Michigan Technological University’s Formula SAE Team would like to thank our sponsors for their generous support.
Alumni and Sponsors of the F-151 and F-194,

As a team, we have reached our major milestones for the Fall semester. The team began the year with the task of installing the fuel-injected KTM 525 in the F-151 chassis. With that project complete, we had two drive days with our 2014 competition car! In October! Over the summer, Yamaha donated two Phazer Genesis engines for our 2015 competition car, F-194, which is currently under construction. One of the Genesis engines is running on the dyno. We designed a new intake for the KTM 525. McLaren racing created the intake on a 3D printer and helped the team develop an engine tune over Thanksgiving break.

The F-151 was two years in the making and the team is excited to bring a solid entry to Michigan International Speedway for the FSAE Michigan competition in May 2014. Also, before the end of Spring Semester, the team will have a drivable F-194 featuring the Yamaha Genesis engine (CVT drive) and new 10” wheel assemblies. We will also have design for the 2016 competition car based on the F-151 with the Yamaha Genesis engine.

We have a lot of challenges coming up with developing a new engine package and a CVT but we’re up for it! All team members have been working non-stop to make sure that the projects will be completed by their deadlines and in time to attend our upcoming competition. With the amount of work put in by all over the last few weeks it is safe to say that all of our goals will be met; which will pay off at competitions with us scoring higher.

We would like to thank you all again for your continued support and look forward to sharing our success this year with you!

The Michigan Tech Formula SAE Enterprise Team
Powertrain Update -- KTM Engine
The Michigan Technological University Formula SAE team is in full stride preparing for the Michigan Formula Series competition in May 2014 at the Michigan International Speedway. The powertrain team is working like a beehive preparing the KTM engine for its debut with the Michigan Tech team at competition. The KTM engine is a 510cc, two-stroke, naturally aspirated engine.

As mentioned, the KTM originally was a naturally aspirated engine that was converted into an Electronic Fuel Injected engine by a past senior capstone team. The KTM engine is currently finished with its dynamometer tuning in the team garage at Michigan Tech’s Advanced Technology and Development Center. Turning back the clock some additional tuning was performed at one of McLaren’s sites in Livonia, Michigan but the team faced several setbacks with the
During the first attempt tuning there was failure in a camshaft timing gear causing engine failure. Parts were ordered and the engine swiftly was rebuilt for tuning only to test again and find metal debris building up in the oil reservoir. Due to the large amount of debris in the oil reservoir, the team had to search for a new used KTM engine on a short budget. The team received the new engine on February 24th. To get the engine on the dyno and fully tuned to meet our competition deadline the team labored as quickly as possible.

Another great addition to the KTM engine is its custom designed intake manifold by a couple members of the Powertrain team. The intake was designed to maximize power with a naturally aspirated engine as opposed to turbo charging the intake which the team was hoping to attempt. The intake manifold runners were designed to target specific rpm bands at which the car will operate to increase volumetric efficiency within those desired rpm bands. To broaden the torque curve, the new intake manifold is a variable design featuring two different length primary runners; for increased mid-range power, a longer runner is used. As the engine rpm increases a linear actuator will open a valve allowing air through a shorter runner. The lengths of each runner have been tuned using Helmholtz theory and this new variable intake manifold has been named the “MTUNED” intake. Along with that addition, the powertrain team and controls team have been working closely on a closed loop shifting system. One of the powertrain team members has designed and manufactured a new clutch master cylinder to be mechanically actuated with a mechanical hand clutch. The control team is working to enhance the system with push button activation to eliminate long shift times, and also assist drivers to learn how to drive the car faster and easier.

**Powertrain Update – Yamaha Genesis Engine**

The Michigan Technological University Formula SAE team is gearing up for the Michigan Formula Series competition in May 2015 with an entirely new engine package and drivetrain. The team will be mounting a Yamaha Genesis 80FI Engine into the MTU F-194 vehicle. The engine is a four-stroke engine with a 499 cubic centimeter displacement with electronic fuel injection.

A large step forward with the Genesis engine is its implementation in conjunction with a Continuously Variable Transmission (CVT). The primary sheave along with the Genesis is from a Yamaha Phazer and the secondary sheave is from a Yamaha Nytro. This new driveline will dramatically change the operation of the Michigan Tech FSAE vehicle and remove the issues the team has experienced in the past with
various shifting systems. This is the first year a CVT has been used by Michigan Tech’s team and the capstone team has been learning a lot this past year to prepare the team for new challenges to be faced.

The Genesis engine project is being lead by a senior capstone team of four engineering students with a lot of support from the subteams. The project is progressing rapidly and constantly meeting or exceeding deadlines. The engine was successfully mounted and run on the dyno by March 28th of 2014. On April 11 it was successfully mounted in the chassis of the F-194. A few challenges that the team has faced thus far is a working wiring harness for the engine and the width of the Genesis with the primary sheave installed. Other challenges that the team may encounter in the future are tuning the CVT, durability of the rubber CVT belt when running in hot summer conditions, and sufficiently cooling the engine without the heat exchanger used on the stock Phazer.

The Genesis engine project is still in its early development for the 2015 competition so there are other projects that the powertrain may see in the future. The team still must complete a full tune for the engine on the dyno with the required restrictor in place, a tough challenge for the powertrain team. A new intake must be made to comply with competition rules. There are the possibilities in the future of installing a turbocharger on the Genesis or boring it out for greater displacement. With the help of sponsors like you, the Michigan Technological University FSAE team will continue to learn and succeed in our efforts at competition and shape some of best engineers in industry.
Chassis & Structures Sub-Team Update - F-151

The F-151 is powered by a KTM single-cylinder 510cc and uses a traditional finite-ratio transmission. The F-151 was originally designed for the Honda F4i the team had ran in past years; however, due to the issues experienced over the past year with the F4i and the fact that a capstone team had delivered the KTM for our use, the decision was made to switch.

During the year the F-151 was retrofitted to function with the KTM, and some brackets on the rear box were changed. Once the team completed the necessary modifications, the body was filled, sanded, and professionally painted over Thanksgiving break (November 25, 2014 through November 29, 2014).

This semester, the chassis team was busy rebuilding the F-151 after painting. All new hardware was used to put each corner back together. Additionally, rigid brake lines were installed along most of the frame in place of using only flexible line as in the past. The flexible line was convenient as minimal fittings were needed, but created issues as it didn’t route nicely or stay put once it was routed as well as the rigid lines did.

The Torsen differential was rebuilt this semester as well, and new brass bushings were made and pressed in.

Due to the engine change, a new gear ratio was needed, and a 32 tooth sprocket was selected. The sprocket was manufactured with wire electrical discharge machining (EDM) from a ¼” thick 7075 aluminum plate, and a computer numerical controlled mill was used to create the pockets that allow the two halves to interface.

The F-151 was completely reassembled and the chassis team finalized the ride height on April 1st. Due to weather conditions in Houghton, even though the car was ready to drive, there was nowhere to drive it due to the large amounts of snow the area was still receiving. As soon as parking lots clear up the team will be ready to test.
Chassis & Structures Sub-Team Update - F-194

The F-194 will be powered by a Yamaha Genesis 80FI, and will use a rubber belt-type continuously variable transmission (CVT) with an intermediary jackshaft to deliver power to the rear axle. The primary CVT sheave is from a Yamaha Phazer snowmobile, and the secondary sheave is from a Yamaha Nytro snowmobile. The jackshaft will connect the secondary sheave and a small 12-tooth sprocket. The power then is transmitted via a chain to a large 48-tooth sprocket mounted on the rear differential, to a cam-and-pawl differential from the front axle of a 2002 Honda TRX500 Rubicon four-wheeler. In past years, Michigan Technological University FSAE has used a Torsen differential, but the cam-and-pawl implemented for the F-194 is much smaller. Due to the size difference and the F-194 having the same rear track width as previous cars, fabrication of new half shafts were required. Due to the lack of required splining equipment the shafts were machined externally.

Work on the F-194 is progressing well. The deadline for having a fully welded chassis is upcoming, and the chassis team is on track to meet this deadline. As of the time of this writing, all of the structural tubes have been made and are in the process of being tacked and welded together, with an estimated completion date of April 5th, 2014. Additionally most of the miscellaneous mounts have been completed and are ready to be welded on.

Apart from the frame, there are several relatively large machining projects ongoing. Firstly, the bellcranks are being cut with a CNC mill from 0.160” thick 6061-T6 aluminum plate. Secondly, removable tube inserts are being made from 1.0” OD steel bar stock. There will be eight total inserts used in the car, four to allow the primary CVT pulley to be removed with the engine installed in the car (for tuning purposes) and four to remove a tube and aid in the ease of removing the engine from the car.

The F-194 is taking shape, but there will definitely be a lot of work yet required to get it ready for competition in May of 2015. However, the Michigan Technological University FSAE team is up to the challenge!

Electrical & Controls Sub-Team
This semester, the electrical and controls sub-team has been working hard to get the car ready for competition in May. The KTM wiring harness in the F-151 has been modified from the initial harness used in the fall. These modifications included switching from a combined Manifold Absolute Pressure sensor (MAP) and Intake Air Temperature (IAT) sensors to a Bosch T-map sensor. Other modifications were made to make the car look more organized and operate more efficiently. The harness has also been documented to make troubleshooting and future modifications easier to perform. This documentation will also be passed down to future formula members to allow for a better understanding of the harness.

The wiring harness for the F-194 Phazer engine has been another project on the electrical team. This new engine required a whole new wiring harness, different from the KTM. The dynamometer harness for the Phazer has been wired and is awaiting the last few modifications.

The electrical and controls sub-team has also been working on designing and soldering a brake light for the car. The brake light circuit board was an original design done by a member of the electrical and controls sub-team. The board was then passed down to another team member to be soldered and placed on the car. A special housing was also made for the brake light to make the overall appearance look more organized and professional.

The team has also been working on programming an Arduino to be implemented into the car. The Arduino will be used to produce a heads up display (HUD) on the steering wheel that will display the temperature of the engine and the RPM. This will allow the driver to get a better understanding of how the car is running during competition.
Team President: Alisha Clark

Alisha, a sixth year dual major studying Mechanical Engineering and Material Science Engineering. She has been a member of the Formula SAE team for five years, president for five semesters. When asked why she joined the team she said “I have grown up working on cars, spending time at race tracks, and restoring cars. I visited the shop during a summer youth program, and knew then that I wanted to be part of the team.” Alisha has honed in many leadership skills by co-leading a chassis design team, making sure that the team makes good progress, and team morale is maintained. Upon graduation she has accepted a full time offer to work at Honda Manufacturing of Indiana, LLC. “Formula has been a great experience and I will miss it” she said, and she will be missed as well.

Chief Engineer: Chais Eliason

This is Chais’ fourth year studying Mechanical Engineering at Michigan Tech. He has been a member of the Formula SAE enterprise for three years. When asked why he initially joined the team he said, “I have always had a strong interest in motor sports. My family began racing in 1952 and [they] have been involved in motorsports [in] one way or another since then.” He hopes that this enterprise experience will help him apply the lessons he has learned in the classroom to real world situations. He also likes that he can experience the entire engineering loop from design to final product. Chais has had the opportunity to develop his leadership skills by managing all of the engineering design this semester. As well as his position as Chief Engineer, Chais was formerly the Chassis Sub-team Leader. After graduation in Fall of 2014; he hopes to find a career in motorsports. Racing oil has circulated through his veins since a young age and he can’t imagine doing anything but working in motorsports.
Chassis & Structure Sub-team Leader: Doug Wojcik

This is Doug’s fourth semester on the Formula team and his fourth year at Michigan Tech. He joined the team because of his interest in racing and cars in general. He really enjoys spending time in the shop. He hoped that the Formula SAE Enterprise would afford him experience working in a team, as well as, design, build, and validation experience. “Mostly I just wanted to be around race cars and a shop while at school.” Doug holds the titles of 2013 Wissota Street Stock WI State Champion and 2nd in Wissota Street Stock national points. Again, he really likes racing and the Formula team has given him the chance to stay involved through school. Doug has really enjoyed the challenge of being a team leader. Doug says that one of his main goals as a leader was to “improve the quality of the work done in our shop.” And he has! We have already made great strides in this from simple things such as rearranging the shop, cleaning, buying needed tools, and keeping a generally positive attitude and recognizing quality work from members. After graduation, Doug wants to race for a living, more specifically, work for a race team as an engineer. Doug really enjoys the challenges of race car setup and creative solutions to improve handling.

Electrical & Controls Sub-team Leader: Craig Thole

This is Craig’s third year on the Formula Team and his fourth year at Michigan Tech. He joined the team because he has always loved working on cars and the Formula SAE team had a need for electrical engineers to make the various electronics function. He hoped that by joining the team he could work on the vehicle electronics as well as increasing his practical knowledge of electrical systems in cars, that he would learn how to troubleshoot problems in an environment other than the laboratory setting. He also hoped to meet new people and gain leadership skills. Because of the Formula team, Craig has gained new friendships, practical experience troubleshooting various parts of the racecar (not just the electrical portion), and time / project management skills, almost exactly what he hoped to gain when joining the team. Through his involvement on the team, he has learned a bit about how to deal with difficult situations when faced with a tight deadline and how to work in a diverse team environment. Along with his leadership role on the Formula team, Craig is also the Treasurer of Eta Kappa Nu (HKN). After graduation, Craig would like to design controls in a manufacturing environment, preferably in the automotive or powersports industries.
Powertrain Sub-team Leader: Steven Wenzel

This is Steve’s fourth year here at Tech and he has been a part of the formula team ever since his first year. He joined Formula SAE due to the desire to be a part of a larger team who also had a common passion for designing, building, and competition of race cars. In joining the team, he hoped to be able to gain a better understanding of how a larger team works together on a large scale project such as a Formula car. He also was looking to gain knowledge in the automotive and power sports fields in which he eventually hopes to make his career. One of Steve’s main accomplishments in formula is the development of the new KTM engine package. This was a project that he started as a first year on the team and has been a part of ever since. Now as the powertrain team leader he will be overseeing the final work on the engine package and the use of the KTM at competition this year. “Formula,” Steve says, “has provided me with a much better understanding of the powertrain development of a race car.” It has showed him the amount of design and validation that must go into the package to ensure performance and reliability. Also it has helped him to understand how to be an efficient leader and the skills needed for product development. With these skills gained from Formula SAE, Steve plans to become a more effective Mechanical Engineer after college and in his future career!

Budget and Marketing Manager: Karl Evenson

This is Karl’s first year on the Michigan Tech Formula SAE Team and his first semester as the Budget and Marketing Manager. He joined the Formula SAE team because of his interest in the automotive industry more specifically chassis design. Karl says that, “formula has helped him to make many new friends and has provided [him] with many new leadership and teamwork skills.”

As a third year student studying Mechanical Engineering, student he has helped to design the new chassis as well as his roles developing competition documents and managing the team’s spending.
During these past two semesters the FSAE dyno-cell has undergone several improvements thanks to our sponsor Denso. Currently the Formula Team, Clean Snow Enterprise, and Super Mileage Enterprise all share the same room for their dyno cells. Thanks to the efforts by Denso these cells have been made safer by adding cinderblock walls between each cell in case of an accident. Safety is always a top priority for a positive working environment in the team shop. The Formula team’s dyno cell had other improvements added as well; a new protective barrier was constructed by members of the Powertrain team to separate operators from the running engine while tuning. This is important for the safety of students operating the dyno cell who are trying to tune the engine for competition. Other changes that the team is performing on the dyno cell include optimizing floor space with new cell layout, water cooling tower for liquid to liquid heat exchanger to cool the engine during dyno operation, installing new accurate throttle control and improving lighting within cell.

Some of our other sponsors have hosted information sessions for our teammates to help learn about the aspects of the Formula Car. Chrysler engineers hosted an online webinar aimed towards engine calibration and tuning techniques/general tuning tips to assist the team. Ford hosted an online webinar for several SAE teams that were geared towards powertrain topics that much of the powertrain sub-team was able to attend and learn from. There have been many other ways our wonderful sponsors have assisted the team as well therefore do not be discouraged if you were not listed here, your assistance is greatly appreciated.
The team would like to thank all our sponsors for the assistance they are able to offer in regards to advice for the team. The team hopes that we can continue to utilize your assistance to help our team achieve success in future competitions and the careers that lay ahead of us.

Some of the current needs that our team is struggling with are obtaining new bearings for our KTM engine to be rebuilt, assisting in how to tune CVT transmission, CVT dyno construction and operation, as well as building a “piggyback” data acquisition system for a phazer engine to assist in calibration. If any of your engineers have experience in these categories and would be willing to offer assistance to the team we would greatly appreciate your expertise. Not only would it benefit our students to learn more about the vehicle, but it will also offer your company some individualized discussions with great engineering students at Michigan Technological University! Please feel free to contact Chais Eliason (cteliaso@mtu.edu) if you can assist with any of the above topics.

How Can You Help?

Whether you are a past member of the team, a long time sponsor, or someone with a new interest in the team, we are always looking for more help. You can donate through the Michigan Tech Fund, found online at https://www.banweb.mtu.edu/mtu/mtf/gift/give.xsql?desig=7300-Annual-Fund, and designating the money for the Formula SAE Enterprise. Some companies will even match an employee's contribution! Find a copy of this newsletter on our website: http://sites.google.com/site/michigantechracing/ and find us on Facebook! Michigan Tech Formula SAE.