was a problem with the connection and the only thing you could hear was tapping on the wire. It became necessary to use our backup microphone. Unfortunately this problem occurred in both the backup and secondary backup microphone, luckily though our last microphone was properly fixed and is now what is being used on the ROV.

The claw, that was designed and built by John-Marc, experienced many problems as well. The first major problem was the decision of what was to be used. We decided to assemble an electric manipulator. After the assembly it was decided that it was not strong enough to complete the task. Perry Slingsby donated us a small piston to work with. He then designed and built a claw around it so that it runs off a compressed air tank pneumatically. The air pushes the piston, opening the claw. Springs inside will close the piston when the pressure is taken off the air line.

The syringe was designed and built by Erin, which is used in retrieving the sample of fluid from the leaking barrel. One challenge that we faced while working on the task was that we were going to do with the sample once we got it out of the barrel. At first we wanted to put it in a bag that was inside a bottle that was 500 ml we realized that it would not work since we needed to give a sample of fluid to the judges and there was no way to get the fluid out once it was in the bag. We were also concerned about getting a sample that was not contaminated with clean water. We argued about whether or not we should have a container for overflow so that the sample would be clean. We finally decided on using a beaker that is 500 ml so we can always get a little extra if we need it. The beaker is also glass so in case of a pressure change it won't buckle the way a plastic bottle would.

The floatation is a very important part of our ROV; it is crucial to the balance and stability of our ROV. At first it was uneven and the backend floated higher than the front end, and the thrusters weren't strong enough to dive at all. So we had to cut some of the foam off and add weights to help it sink.

These are the problems we encountered during testing, and the way we decided to fix them. We worked together to improve each others ideas. We fixed these problems and now have a working ROV that can complete the tasks required.

Lessons Learned

We have learned many valuable lessons this year working on Mulco Hipperus. We learned how to work together, and take advice from others such as our peers and mentors. Working together was crucial in order to build our ROV. At first we tried to appoint separate tasks to individuals. We later found out that it was impossible to have only one person work on a task while the others are uneducated about it. Luckily, we realized this mistake before it got out of hand and were able to have groups work together.

Personality was a large factor in the completion of Mulco Hipperus. We had to set aside our differences and allow others to give advice and help. Without the constructive criticism of our peers and mentors, Mulco Hipperus would not have been finalized.

If we had not learned how to work around the personality traits of others in order to get along we would have never been able to create the ROV. By working together and sharing ideas we have made something that we could not have accomplish on our own. To see it work was really amazing and showed all the hard work that went in to it was worth it.

Future improvements

There are many improvements that we would make after our experiences this year. One particular improvement would be to have started the project earlier. We first started out doing fundraisers in order to get money for materials needed for Mulco Hipperus. We spent about two months raising money until we reached the amount desired.

Another improvement would be to have not set up the individual tasks. This mistake slowed us down because only the individual working on the specific task knew what the task was about. We now realize that we needed to have team work all along and without it we went nowhere.

Communication also needs improvement. The team needed to learn how to get along and not be segregated within the team. Separation only lead to problems and if we had worked together the project would have gotten done sooner and might have been able to avoid so of the later difficulties we experienced with the ROV.

Current Use of ROVs in National Marine Sanctuaries

The use of ROVs in National Marine Sanctuaries is incredibly important to the aspect of oceanography and discovery. ROVs have allowed scientists and researchers to go where divers are unable to get to before. ROVs also allow research in hazardous situations where divers would be at risk.

The current uses of ROVs in National Marine Sanctuaries provide people with marine science interest to interact by use of video documentary. One such project was the NOAA Live Webcast from the Thunder Bay National Marine Sanctuaries and Underwater Preserve. The Centers' ROV was dispatched to the bottom of Lake Huron. The ROV, joined by divers documented their exploration of the wreck of *Montana.* The Center also documented two species- zebra mussels and round gobies. The NOAA's research program developed a wireless network to broadcast the documented video on to the ship from the ROV. The video signal was sent to the University of Connecticut and then to the American School for the Deaf. The project was a success; the students from the American School for the Deaf were able to see real life topics of oceanography that they

had been learning in class. (Undersea Research Program, 2002)

The NOAA is also starting to explore the Olympic National Marine Sanctuary depths. The project, Sanctuary Quest: West Coast Expedition 2002, send a U.S. Navy ROV to research the Channel Islands, Gulf of the Farallones and Cordell Bank. The ROV collected data in underwater habitats that have either been rarely explored or never explored. "We are working to understand how the sanctuaries function as a system," says Daniel Basta, director of NOAA's National Marine Sanctuary Program. (Steelquist, 2002)

With all the research that marine scientists study, most of it would be unknown without the help of an ROV and its features. Such features include: video recording, lighting, arms, tethers, and other specific features designed to complete certain tasks required.

Acknowledgements

1. Perry Slingsby Technologies- for their time, technical expertise, and guidance. Team Piranha is very gracious to Steve, Michael, Bruce, and everyone else who contributed their efforts into the creation of Mulco Hipperus. Perry also made a monetary donation and use of their deep water ROV test pool.

2. MIA- Marine Industry Association of Palm Bach County, monetary donation.

3. MIEF- Marine Industries Education Foundation, monetary donation.

4. MATE- Sponsorship for building supplies, travel, room and board, overall event.

5. Henry Stevens- monetary donation.

6. Brian Rayfield- monetary donation.

7. Verdes Tropicana Bowling Alley, monetary donation.

8. CUS- lights, scholarship.

9. Shurflo- thrusters.

10. Anspach- team shirts.

11. Palm Beach Lakes- Ramblings newsletter, published article.

12. Palm Beach County Magnet School's Newsletter- published article.

13. Ferrandino Family- use of pool.

14. Mr. Bradbury- use of pool and picnic.

15. Parents.

16. Team members unable to attend competition.

17. Ocean News and Technology- published article.

PARTS

DONATED

Syringe
500ml beaker
Bilge pumps
Bag
Tube
Air Pump
Piston
1/2" PVC board
Springs
Compression nuts and bolts
Air tank
Air tank fittings
Microphone
Film canister
Fiberglass
Epoxy resin
7-connecter sprinkler wire
Dive watch
Measuring tape

BOUGHT

Bottle
1/4" PVC board
Nuts and Bolts
Air lines
Pipe clamps
Olive oil
Marine goop
Spray foam
PVC pipe
Paint
Polypropylene rope
Electrical tape

BUILT

Base/ platform
Brace
Funnel
Manipulator arm

2003 MATE/MTS ROV Committee Student Competition

Budget/Expense Sheet

Period:

School Name: Palm Beach Lakes HS Team Rranha — From: 8/1/2003

Instructor/Sponsor: Capt. Greco, Mr. Bradbury, Mr. Shewmaker — To: 6/4/2004

Funds

Date	Deposit or Expense	Description	Notes	Amount	Balance
8/1/2003	-	Beginning balance for school year 2003/2004		$400.82	($400.82)
9/10/2003	deposit	Bake Sale		$137.35	($263.47)
9/29/2003	deposit	Car Wash		$173.50	($89.97)
11/21/2003	deposit	Bake Sale		$54.89	($35.08)
12/15/2003	deposit	Penny War - classroom donations		$98.55	$63.47
12/23/2003	deposit	Donation - Mr. Henry Stevens		$250.00	$313.47
1/8/2004	deposit	Penny War - classroom donations		$141.68	$455.15
1/29/2004	deposit	Donation - MATE builing materials		$100.00	$555.15
2/3/2004	expense	Penny War reward to winning class		$64.63	$490.52
2/6/2004	deposit	Donation - Verdes Tropicana Bowling Alley		$51.00	$541.52
4/7/2004	expense	Delta Airlines deposit		$440.00	$101.52
4/20/2004	deposit	Bake Sale - breakfast/lunch Teacher Test Saturday at HS		$586.31	$687.83
4/20/2004	deposit	deposit Jennifer Koury trip to CA		$50.00	$737.83
4/26/2004	deposit	deposit Laura Eadie trip to CA		$50.00	$787.83
4/26/2004	deposit	Bake Sale - New student registration		$104	$891.83
5/3/2004	expense	ROV materials - George		$22.14	$869.69
5/3/2004	expense	ROV materials - Erin		$19.73	$849.96
5/6/2004	deposit	Donations - food sales		$185.60	$1,035.56
5/6/2004	deposit	deposit - John-Mac Diot trip to CA		$50.00	$1,085.56
5/6/2004	deposit	deposir - Erin Engler trip to CA		$50.00	$1,135.56
5/6/2004	deposit	Penny War - classroom donations		$46.19	$1,181.75
5/11/2004	expense	ROV materials - Gidget		$79.14	$1,102.61
5/11/2004	expense	ROV materials - Joe		$31.83	$1,070.78
5/11/2004	expense	ROV materials - John-Marc		$30.01	$1,040.77
5/18/2004	deposit	Donation - Brian Rayfield		$100.00	$1,140.77
5/18/2004	deposit	deposit- Cherish Cook trip to CA		$50.00	$1,190.77
5/18/2004	deposit	deposit - Minda Shewmaker trip to CA		$50.00	$1,240.77
5/18/2004	deposit	airfare for baby Shewmaker		$238.85	$1,479.62