New Richmond HS Supermileage Team

Proposal Packet

Problem Solving Essay-

During the year we have experienced many problems and successes with our hmv car. Starting out we had trouble putting a basic design together. We couldn't figure out if we wanted to do a car like the previous year, which is the "bubble car," that car we had to steer with our butt to turn. Seeing as how last year one of our members rolled it, me, we decided against the idea. We wanted to have our weight distributed evenly on all 3 tires so we took that into account. We moved the main axle up under our knees, which moved it up around 2 or 3 feet total. Then we took into account other things that have become a problem in the past years, such as steering, stability, axle bending, and pressure points along the car. Having all this taken care of we moved on to constructing the car. The first time we tried to bend the aluminum bar it broke. So we tried it again and it broke again. We thought that we had the wrong aluminum. We then found out that when we bent the bar outside that it was too cold for it to bend right so it broke. Then we found out that it broke the second time because of we bent it in the same spot way too much. Learning this and figuring out how to bend the tubing correctly, we moved on. Putting the frame together was the easy part. It took the longest but it was really fun. We had one experienced welder and one who learned on the fly. Having two welders in the group really helped because we could get the car's frame done twice as fast. Our other member was really good at the mill. He whipped through all the axles mounts for the wheels for the whole team, the engine mounting plate, and any other miscellaneous items along the way in a relatively fast time. Having strengths in both the mill and the welding/ engineering to initially figure out what to do and correct major and minor issues along the way, we ended up putting the car together in a very short amount of time compared to other years.

Steering assembly-

The steering assembly is a very large milestone improvement compared to other years. It starts off with a standard 2" X ¼" wall tubing that is 4'-0" long. After cutting this tube it is squared off on each end prepped for the next piece that is to be welded to the axle. The next piece is a ½" X 2" X 2.5" flat stock aluminum piece. After cutting to rough dimensions, it is then squared off on all sides so that it will be level to the axle and the rest of the frame. Then the flat stock has two offset holes drilled into it for securing the tire axle to the frame axle with ball join bolts. After the axle and the flat stock are prepped to be placed into the car, they are welded level to the frame and left to cool. After that, we milled and lathed and threaded out our own axles made out of leaded 1" solid steel stock to fit to specifications on the tires we were using. Then on the unmilled end we milled out vertical flats into where the lathed part ended to fit our own brake caliper mounts on. Further down the unmilled end we milled out horizontal flats to fit them exactly between the ball joint bolts that we bought at the local agriculture outfitter. Then we milled down an insert .2" for the tie rod to axle lever and drilled and tapped a hole for the bolt to secure the piece to the axle. Then we drilled out the final hole into the axle to secure the axle to the ball joint bolts then to the frame axle. The next piece we made was the tie rod lever. It was made out of ¼" X ¾" X 6" flat stock that we drilled one 3/8 hole on one side and a ¼ hole on the other to put it on to the tie rod end and the axle. Then we bent it down to make it so it would be able to clear the plate that the ball joint bolts were mounted to so we wouldn't have to deal with a shallow turning radius. Then we moved on to making the tie rods out of 3/8" solid steel stock and cut them to 23.5". After we threaded them to 3/8 U.S. 24 thread to fit into the tie rod ends we already had. Then we moved on to the steering column assembly. We started first with the tab that the tie rods would connect to, it was made out of ¼" X 2.5" X 4" flat stock and had a 1" hole drilled in it for the steering column on one end and two 3/8" holes on the other for the tie rods to connect to. The steering column is a total of about 12" long and has a custom knuckle joint integrated into it. The knuckle joint center is made out of 1" X ¼" thick square stock that is 1.5 inch long. Welded on each side of the knuckle joint are 2 tabs with a ¼ inch hole to put through the square stock and the tabs themselves. With all this assembled it created a very well working knuckle joint. And the final piece of the steering is the steering wheel; we used a common custom airplane style aluminum steering wheel so we can easily put the gas and brake on them. That is the complete steering setup for car #4 on the New Richmond HMV team.

Brake System-

The brakes are made up of total a caliper mount, an axle to mount the mount, the caliper, the cable, and the handle. The handle and cable setup was taken from a standard mountain bike and incorporated to fit our needs. The calipers we sent out were professionally milled out at WITC technical college in town from one of our previous HMV members attending the school. We previously had a custom mount that didn't work very well and used only a fraction of the brake pad; this year this new design will use almost the entire pad to stop. The caliper itself is also a standard mountain bike cable brake caliper and is mounted firmly to the custom brake mount. The caliper has a 1" hole milled into it to fit over the axle and vertical flats to match the others talked about in the steering assembly.

Power Train Configuration-

The power train consists of the engine, a centrifical clutch assembly, a 24" tire, around a 130 tooth sprocket, size 35 roller chain, and a custom engine and tire mount. The engine supplied to us is a standard 3.5 horse Briggs and Stratton motor and is mounted in the rear of the car along with the tire. The tire is pre-made for us and bought from a cycle store in Hudson, WI. The sprocket is a custom sprocket made a few years ago from a CNC program that students designed and sent to a professional company to be cut out to perfection. The centrifical clutch was also bought and came with the engine. We bought the chain and make it to the length needed ourselves with a link pusher and master links. The engine mount is made out of aluminum freeway sign material provided to us by a 3m-employee parent of an HMV member. We cut it in half because it was too wide for our use, so we then welded it back together and added bracing to ensure that no twisting of the plate happened

Safety items- One of the main safety items includes the 5- point safety harness and welded custom mounts to the frame. The roll cage and frame integrated roll bar completes the safety systems in our car along with the inside and outside kill switches and fire extinguisher.

Performance- The performance stage has not yet been addressed.

Daily Log Book

Sept. 3- Informational meeting and initial assembly of the hmv program for the year.

Sept. 10- Made teams and started throwing out ideas for this years design. Cody Simpson, Brandon Meister-place, and Tim Reuvers joined together to make the fourth and final car.

Sept. 17- Designs got put on hold for the sponsorship weekend, which included our annual smash and bash and community sponsorship. Sponsorships are essential to our every success and failure so we took out more time to collect finances through sponsorship.

Sept. 24- Designs put back on the table. Realize that the Bubble design is not the way to go from the previous year; it was too unstable for the steering. Whole team realized that our steering situation always has problems so we our homework was to find information on all types of steering there is and vote on which one was the best on the next Monday.

Oct.1- presented all steering types found and discussed. Top ones were the rack and pinion, and the classic tie-rod arrangement that we do. Our group chose the classic arrangement and wanted to engineer a better way to reduce the pressure on the arrangement.

Oct. 8- Base design is drafted. Analysis of other things we always have problems with - brakes, steering, weight distribution, engine, and pressure points. We chose the 3.5 brigs for our engine. This will eliminate our problem of getting up hills such in previous years. New brake design is introduced- new design will grip more of the material so it will stop faster. To reduce the pressure on the steering system we chose to use eyebolts to connect the axle to the wheel system. We wanted all three wheels carrying the same load so we move the axle back 2 to 3 feet from previous designs so it's up under our knees and carries more weight so that there will be less stress on the engine, hence better gas mileage.

Oct. 15- redrafted our base design with the incorporation of everything. Everyone took out time to teardown the past years cars except for one that we modified and planned to make it bigger and put a kick start in. We finalized our base frame designs and based our plans on all of our previous cars, combined the ideas keeping the good working systems and incorporating the new and improved systems to make the new model

Oct. 22- we started bending metal. Had problem with metal and it broke twice. Thought we had received the wrong aluminum but it was the correct kind. It

broke the first time because we kinked it in one spot and it cracked. The other time it cracked because we tried to bend it outside but realized cold metal doesn't bend that great.

Oct. 29- Cockpit floor completed by using horizontal braces to tie everything together and make it more rigid. Cockpit back and side completed by using bent bars for the firewall bar and rigid one inch tubing to make triangles in the side to make it as strong and comfortable as possible.

Nov. 5- welded together the Cockpit floor to the Cockpit back. Started working on the engine compartment floor. Engine plate is designed and drafted into AutoDesk Inventor.

Nov. 12- Finished working on the engine compartment floor and welded it to the passenger area floor. Began to work on the roll bar; cut, bent and welded it to the rest of the frame.

Nov. 19- finished roll bar and started and finished the mounting of the rear tire by using ¼ inch by 2 inch flat stock with the same exact slot in them and bending 2 exactly alike one inch tubes to make hoops for welding them to the flat stock and welded the assembly to the frame.

Nov. 26- figured out how to mount the engine, found out we could use freeway sign material, design was set aside for later use because other systems were more important to finish at the time.

Dec. 3- Began milling out axles that holds the tire assembly. We put the raw axle stock on the lathe and milled down the parts for specifications to put the tires on snugly, then we used the lathe to turn the treads into the end of the axle to put the nut on to hold the tire on.

Dec. 10- Continued to mill out axles. We milled down the flats for the brake caliper mounts. Ben, a previous HMV member introduced a similar, yet improved version of the brake caliper mounts so that we will use more of the brake pad to stop. Then we milled down more of the perpendicular flats to mount the axle to the ball joints, then to the axle. Then we milled down the inset for the tie rod to axle mounts. After that we finished the axles off by drilling the hole for the tie rod to axle mount and the ball joint bolthole.

Winter Break- Bent bars for the sides of the passenger area. Welded them to the car. Looked at axle mounts design. Axle mounts completed. Welded to the axle. Measured and cut webbing supports for car. Tacked webbing supports for the frame. Continued to mill out axles

Dec. 31- Christmas break holiday

Jan. 7- finished assembling axles for whole team. Realized that our main axle was cut too long. 5 inches over par. With the axle ends already welded to the axle we decided to cut main axle in two and re-weld it back together again after we had cut 2.5 inches off each middle end. This brought us under the limit, which saved us from cutting off the axle ends and re-welding the whole set up.

Jan.14- Welded axle to the frame. Leveled axle by blocking it up on foam blocks and tacking it so that it would be completely level and square to frame. Finishing welds on various parts missed previously on the frame. Tim used AutoDesk inventor and drew up our main systems; including our steering, our 5-point safety belts, drive train, firewall, and parts of the frame.

Jan. 21- finishing welds. Designed, cut, and drilled square flat stock for engine mounts. Made our own custom mount out of street sign material provided to us by a 3m-company member. It was first too wide so we cut it in half and shortened the width and added support flat stock and milled down and modified bolts to fit in the slot pre-designed into the material.

Jan. 28- Researched if adding oxygen would increase gas mileage. Tested our theories. Results are that it raised the RPMs of the engine and results were inconclusive for the gas mileage increase. We didn't want to blow our engine so we figured if we tried just adding a little oxygen to the engine would keep it from overheating yet give it better gas mileage.

Feb. 4- Completed support bars for car and welded them to the frame. Basic frame is completed and ready to start putting and incorporating main systems such as drive-train, steering, safety, covering, roll-bar, and all mounts for tires.

Feb. 11- Set and welded 5-point seat belt mounts, which, including the main roll-bar system incorporated into the frame which is designed to hold well over 300lbs, is the main safety system in our car. The other safety systems we have are a mounted fire extinguisher and kill switches in and out of the car

Feb. 18- Started creating firewall. Realized it would be tougher than we thought because of all the bends we did for the back supports. Started with the top of the firewall and worked our way down. We used paper presets to measure, trace and then cut out the sheet metal. Needed four pieces because of all the bends.

Feb. 25- Set and welded steering column into place. This took a long time to make sure it was level with the axle, the tie rod ends and the ground. Realized

that the main axle was tilted in a bit but didn't need to be fixed because it wasn't that far off.

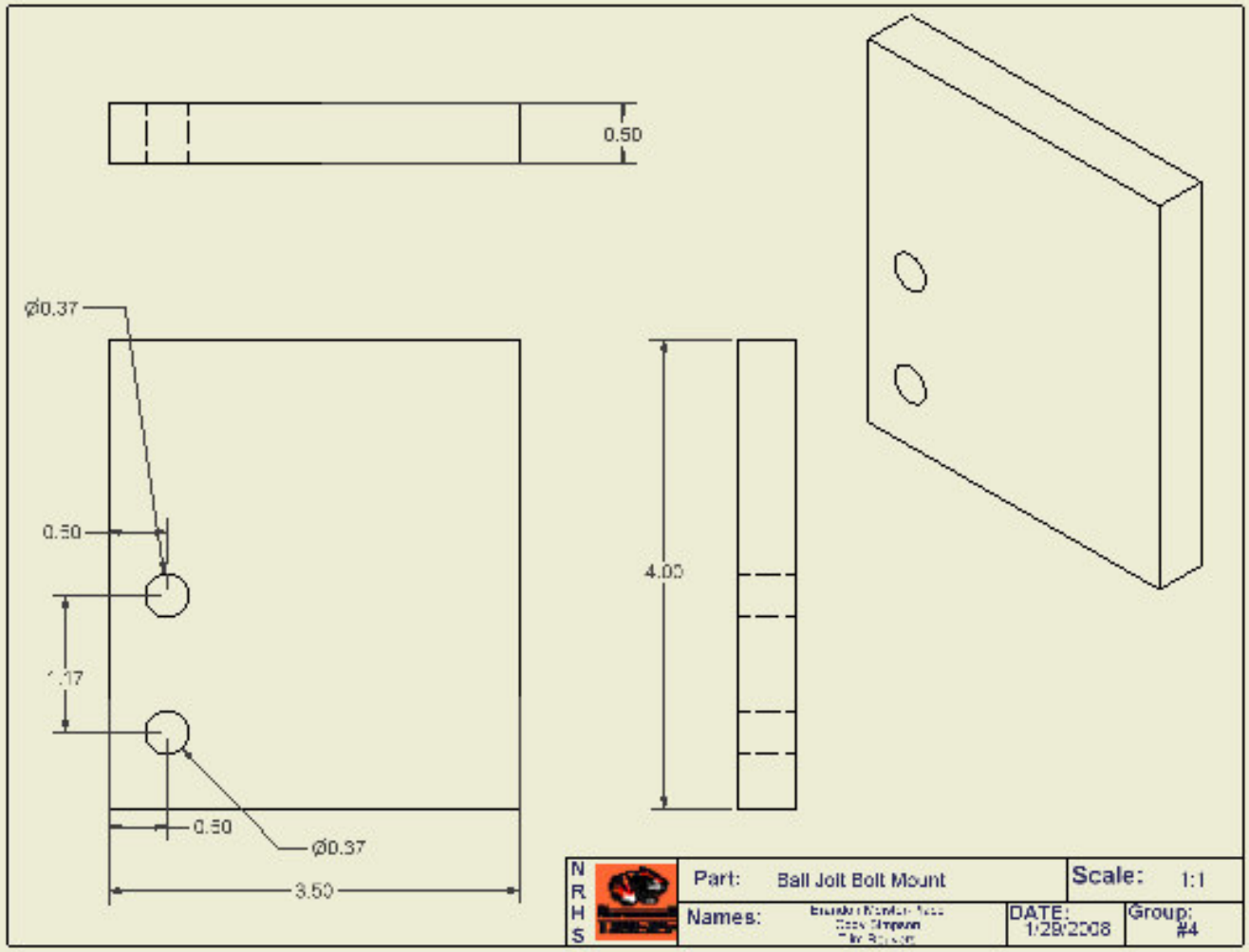
Mar. 3- designed and made the steering wheel, which was based off of last years removable steering wheel, which originally came from a basic airplane steering wheel design. We then welded it to the steering column. We then realized there was no room to get in and out so we made our own custom all aluminum knuckle-joint and incorporated it into the steering column.

Mar. 10- the larger tires that we based our design off of were being used by another group. This created a problem because our perfect clearance wasn't perfect anymore; it ended up being about a ½ inch of clearance, which was clearly not enough. Added half inch flat stock piece to bottom of the axle to accommodate for the loss clearance. We then drilled a hole into the flat stock by using blocks and a level to get the axles completely level to the axle so everything would be welded on square, then we could put the second eye hook in. After that we assembled the axle and put the tires on and found that we had corrected the clearance problem.

Mar. 17- Measured and cut tie rods to length. Threaded tie rods to specifications for tie rod ends, which was 3/8 24 thread. Tried to put tie rod ends on, realized they were very dirty so they needed to be re tapped to fit on good. Forgot to accommodate for the ends by subtracting an inch by both sides. Trimmed down the sides and fit good.

Mar. 24- Steering is completed and took for a test drive. Slop noticed and planned to correct. Corrected steering problems by adding material to oversize then milling down until a perfect no slop fit. Engine was test run and needed to be tuned.

Mar. 31- Built and welded the holder for the gas tank. Decided on color for our car. Blaze orange frame with a navy blue monocoat. Prepped car for paint over the weekend, took off front and rear tires, took off engine, took off tie rods and axle assemblies. Once ½ inch tubing comes in we will have our front and back canopies.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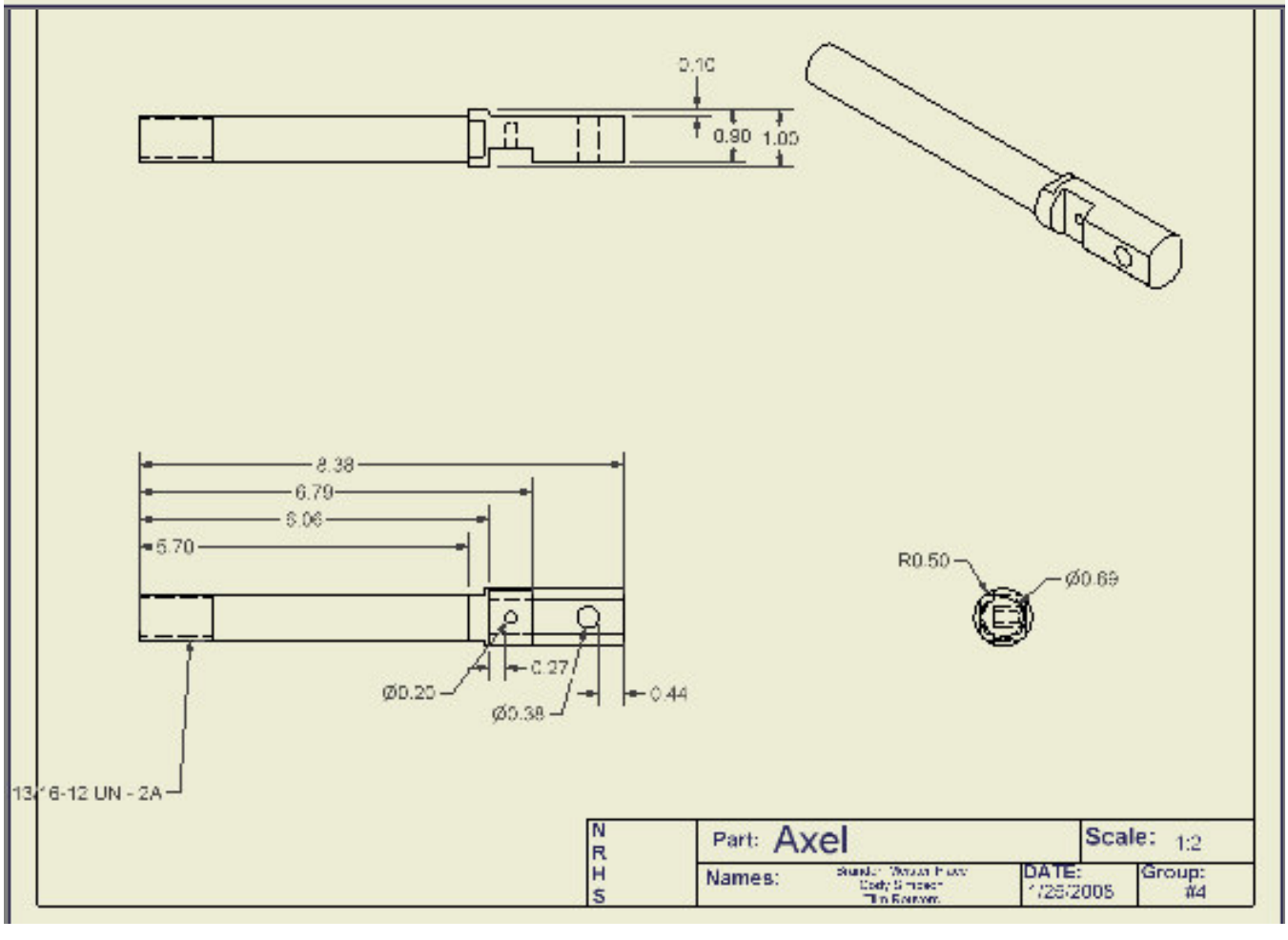
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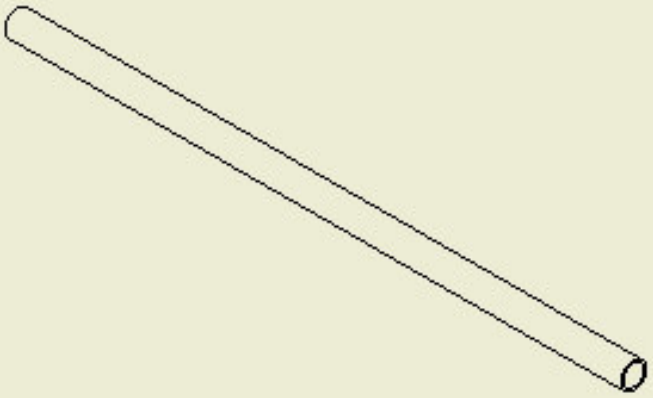

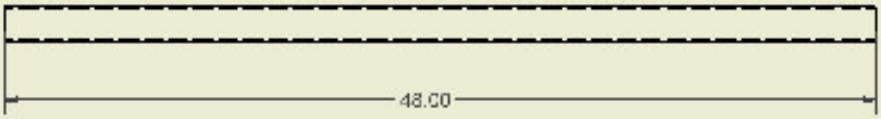

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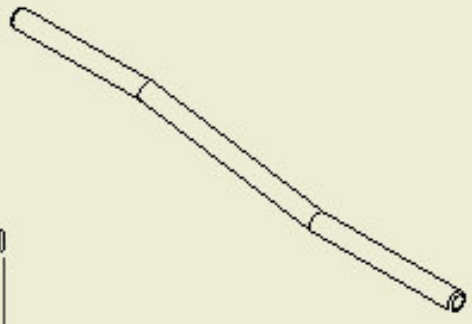

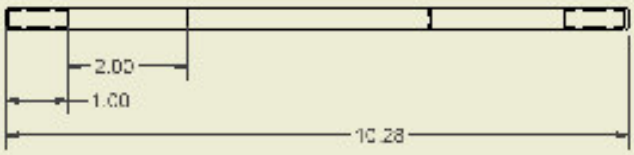

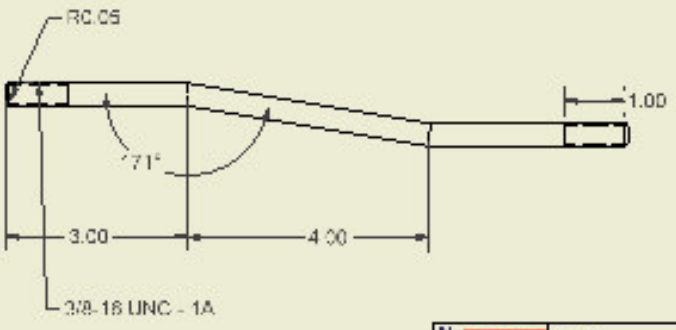

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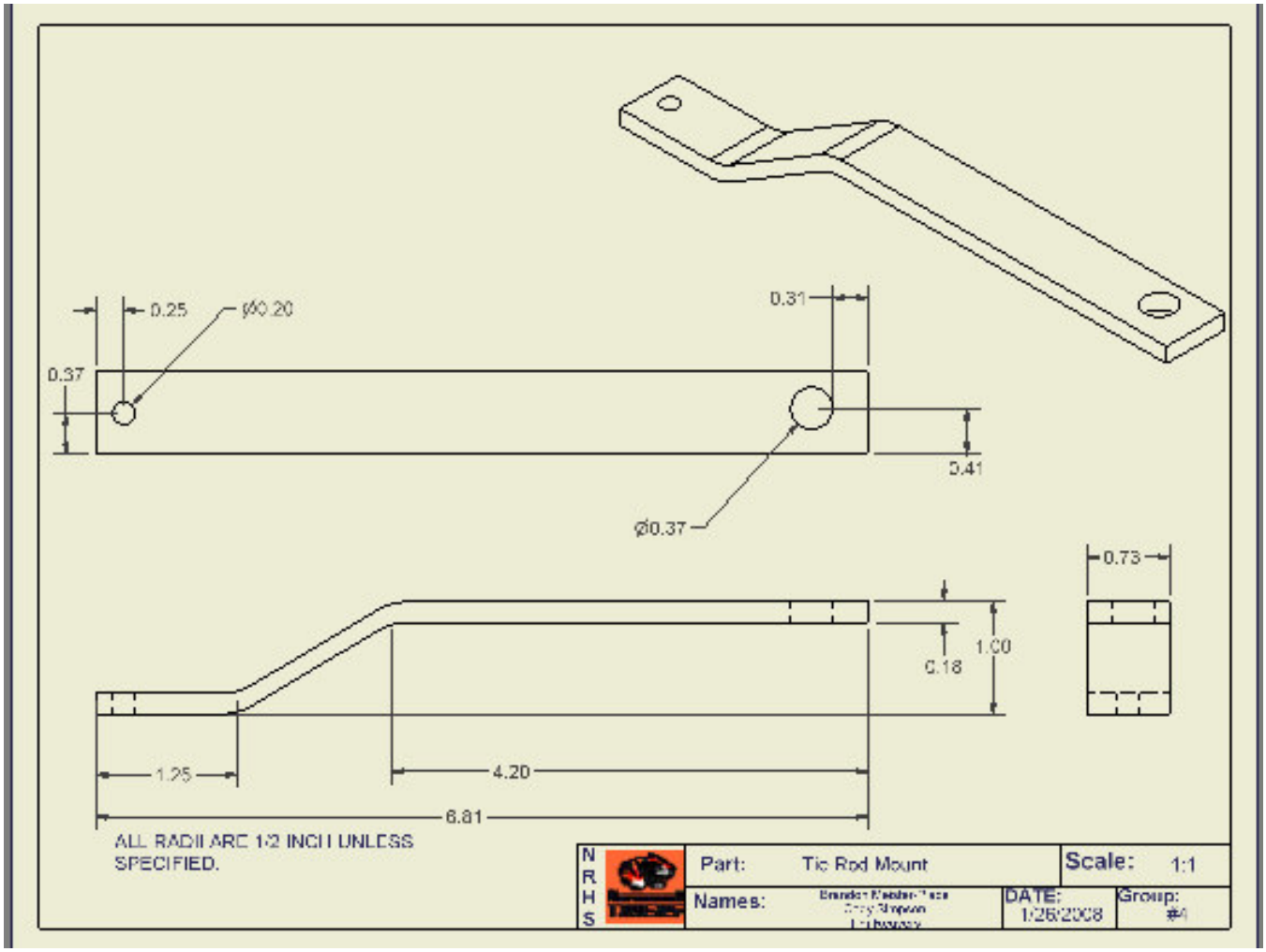
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