The Sound School
Regional Vocational Aquaculture Center

Team Members
Josh Andreozzi
Nate Andreozzi
Ryan Beitler
Bill Bogen
Pat Cannon
Dan Farkas
Katie Hardin
Matt Olsen
Mike Picozzi
Joe Wilson
Kurt Wivagg

Instructors
Dave Low
Ned Costello

Future improvements for our project:

There are a lot of things that need to get done between now and the competition. This technical report will be far less complete than the information on our poster project because, as most human beings are, we are all a bunch of lazy procrastinators who have put much of the wiring and testing off until the very last week of school. Even after school has let out, many of us will be spending the first week of our summer vacation locked in the dungeon that is Dave's classroom probably accomplishing more in that week than we have so far this year. Such things will likely include:

- Figuring out what motors we are actually using and attaching them to the ROV
- Creating a control system (joystick, switches or other…for movement) and wiring it to the motors
- Attaching everything to our tether
- Probably re-calculating and editing our floatation
- Finally getting the thing in the water…most likely in Mike's pool.
- Testing out our ability to complete our mission tasks and making many last minute improvements to our sub-units so that we actually can complete most of the tasks.
- Actually making the stuff for the poster and getting color printouts of the pictures we have taken
- Maybe drafting the ROV in CAD if anyone gets around to it
- Get the hydrophones working and possibly testing them although we don't have a pinger to test them out with.
- Many, many other things

Lesson Learned

The most important lesson learned throughout this project would be to get things done on time. If one person does not get his or her task done on time, then everyone else suffers if that important task is not done. For example, once our subassemblies were completed, they need to be placed on the frame, but when the frame was still incomplete, then we couldn't have the subassemblies test-fitted on the frame. This is why it was important to get tasks done on time. When one person does not do his or her job, then everyone suffers when the progress is halted. We found it important to keep progress moving so that the overall goal could be achieved at the end of the time frame. The obvious goal is being that of completing the ROV. Keeping to a timeline is essential to the well being of the project so that the project can be finished by the specific date that it is assigned to be completed on. At the end of this project we realized that everyone needs to be dedicated to his or her specific task and not worry about other peoples' responsibilities and therefore would finish one task before starting work on another. Once one member of the team has completed their task then they can work on helping other people with their tasks. This is helpful to everyone because then not only is one task completed, but a harder task can be worked on by more than one person and then task will get done quicker.

One Problem and how we Over Came It

Overall this whole project had a large amount of problems, things going wrong, nothing going right, and most importantly, the troubleshooting to do after everything went wrong. A specific series problems I remember were with our robotic arms now reduced to a single robotic arm. When we realized we needed something that could pick up an object we immediately looked to an arm. With this newfound realization of our objective we spent a lot of money on the Lynx6 Robotic arms. When we built them they seemed to work great, and we were learning how to use them with Bs2 BASIC Stamp controllers. Then we needed an easier way to control the arms, something that would be more efficient for the ROV. We then decided on a Playstation controller, which was convenient because we had found adapters for it on the Lynxmotion web site. After this we tested the arms they both were still up and running. Sooner rather than later though, the servos started to give us problems, namely they just couldn't take the use. Our first problem came when a servo's internal gear train stripped, so we needed new gears. We decided to buy two sets of metal gears to prevent future stripping, because it was made of plastic and one extra set just for a cushion in case another ceased functioning. As soon as we got the gears in the mail another servo received a voltage overload with a new design for the power and two more micro-servos gear trains were stripped. Basically we were out of money and left with two malfunctioning robotic arms. All in all we compiled the servos to create one functioning arm but this did not end the terror that had become of us. So nothing else can go wrong, it can't get any worse right? Wrong, it got worse. The power was strong enough to go through the 60 ft of tether. So we thought that could just attach a battery pack to the arm underwater so when the arm turned on it would work just fine. Then, the arms required a 9volt battery to run the Bs2. The Playstation controller sends commands to that once buttons are pushed and unfortunately there is a 9 volt voltage drop with 60ft of tether so we are at 0 volts and we need to make up for 18, 9 up and 9 down. Thusly we came up with a new idea to, instead of making 2 amplifiers, multiplex and then de-multiplex the signals for the buttons and amplify the 1 signal to make a long story short the input data type was incompatible and we were back to the drawing board. We finally gave in and decided to use the 2 amplifier integrated LM339nIC chips. So as of now nothing is wrong with the L6 arm and I hope no more troubles will come out of them.

What we have learned

"The foundation of every state is the education of its youth."

-Diogenes Laertius

Our youth must be educated for America to survive. The National ROV competition is educating our youth in ways that never seemed possible. The most rewarding thing the ROV competition has given us is the experience of working together to overcome challenges and obstacles.

At the beginning of the year the Sound School ROV Team were very devoted and diligent. But toward the end of the year our devotion and diligent were slowly being thwarted. Three weeks before the documentation report was due we kicked it in gear. The ROV project has shown us as a whole that hard work and diligence is needed to complete any project in the real world. For most of us who are going to college or work after high school this is a priceless and knowledge skill to know, that we will heed for the rest of our lives.

One lesson I learned during this project

One of the many lessons I learned from this project is the importance of teamwork. When working on a large-scale project like this one, teamwork is essential to progressing smoothly. It is important to utilize the availability of team members, they are there to help and they are there to do the same project that you are doing. When I needed help on a technical part of the project, I have learned that it is always better to have two working minds on that section so small mistakes do not slip through and cause larger scale problems on the ROV. This does not mean that if you are assigned something that you ask everyone else to do it for you while you lay back and do nothing. The concept of teamwork means exactly how the word sounds it means that the team works together. The team does not have to be working side by side or doing everything together but it all has to flow and it has to be in unison. I learned that on a team a very important part is compatibility because without this it makes it harder for people to agree and see the same side of an idea or reasoning. Teamwork is an idea that speeds up the process of project evolution rapidly. Without a sizable amount of teamwork, if everyone is always fighting or having disagreements it can really hurt the project. This is the lesson I learned in the duration of this school year.

What I would do differently

First of all, in all projects, like this one, and in all competitions, things go wrong. We expected things to go wrong and we were aware that nothing is perfect, but we did not prepare well enough. We overestimated our time and we underestimated the task.

We made a timeline and we had thought that we were prepared and ready to take up this big project with ease. Unfortunately our timeline ended up unrealistic and we did not plan out what needed to happen first well enough. Specifically we thought our ROV would be completed by May and we'd have more than a month to test drive it. We did not have enough people working on the motors. We would possibly have purchased better motors that did not involve so much extra work on them if we had more people on that task.

We did not factor in vacations, snow days, and no shows. All these ended up piling up on back work that need to be done but a certain person knows what to do on what needs to be done but they weren't there that day. What I would do differently next time is I would take charge and make sure everyone was working all the time and not just think, "Well we have enough people and enough time that that one person doesn't matter."

Overall, If I were to do this again what I would do differently is plan more on what isn't going to happen or what can prevent things from happening and not so much plan on what we want to happen. I would be more responsible for myself and for the team so I know I'm putting in my all. I would make sure that the right people were asigned to the tasks that brought out what they were the best at. Lastly I would make sure all big decisions were made as a group or at least not only by one person.

Discussion of Future Improvements

Unless a ~~project a~~ project goes perfectly then there is always room for improvements, and this project was far from perfect. When the tasks were first assigned to us we were overwhelmed with the tasks that we had to complete. A handful of us competed in last year’s New England Regional competition but it was nothing compared to this year’s nationals. We were told to complete this task by ourselves with very little help from our advisor, which is good because this project gives of the life experience of a real project. Unfortunately our lack of skill in such an area left us at a severe disadvantage and required us to learn what exactly we were doing before we did it. It seemed at times that it would have been more worth while to take an entire month and research all the designs possible then take another month to lay out exactly what would be done, thus eliminating any confusion on what is or can be done to modify the ROV. This was our original plan but again we needed to improve ourselves because the ideas we had were all based in theories.

In a more physical way of improvement versus our mental needs, our ROV needs improvements that can no longer be made this time. Attaching all of our sub assemblies has been quite the task. Using Clic-clamps we need to find a more efficient system. Secondly we are now using the trolling motors, this may or may not be in our favor due to the excessive weight these monsters put on us.

Overcoming a challenge

One challenge I think we all came up against during this project was a lack of communication between team members. With a group as large as ours, ten people, all working on separate parts of the project, and all having different ideas and plans for how to do things, we certainly didn't always know what other people were up to. As a result, some of our plans conflicted with some of our other plans and we had to rework things and coordinate things, wasting much time and effort. Of course, we all knew we should tell each other what we were planning on and work out our designs before beginning construction. Unfortunately we all preferred to figure out how we were going to do things by creating them and then messing with them until they did what we wanted them to do. Using that process, with not much planning involved, meant that we never really knew how our sub-units were going to turn out until we were done making them, which didn't leave much room for compromise between teammates.

ROV's In National Marine Sanctuaries

To describe how ROV's are being used to explore and understand our National Marine Sanctuaries, What better then to actually describe an occurrence of ROV's in the field, namely the Thunder Bay National Marine Sanctuary. At this site the Phantom III ROV was used to accompany divers underneath the water of Thunder Bay.

The Thunder Bay National Marine Sanctuary and Underwater Preserve is one of the thirteen National Marine Sanctuaries and is only the second dedicated to the understanding and preservation of submerged cultural resources. It is suspected that over a hundred shipwrecks lie within the boundaries of the sanctuary in waters ranging from 20 to over 200 foot depths. Due to time allowance of humans under such a large body of water ROV's must be used to study the sanctuary.

NOAA's Undersea Research Program's Center for the North Atlantic and Great Lakes has been working with the University of Connecticut's Information Technology Services to develop a mobile, low-cost wireless network to broadcast high quality video from a ship to a shore base for outreach and educational purposes.
Last month this wireless network was successfully tested by producing a live web cast from Thunder Bay as a means to promote public awareness of the rich cultural history lying on the floor of Lake Huron. During a half-hour period of time the ROV followed divers as they conducted a spot check of the wreck, including documenting the distribution of two invasive species - the zebra mussels and round gobies.

The ROV followed the divers on the shipwreck, sending the video signal through its tether to the ship where it was then encoded and transmitted over the wireless network to shore. The shore station was located at the Sanctuary's main office in Alpena, Michigan. The video was then sent to a server at the University of Connecticut and from there to the American School for the Deaf in West Hartford, CT. Live video has proven to be highly effective means of engaging Deaf learners. The video signal was also broadcast on a big screen monitor at the Sanctuary office, the GLERL in Ann Arbor, MI and the University of Connecticut in Groton.

With the assistance of ROV's we are able to gather information about our National Marine Sanctuaries as well as further educate students' worldwide.

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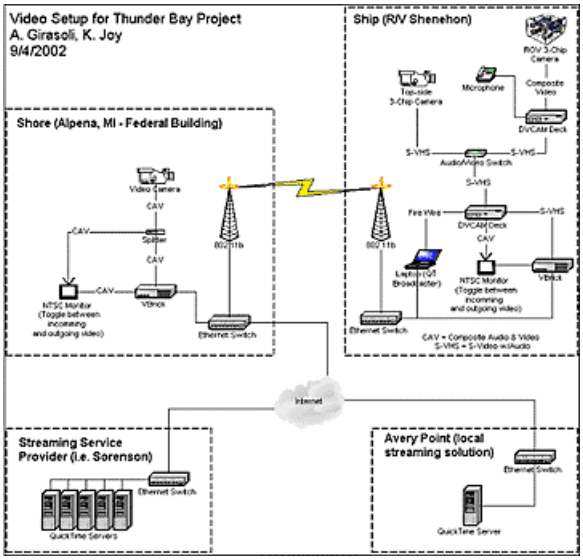


Troubleshooting Techniques

CTD censor: Checked for continuity between stuff using the multimeter and made better connections between the stuff that didn’t have good continuity.

Liquid extraction: Trial and Error

Arms: We used an oscilloscope to see where the signal was dying. We learned that signal was not making it all the way down the tether so we made an amplifier to amplify the signal down the tether.

Towfish grabber: Squeezed to see how hard it was to open and then shortened the spring mechanism and squeezed again…repeated until we felt that there was very little resistance on the carabineer gate but it still closed on its own.

Josh and Nate working on motor test.

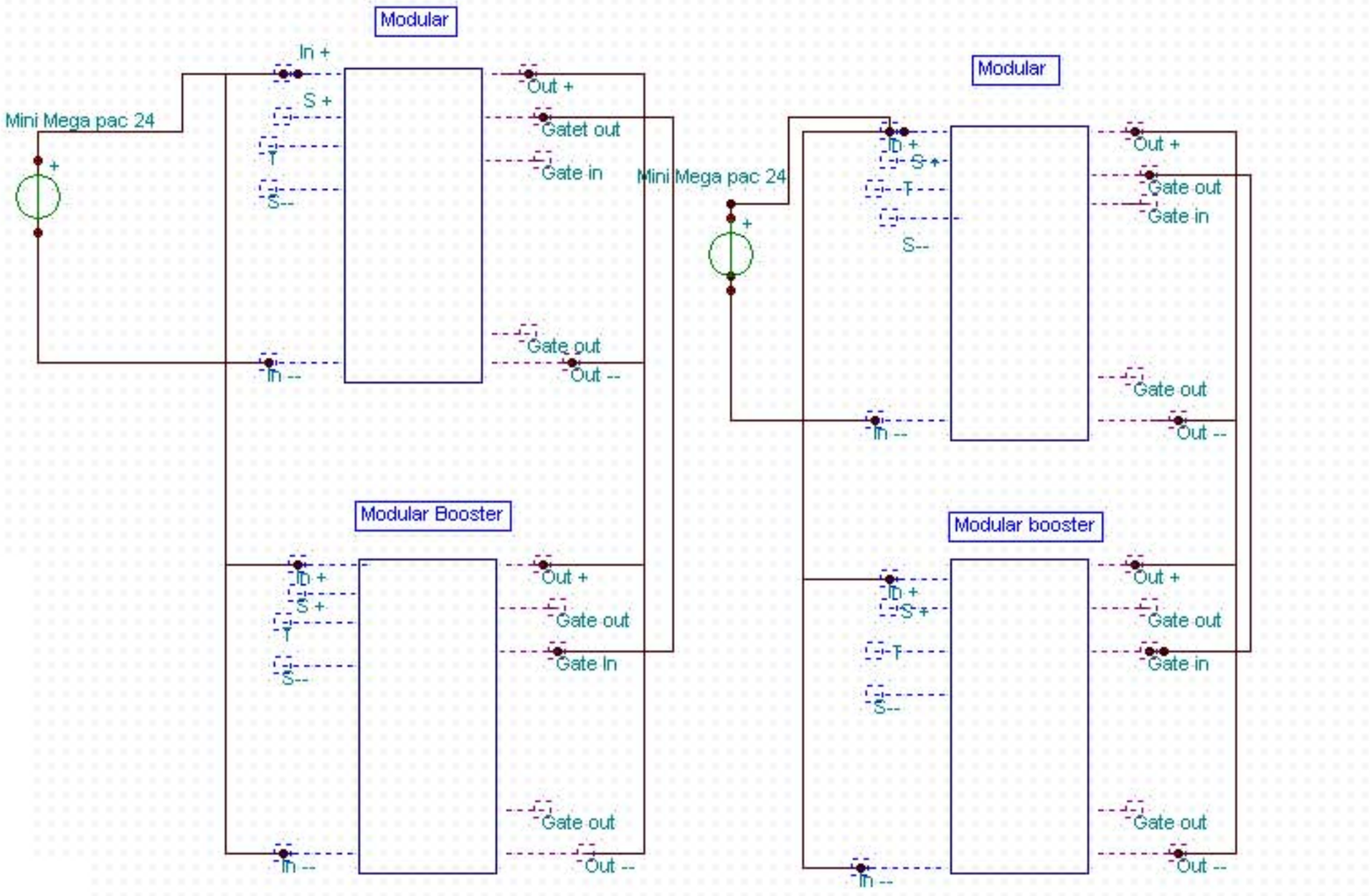
Kurt and Joe working on the arm.

Ryan and Mike on Hydraulics

Pat figuring out the pump system needed

Dan and Mike working on the Rabbit processor

Katie salvaging what she can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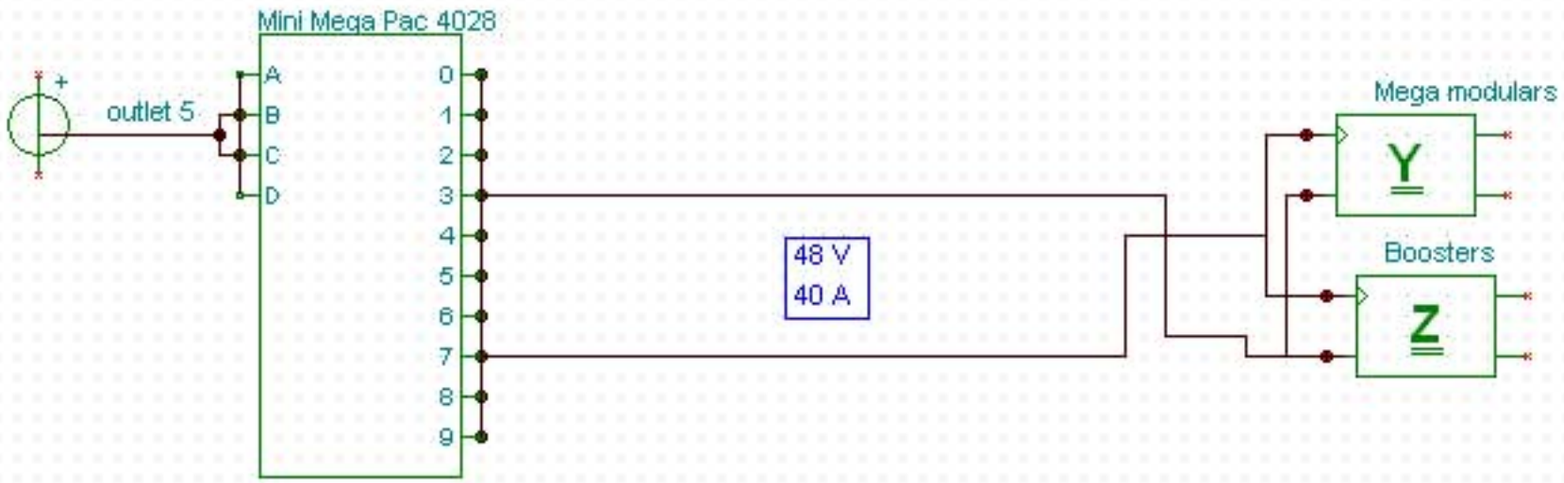
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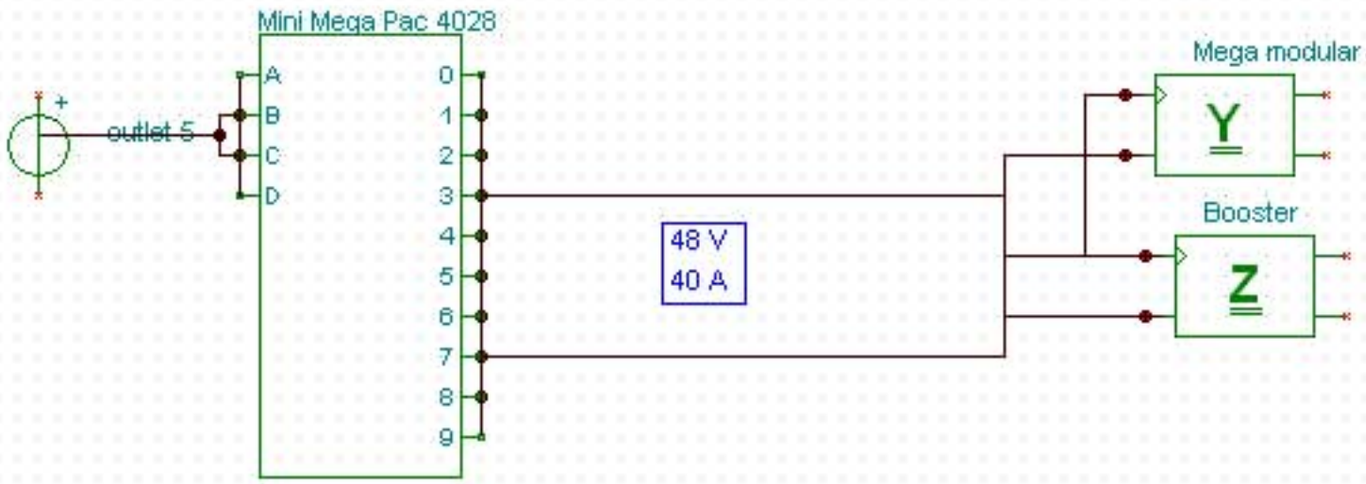
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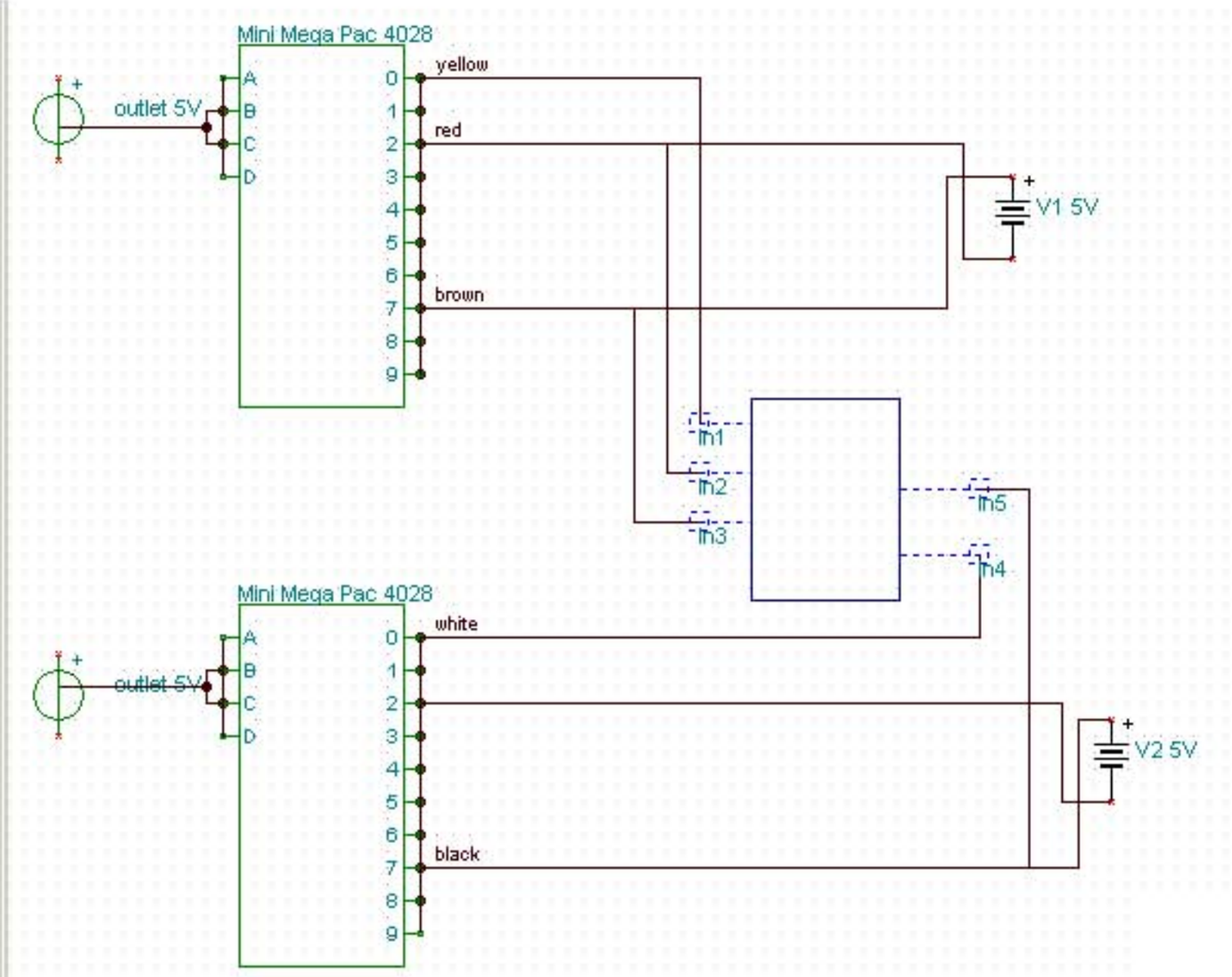
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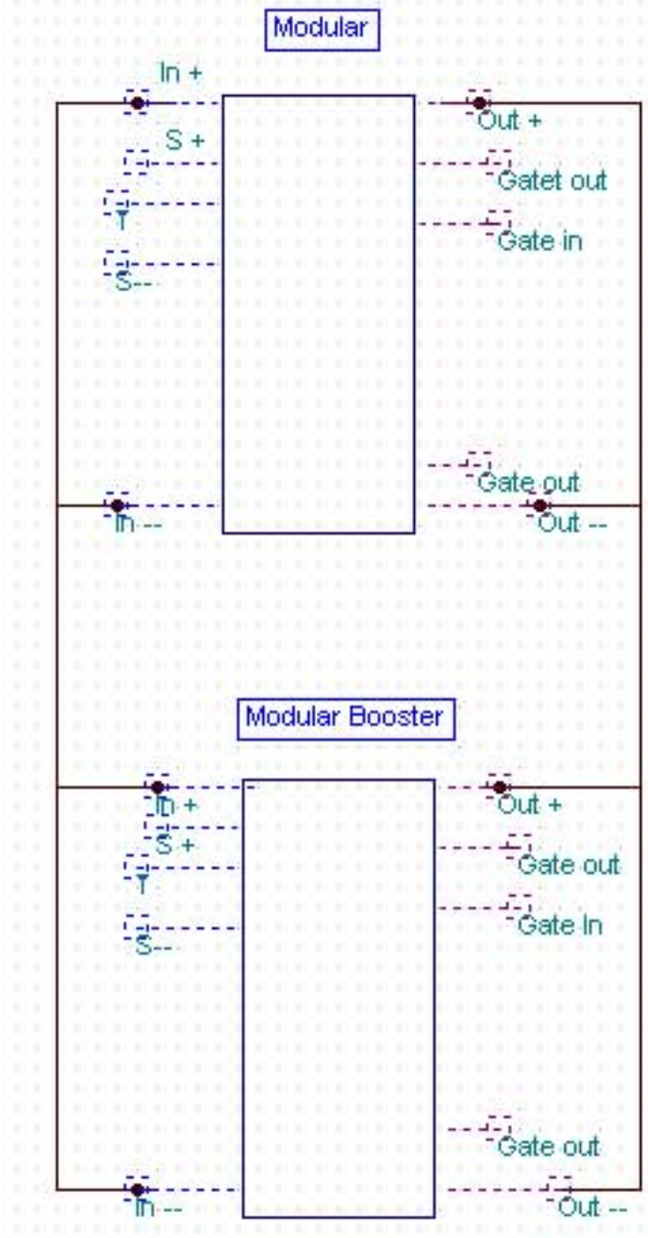
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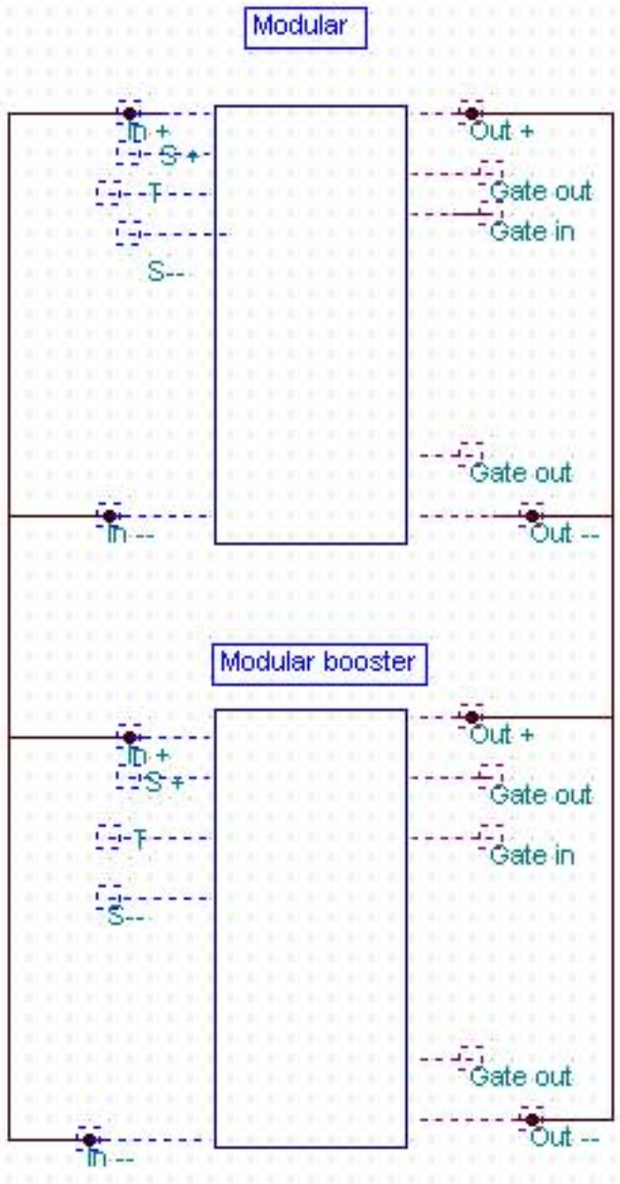
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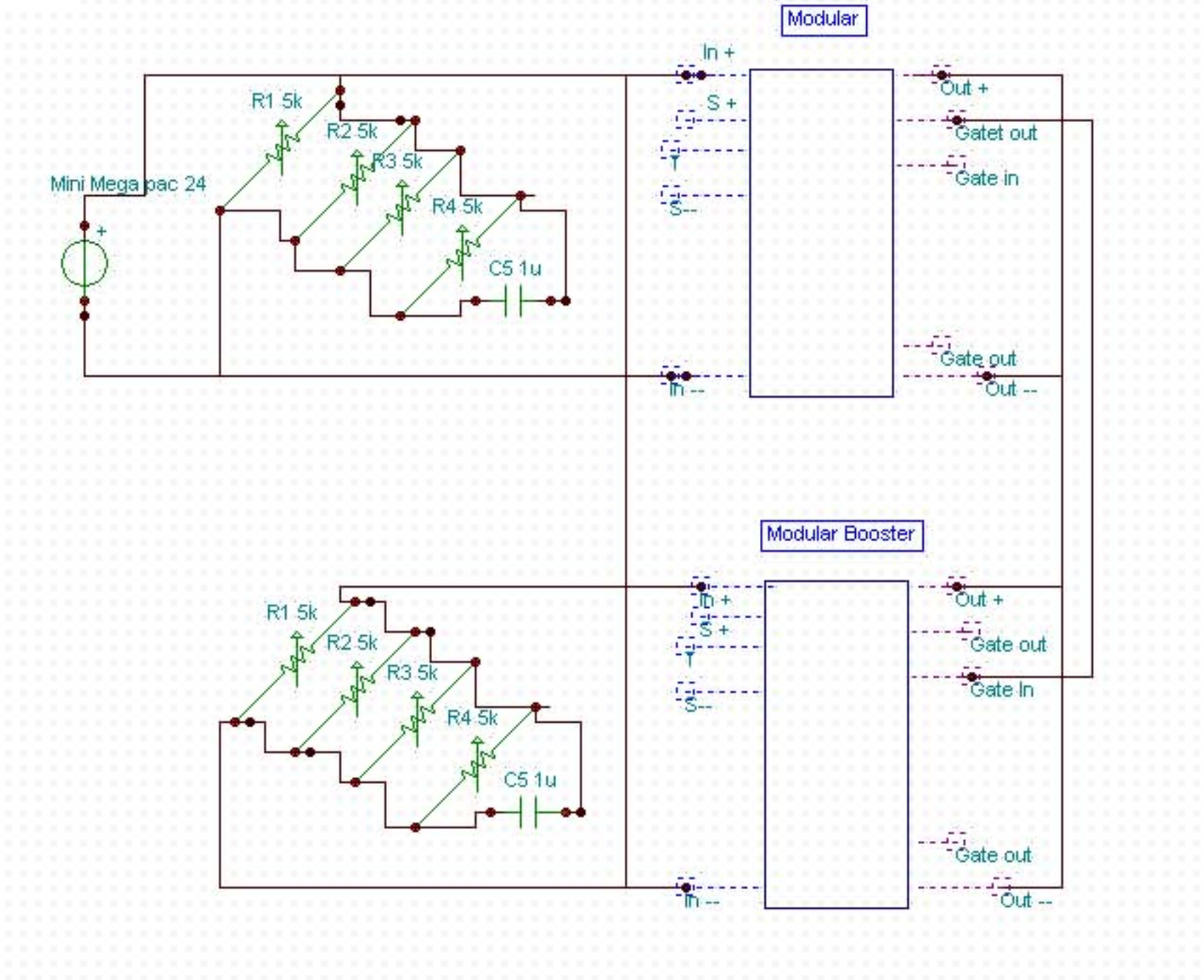
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Acknowledgements

Kayak Outfitting Dumas Boats
For Sponsoring Us

And for our teachers who donated their time, patience, skill, knowledge and materials to us:
Dave Low
Ned Costello
John Roy
Ken Donovan
Ned Flanagan

Budget/Expense Sheet

Period:

School Name: The Sound School — From: 9/1/2003

Instructor/Sponsor: Dave Low — To: 6/10/2004

Funds

Date	Deposit or Expense	Description	Qty	Amount	Balance
9/3/2003	Expense	HydroPhone	1	$ 143.95	$ 143.95
9/3/2003	Expense	Condenser Microphone Element**	1	$ 3.49	$ 3.49
9/3/2003	Expense	Audio Cable, 2 conductors (#24) +shield** 25ft	1	$ 7.99	$ 7.99
9/3/2003	Expense	atwo conductor, 1/8" mono phone plug**	1	$ 2.99	$ 2.99
9/3/2003	Expense	Mini Audio Amplifier/Speaker**	1	$ 11.99	$ 11.99
9/3/2003	Expense	black tape, rubber electrical (NOT PVC tape!)	1	$ 0.99	$ 0.99
9/3/2003	Expense	Battery holder, fits 1 "C" cell**	1	$ 0.99	$ 0.99
9/3/2003	Expense	Wire, Insulated, #24. 50 ft of orange, white, blue**	1	$ 3.19	$ 3.19
9/3/2003	Expense	12 gauge wire cable/per foot	100	$ 0.99	$ 99.00
9/3/2003	Expense	Nashua Duct Tape	5	$ 4.89	$ 24.45
9/3/2003	Expense	AGU 40 Amp Fuses	4	$ 7.00	$ 28.00
10/12/2003	Expense	otter box	4	$ 24.95	$ 99.80
10/12/2003	Expense	12 gauge wire cable 0.99$ ft	1	$ 10.00	$ 10.00
10/12/2003	Expense	stainless steel cylinder:	2	$ 70.70	$ 141.40
10/12/2003	Expense	Dumas Speed Control 12 Volt Motor	8	$ 49.99	$ 399.92
10/12/2003	Expense	Dumas Plastic Prop 1/8" .19-.35	15	$ 1.15	$ 17.25
10/12/2003	Expense	Dumas Plastic Prop 3/16" .19-.35	15	$ 1.15	$ 17.25
10/12/2003	Expense	Dumas 2" Left Hand Bronze Prop 3-Blade 3/16"	3	$ 17.99	$ 53.97
10/12/2003	Expense	Dumas 1.5" Left Hand Bronze Prop 3-Blade 1/8"	3	$ 15.19	$ 45.57
10/12/2003	Expense	Dumas Boat Motor 12 Volt	1	$ 54.99	$ 54.99
10/28/2003	Expense	Lynx 6 Robotic Arm Combo Kit	2	$ 429.98	$ 859.96
10/28/2003	Expense	3/8 in. x 100' Polypropylene Truck Rope	1	$ 6.47	$ 6.47
10/28/2003	Expense	3/4" SCHEDULE 40 PVC PIPE SLIP CAPS	5	$ 0.18	$ 0.90
10/28/2003	Expense	10' 3/4" PVC Piping	5	$ 1.39	$ 6.95
10/28/2003	Expense	PVC Piping 1 1/2"x10'	10	$ 2.98	$ 29.80
10/28/2003	Expense	PVC Tee 1 1/2"	15	$ 0.99	$ 14.85
10/28/2003	Expense	12 volt Electric Motor	8	$ 60.00	$ 480.00
10/28/2003	Expense	3" Diameter Bronze Propeller Kit	8	$ 29.75	$ 238.00
10/28/2003	Expense	Shaft & Stuffing Box Kit	8	$ 15.00	$ 120.00
10/28/2003	Expense	16 gauge speaker wire	1	$ 19.99	$ 19.99
10/28/2003	Expense	18 gauge Speaker Wire sold by ft	50	$ 8.99	$ 449.50
10/28/2003	Expense	PVC Bend 1 1/2"	15	$ 0.62	$ 9.30
10/28/2003	Expense	8 gauge Speaker Wire sold by ft	1	$ 10.00	$ 10.00
10/28/2003	Expense	9V Battery	5	$ 1.48	$ 7.40
10/28/2003	Expense	9V Battery Clip	5	$ 0.31	$ 1.55
10/28/2003	Expense	Circuit Board Stock	1	$ 20.76	$ 20.76
10/28/2003	Expense	5V Regulator	5	$ 2.28	$ 11.40
10/28/2003	Expense	15uF Capacitor	5	$ 0.36	$ 1.80
10/28/2003	Expense	500' Roll of 5-Wire Cable	1	$ 70.20	$ 70.20
10/28/2003	Expense	Cable Ties	30	$ 0.03	$ 0.90
10/28/2003	Expense	64 Pin Gold Plate Header	1	$ 6.72	$ 6.72
10/28/2003	Expense	Pre-Stripped Wire Wrap Wire	1	$ 4.44	$ 4.44
10/28/2003	Expense	4.7K-OHM RESISTORS	10	$ 0.06	$ 0.60
10/28/2003	Expense	TEMPERATURE SENSOR	5	$ 2.05	$ 10.25
10/28/2003	Expense	2.0K-OHM RESISTORS	30	$ 0.06	$ 1.80
10/28/2003	Expense	REFLECTIVE PHOTOSENSOR	5	$ 1.11	$ 5.55
10/28/2003	Expense	510-OHM RESISTORS	30	$ 0.06	$ 1.80
10/28/2003	Expense	1.0M-OHM RESISTORS	30	$ 0.06	$ 1.80
10/28/2003	Expense	BLACK TEST POINT TERMINAL	5	$ 0.21	$ 1.05
10/28/2003	Expense	WHITE TEST POINT TERMINAL	10	$ 0.16	$ 1.60
10/28/2003	Expense	1/16" Urethane Hose Blue - 50ft	3	$ 9.15	$ 27.45
10/28/2003	Expense	1/16" Urethane Hose Green - 50ft	2	$ 9.15	$ 18.30
10/28/2003	Expense	1/16" Urethane Hose Red - 50ft	2	$ 9.15	$ 18.30
10/28/2003	Expense	1/16" Urethane Hose Clear - 50ft	3	$ 9.15	$ 27.45
10/28/2003	Expense	1/8" Urethane Hose Blue - 50ft	3	$ 17.85	$ 53.55
10/28/2003	Expense	1/8" Urethane Hose Clear - 50ft	3	$ 17.85	$ 53.55
10/28/2003	Expense	3-56 TO 1/16" Hose Fitting	10	$ 2.20	$ 22.00
10/28/2003	Expense	Coupling 1/16" Barb	10	$ 2.60	$ 26.00
10/28/2003	Expense	Coupling 1/8" Barb	5	$ 2.60	$ 13.00
10/28/2003	Expense	stainless steel cylinder:	2	$ 70.70	$ 141.40
10/28/2003	Expense	T's - 1/8" ID Tubing	20	$ 1.22	$ 24.40
10/28/2003	Expense	T's - 1/16" ID Tubing	20	$ 0.98	$ 19.60
12/12/2003	Expense	BRASS RACKS - 20° Pressure Angle-12 inch	2	$ 22.90	$ 45.80
12/12/2003	Expense	BRASS PINIONS - 20° Pressure Angle	2	$ 11.40	$ 22.80
12/12/2003	Expense	Duct Tape	5	$ 2.93	$ 14.65
12/12/2003	Expense	Electrical tape	5	$ 1.97	$ 9.85
12/12/2003	Expense	3M 2130 SizeB 7.6oz Flm Ret Comp	10	$ 13.25	$ 132.50
12/12/2003	Expense	Brass threaded Drive Dog Kit	1	$ 3.50	$ 3.50
12/12/2003	Expense	Shaft 3/16 X 16" Kit	1	$ 12.00	$ 12.00
				Subtotal	$ 4,248.62
				Tax	$ 254.92
				TOTAL	$ 4,503.54

Ownership								3-29 to 4-2	4-5 to 4-8	4-12 to 4-16	Vacation
	Design										
		Control System									
Dan, Josh, Nate	NA		Motors								
				Mounting							
				Positioning							
				Vectoring							
				Waterproofing							
				Attach propellers							
		Electrical Systems									
			Liquid Extraction								
Mike			Tether								
				Length							
				Hoses - Pneumatics/Hydraulics							
				# of Strands							
				Flotation							
				Wire Gauge							
				Tether management system							
Pat			Control Box								
				Format/Layout							
					Digital or analog						
					Switches						
					Video displays, Gauges, Data screens						
				Computer/laptop							
Joe, Kurt, Ryan		Retrieval Systems									
			Hydraulics								
			Arms								
				Programming							
				Waterproofing							
			Camera								
		Control Programs									
			Arms								
			Hydrophones								
			Control System								
			Pinger Location								
Mike, Ryan		Buoyancy									
			Variable ballast								

			With subs								
Dan, Josh, Nate		Propulsion									
			Motors								
				Water proofing							
				Stuffing box							
				Shrouds							
				Props							
Joe, Mike, Pat	**Construction**										
		Control Systems									
			Motors								
			Tether								
			Control Panel								
				Control Box/Joystick							
Dan, Ryan		Electrical Systems									
			Tether								
			Control Box								
Katie		CTD Sensor									
			Creation								
			Water Proofing								
			Read-Out								
Joe, Kurt		Retrieval Systems									
			Arms (O-Ball tagging, Bell)								
				Waterproofing							
				Mounting							
			Beitson (Pinger)								
				Mounting							
Pat		Control Systems									
			Thrusters								
			Lights								
			Beitson								
			Arms								
			Variable ballast								
Katie, Kurt, Joe		Lights									
			Location								
			Mounting								
Katie		Video									
			Location								

			Mounting								
Dan, Josh, Nate		Propulsion									
			Location								
			Mounting								
			Wiring								
Dan		Control Programs									
			Dynamic C								
				Hydrophone program							
			SE1100								
Everyone		Mock-ups									
			Captain's Bell								
			Leaking Barrel			complete					
			Pinger								
			Towfish								
			U-Boat								
Bill	**Documentation**										
		Technical Report									
			Project Goals								
			Timeline								
			Biographies								
			Daily Logs								
			Schematics								
			Pictures								
			Rationale								
			Problems/Solutions/Trouble-Shooting								
			What would we do differently								
			Acknowledgements/Sponsors								
			Budget/Expense Sheet								
			2 Essays								
			Skills We have gained								
		Poster									
			Working Pictures								
			People Pictures								
			ROV Pictures								
			Testing Pictures								
			Subassembly Pictures								
			Schematics								

			Rationale								
			Do differently								
			Team Name								
			Acknowledgements/Sponsors								
		Budget									
			How much Spent								
			Plane Tickets								
			Donations								
			Sponsors								
		Brochure									
			Important Dates								
			Pictures								
			Goal								
			Wants/Needs								
			Contact info								
		Diagram/Schematic Notebook									
			Electrical								
			Mechanical								
			Structural								
Everyone	**Testing**										
		All Subs									
		ROV									

Improvements/Last minute tweeks

4-26 to 4-30	5-3 to 5-7	5-10 to 5-14	5-17 to 5-21	5-24 to 5-28	6-1 to 6-4	6-7 to 6-11	exams	Summer