



New engine, new decade

2010 CHASSIS DELIGHTS

Inside this Letter

Cooling Innovations	2
One Cylinder Thumps	3
Our Sponsors	4
Drivetrain on Track	5
Electrocution Extraordinaire	6
Contact Us	7

Construction on the 2010 Chassis is well underway. We currently have the front mostly welded and the rear tacked. This chassis is 6 inches shorter than last years, measuring in at approximately 82 inches in length. The nose of the chassis is unfortunately slightly wider to accommodate the newly implemented template penalties.

The 2010 Chassis was designed to be 54 pounds before mounts and the carbon floor with a torsional stiffness value of 800 ft-lb/deg. We had the chassis tubes sent out to be CNC notched by Cartesian Tube Profiling. We spent an extra couple weeks getting the model correct in Solidworks, the program that Cartesian uses, but the time saved was tremendous. We sent out the files and had the tubes back within a week and a half. We have moved at a careful steady pace making sure all the tubes in a sec-

tion fit up before moving forward. Overall we've spent about 3 weeks thus far on putting the chassis together. This is much faster than in years past. This process should be continued in the future because the time saved far outweighs the cost. We only spent \$1500 on top of the material costs to have this process done. This amount reflects the \$900 discount given to all FSAE teams by the company.

We are also implementing another new process in the chassis this year. During the construction of the chassis we have taken care to make sure each tube is vented into each other with the intention of pressurizing the chassis tubes with nitrogen. This will enable us to detect a crack in the chassis if one is to develop. This process will also help combat corrosion from the inside due to the inert nature of nitrogen.



ON VT MOTORSPORTS.COM

A Twitter feed has been added to the VT Motorsports homepage that will be used to post updates of progress on the 2010 car. The use of Twitter, Twitpic, and Twitvid will allow the team to post up-to-the-minute media updates including dynamometer videos, fabrication progress, and upcoming events the team will be attending. Twitter will allow alumni to hear more frequent updates without waiting for monthly newsletters, follow VT Motorsports on Twitter!



Cooling Innovations

For the cooling system on the 2010 formula car big steps have been made in the way of testing. With the assistance of Dr. Ekkad, Dr. Poquette and Dr. Thompson, it should be one of the most efficiently designed radiators at competition. To design the cooling system, new techniques such as computational fluid dynamics, HTRI and wind tunnel testing are all being utilized.

The 2010 cooling system will also utilize proper ducting through a diffuser-nozzle duct and fan. To optimize the ductwork, CFX, a computation fluid dynamics program, is being used to find the



optimal geometry with minimal flow losses. The improved duct work combined with a thinner radiator (1" vs. 2.75") will drastically improve the flow through the radiator. This will have a significant effect on the efficiency of the radiator while allowing us to run a much smaller radiator, thus saving weight.

With the help of Dr. Ekkad, wind tunnel testing, a VT motorsports first is also taking place. New material called graphite foam is being researched for potential use on the fin design of the radiator. Graphite foam has a higher heat transfer coefficient compared to aluminum, but it can cause a higher pressure drop if the fin design is not optimized for the speed. To test the advantages of this, the 05' car's radiator has been set

up for wind tunnel testing and a comparison run between aluminum fins and various graphite foam fins will be taking place this and next semester. Dr. Poquette's new soldering process allows the graphite foam to be bonded to aluminum, something which was not possible before.

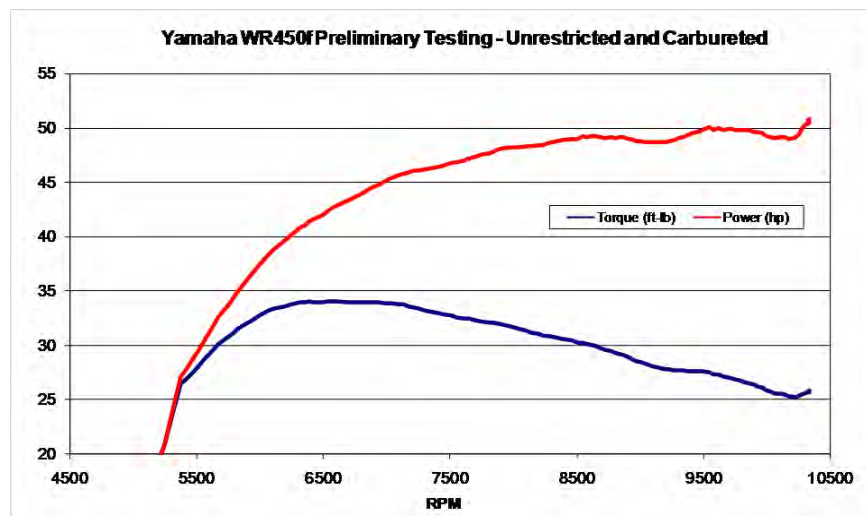
"The improved duct work, combined with a thinner radiator (1" vs 2.75") will drastically improve the flow through the radiator."

Pressure transducers, thermocouples and even an infrared camera will be used on the wind tunnel to show temperature and pressure gradients across the entire radiator. With this information critical areas can be identified and improved. With the new technology and testing, the 2010 cooling system hopes to be the most efficient and reliable system that Virginia Tech has ever had.



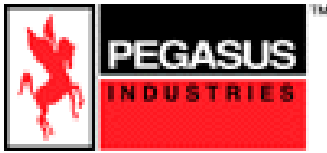
One Cylinder Thumps

The 2010 team has begun the extensive process of troubleshooting and tuning our new engine platform, a Yamaha WR450f single cylinder motor. The switch from a turbo-charged Honda CBR600 to the new single cylinder has introduced many issues that are being worked through. We have converted the single cylinder from carburetion to fuel injection with the addition of a crank trigger wheel and a cam sensor. The MoTeC M400 engine control unit has also been adapted to control the single cylinder. The summer was spent re-vamping the dynamometer room in the basement of Randolph as well as implementing the new motor. All engine components needed for testing were manufactured and the engine was mounted on the dynamometer to begin troubleshooting. The motor was started for the first time on MoTeC and in fuel injected form in the middle of September. However, numerous problems appeared and it was found that fuel was finding its way into the oil. Therefore our original engine was pulled off the dyno and disassembled to find the source of the problem. In the meantime another motor was sourced and ordered to continue the testing and troubleshooting. As soon as the fuel and ignition base maps are set, the engine team plans to do multiple rounds of testing. The testing will include the effects of runner length, plenum size, exhaust primary sizing, and restrictor length on the power band of the motor. The 2010 team has high hopes of achieving the same torque and power curves as seen in the preliminary unrestricted and carbureted testing. A video of the preliminary testing can be seen on YouTube.com by searching "Yamaha WR450f Dyno Testing Compilation" and the results are shown in the plot below.





We Thank Our Sponsors



Drivetrain on Track

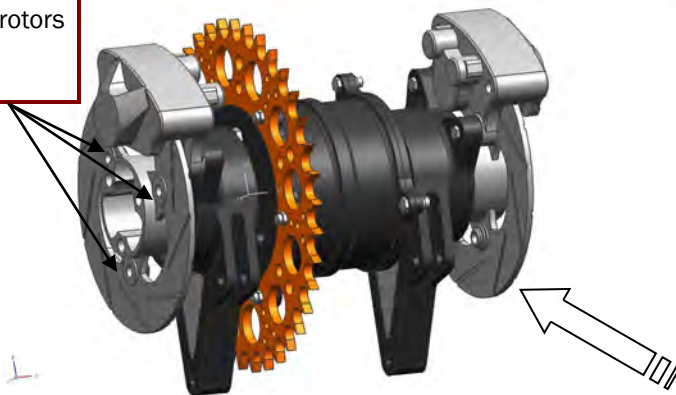
Custom CV Stubs

The 2010 CV system is a custom design featuring a "4130 like" steel called *Flexor*. The material was donated from Pennsylvania Steel Corp. and the custom machine and heat treat was donated by a sister company Pegasus Industries. The design allows for a floating rotor to be positioned around the tripod housing of each inboard stub. This de-



sign allows a reduction of the rotational inertia of the brake rotors by 36% and an increase in surface area of 15% for cooling. The braking forces will be removed from the torsen, relieving the unnatural understeer into cornering caused by differential braking, and sent through the new CV rivets and downstream through the halfshafts.

Notice the three rivet mount design between the rotors and CV axles



Gear Indication

Shifting will be managed by MoTeC M400 ECU. All 5 gears will be kept on the 2010 car. The gear position indicator seen above will be coupled with a calibrated potentiometer. The corresponding position of the shifts will be associated with certain voltages, which our MoTeC M400 will read as specific gears. Since neutral is halfway between 1st and 2nd gear, the MoTeC will have dedicated shift signatures depending on the current position of the gear. A digital display of the gear will be centered on the tachometer.



New wheel inners will be cut in house this year, along with the experimentation of carbon fiber outers. The blue machine wax has multiple uses; so far we have used it for verifying the code for the inners and the steering wheel and will soon construct a mold for the carbon fiber outers.

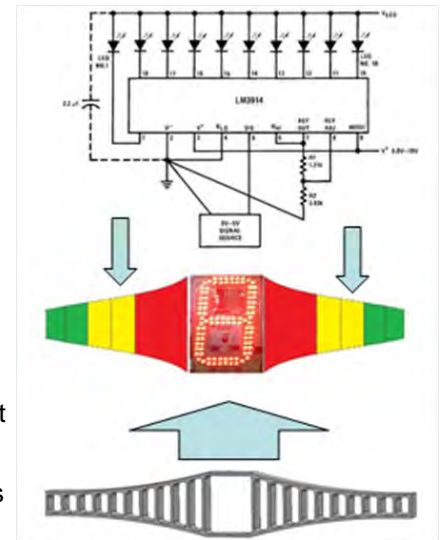
2010 Rear Assembly

ELECTROCUTION EXTRAORDINAIRE

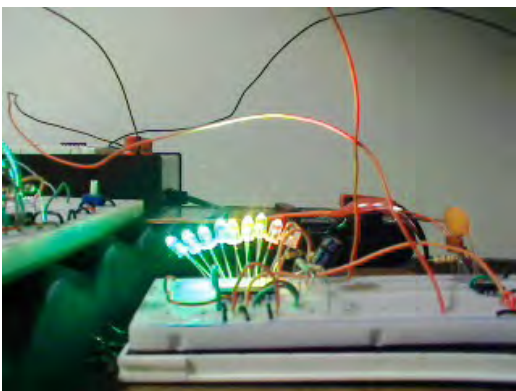
The Electrical team is buzzing with innovations for the 2010 team car. An electrical academic advisor Dr. William Baumann has joined our newly approved, two person Electrical Subteam. Our first accomplishment is the newly designed tachometer circuit and housing. Michael Lilly, an electrical engineering student, has taken it upon himself to redraw the schematic for the tachometer, build a working prototype, and follow through an engineering design process in order to evaluate the effectiveness of various light configurations. The result is a tachometer that will illuminate a number of yellow bars while the engine is within its power band. If the driver sees red and flashing, it is an indication that he or she should up shift. With green lights, the driver is in too high of a gear. The tachometer circuit will cascade from both directions outside of the driver's focal point on the dashboard and convene at the center, framing the gear indicator.

“The tachometer circuit will cascade from both directions outside of the driver’s focal point...framing the gear indicator.”

Power distribution has also been investigated and upgrades have been made to give all other components the juice they need to go fast. Our 45W stator has been overhauled and replaced with a 150W, current producing machine. An investigation of average power has led to a required current of 8.5 amps at any given moment. With a 150W stator, we provide this and more. The next step to powering this race car is to analyze the proper battery to minimize packaging, ensure reliability, and fulfill maximum power needs.



Finally, this month the team will be holding a meeting to finally establish a direction for determining the 2010 data acquisition system. The two options are an in-house build based on the new Intel atom series of compact motherboards and a National Instruments Compact RIOS DAQ. The RIOS will provide the team with an out of the box support for most sensors sans strain gauges, but will require extensive LabVIEW work on top of lead time, and a relatively large DAQ system. The in-house build, on the other hand, will basically perform the functions the team needs it to. The trade-offs are a longer build time, and more extensive testing than any other option. The current design decision is to use the Aim Pista MXL datalogger to its fullest potential, and build a better and cheaper thermocouple amplifier to receive EGT and other necessary temperatures to the Motec ECU.





Sponsors, Thank You

We sincerely thank all of our sponsors for their interest, time, effort, and technical and financial support they continue to provide to our team. Our ambition to learn and succeed continues to grow, and further sponsorships are cardinal to our progress. Thank you again for your support, and listen out for future updates.

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Questions? Comments?

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The purpose of this newsletter is to post formalized updates to our friends, sponsors, potential sponsors, alumni, and anyone involved with our Formula SAE senior design team. Feel free to give us feedback on our mission to fabricate a fast, quality, reliable, and safe formula-style racecar. Any questions or suggestions please contact Wade Harvey:

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