Greetings supporters and friends!

Welcome to the 2013 Formula Hybrid Competition Season! We are incredibly excited to be designing Dartmouth’s first all-electric race car. Big changes within the team since last year have gotten us off to a promising (albeit slightly slow) start but will ultimately allow for better integration with and expansion within the Dartmouth community.

2012 Update

To bring everyone up to speed, the 2012 competition was a resounding success! Ellie, the 2012 race car, operated on a hybrid powertrain, using a single-cylinder 250cc Honda gasoline engine and an 18kW electric motor. The DFR team placed fifth in the Hybrid Competition, and won third place for both the Ford Efficiency Award and the GM Best-Engineered Hybrid Award.

So we congratulate last year’s team! We also thank last year’s team for leaving us an awesome car; nearly everyone who had worked on the car last year has graduated and moved on to bigger and better things. The lack of a returning force to drive this year’s team has presented the new team of leaders with an opportunity to drive the team in a new direction.

Club Restructuring

Taking Initiative:

This past summer, the class of 2014’s sophomore summer, a couple of us had expressed concern and frustration with our inability to get meaningfully involved in DFR in the past. A couple grew into a few grew into several grew into seven of us who were serious about taking over the abandoned club. We spoke with the club’s faculty advisor, Professor Collier, about how the club could be restructured to again return the focus to the entirety of Thayer School. We learned that the previous teams had difficulty managing an organization for undergraduates because they were all working on their capstone engineering design project for ENGS 89/90: Engineering Design and Methodology, and didn’t have time to treat DFR as an extracurricular club, but rather focused on it as an academic project. Collier agreed that while DFR did provide ENGS 89/90 students with a great cumulative engineering experience, it did not lend itself well to undergraduate involvement, and encouraged us to push for more of an open undergraduate club. The club would work alongside the 89/90 students but would be organized and run by students unaffiliated with the class.

With high hopes and lots of interesting ideas, seven ’14s (Sean Hammett, Scott Brookes, Will Jewett, Erik Skarin, Paul Hogan, Eric Din, and Arthur Bledsoe) met and decided to elect Eric and Paul as the Dartmouth Formula Racing Team’s 2013 Captains, while the rest would serve as sub-team captains.

We still need your help!

Many many thanks to those who have donated. Dartmouth Formula Racing relies entirely on generous donations from our sponsors. For more information, please read on, or visit http://www.dartmouth.edu/~dfrr/
GETTING ACCQUAINTED:
Jumping into a leadership position of such a technical organization proved to have quite the steep learning curve. However, with awesome resources such as Professor Collier and Jason Downs, a shop instructor extremely involved with the previous team, we were able to begin to make a plan for our next race car as well as a grander vision for the club.

After much discussion among ourselves and with advisors, we decided that the best and most logical plan of action would be to split up 89/90 and the club. The capstone course’s students would continue to improve upon the current hybrid while we, the club (able to attract underclass engineers as well as non-engineers), would develop and build our own race car. This restructuring would allow us to work collaboratively with (and yet relatively independently from) the 89/90 projects and function as a club that gave undergraduates an opportunity to play a significant role in system design and implementation: roles that were usually reserved for 89/90 students.

Campus Involvement:
With our new club structure in place, we were extremely excited to involve more of the Dartmouth study body. Several activities fairs and many campus emails later, Rett’s Room in Thayer was packed with enthusiastic new members. Engineers and non-engineers alike have been getting involved and now have meaningful roles in the development of the new car. The picture above shows the team this year.

ELECTRIC EXCITEMENT:
Inspired by the mind-blowing performances of all-electric vehicles brought to competition by Kansas and Illinois Institute of Technology last year, we decided to develop an all-electric vehicle. Although Dartmouth has been building hybrid vehicles for the past five years, well before any of us arrived, we have heard (and watched YouTube videos) of the explosive power of the old FSAE 600cc ICE powered vehicles. We hope that a move to electric vehicles will bring back that excitement and power with their low end torque and high power density.

A PLAN FOR THE NEW CAR
Designing and building an entirely new car is a huge task, one not taken on by Thayer students for years. Here are our current major projects and the progress in each.

DRIVETRAIN:
With the traditional hybrid set-up, platforms from year to year stayed relatively consistent; there was no reason to deviate from the maximum-displacement 250cc engine. However, designing an electric powertrain from scratch allows for much more creativity. We could run one motor with a mechanical differential, two with a software-controlled electronic differential, or four with independently driven wheels. Oddly enough, the inventor of the GorillaPod articulated camera mount offered to build us custom electric motors. These motors would be small enough that they could be frame-mounted in the front which would allow for more effective regenerative braking than...
just rear wheel drive. Development of these custom motors started off well: a planetary gearset with reduction to our specs was integrated in a week, the size and weight proved to be perfect for our application, it seemed perfect! Too perfect, it turns out. Unfortunately, the manufacturer ran into problems with sourcing an appropriate controller and, seven weeks later, we're still without a solid motor option.

We had initially planned to make it to the 2013 competition with the new car, a plan that was doubtful from the beginning. Unfortunately, the delay in motor development has pushed us to look to 2014 and to rely on the 89/90 class to bring a car to the 2013 competition.

We are currently in the process of redesigning our drivetrain. We are deciding between a one and two motor design because without the help of our custom motor manufacturer, we don’t believe a four-motor system is practical.

Suspension & Uprights:
One of the biggest issues with the 2012 car is its lack of tunability. While the innovative monoshock suspension design developed by Thayer students a few years ago looks great on paper and in simulation, it has not been very effective from a handling perspective. With the new car, we are going to return to a traditional pushrod suspension system with a spring for each corner, allowing for more tunability. The 2010 team that designed the current wheel uprights came up with beautifully machined uprights. However, there are certain high-stress areas that have caused multiple failures. In the revision of these uprights, we will take a look at the failure areas and ensure that the next iteration of uprights do not fail under normal driving demands.

Chassis:
Once we finalize the drivetrain platform as well as suspension, steering, and upright geometries, chassis design will be finalized. There are several options moving forward from there. Our CAD model of the frame can be sent to a shop and they will laser cut and bend tubes that we can then weld together in house. Another option would be to outsource the entire operation to a chassis shop as was done with the current chassis. Stay tuned for updates!

The Plan for 89/90
BE students enrolled in 89/90 this year will be working on improving the 2012 race car. They have a team of six (split into two teams of three) ready to tackle the drivetrain and suspension. Their drivetrain team has decided on an all-electric setup, utilizing a 87 hp max DC motor which should make for a blistering fast car! The suspension team will be keeping the monoshock setup in the rear but changing to a two shock setup in the front. They are a great group that will no doubt make great changes to the 2012 car and make an extremely competitive 2013 car.

Miscellaneous Updates
We have a new logo!
This year, the team has a surprising number of studio art majors, minors, and wanna-bes. One of them (luckily, the SA major), has redesigned our logo. We think this is the first time in ten years that the team has had an aesthetic refreshment, so thanks, Sean, for an awesome logo!

First Annual Car Show:
On October 14, DFR put its first annual custom, antique, exotic car show! We had emailed (spammed) every local car club and put up (plastered) posters all over the Upper Valley for the show. Eric made an appearance in the Valley News and on the radio to promote the show.

And it was a huge success! In the days leading up to the show, we kept getting new entrants and the list kept growing and growing... we were expecting nearly 40 cars to show. However, heavy rain the previous night and a steady rain throughout the day pushed that number to a still-respectable 25.

We even built our own trophies. We mounted old car parts on a piece of varnished wood with custom engraved plaques made in house. Here were the recipients of the trophies:

• People’s Choice: Tesla Roadster
• The Loudmouth (loudest): 1966
Jaguar E-type Race Car
• The Drive In (best date car): 1950’s Willy’s Jeep
• The Great Gatsby (best restoration): 1962 Austin Healey 3000 MKII
• The Outlaw (most illegal): Caterham Super 7
• The Bullitt (coolest): ’76 Ford Capri 2
• The Audrey Hepburn (sexiest): 1967 Jaguar MK2
• The Foreigner (best import): 1971 Citroen DS 21
• The Patriot (best American car): 1970 Chevy Camaro
• Captain’s Choice: 1929 Model A Boattail Speedster

People were so pleased with the trophies that the next day, we found the owner of the Tesla Roadster raving about the show and the trophies on the Tesla forum. DFR gained a lot of credibility with locals in the Upper Valley. We began planning the show as a fundraiser and quickly realized that we were just interested in seeing the cool cars on the Upper Valley out of garages and on the road. And that’s exactly what happened!

Sponsorship
This is an incredibly exciting year for DFR. It’s the first time the club has existed separately from the capstone engineering course. We have huge participation from non-Thayer students as well as Thayer undergrads. This means that more people are involved and more people are having meaningful, hands-on contributions.

But this also means our costs are high. Electric powertrains are extremely expensive, and the projected cost to improve last year’s car as well as build a new one is over $90,000.

We would like to extend huge thanks to MacLean-Fogg, The Byrne Foundation, Mr. Robert Zimmerman, and Mr. & Mrs. Dorros for their generous donations to this year’s efforts. Your donations have enabled the 89/90 team to purchase their entire powertrain - motor, controller, battery, charger, and battery management system.

Still, there is a long way to go in terms of sponsorship. If you are interested in becoming a Dartmouth Formula Racing sponsor, please visit our website at http://www.dartmouth.edu/~dfr/ or email us at dartmouth.formula.racing@dartmouth.edu.

We realize there has been a big change in leadership and club structure this year. And for those of you who have been involved in DFR for far longer than we have, we apologize if there has been any discontinuity or lack of communication this year. We hope that this newsletter is a good first step to keeping in touch with the DFR community. Please feel free to contact us with more questions, comments, or concerns about the direction of the club or the direction of this year’s car. And if you’re in Hanover, come visit and check in on us!

Sincerely,
Eric Din, Paul Hogan & the DFR Team