Editor’s Comments

Through this periodic newsletter, we hope to keep all the people who make this project possible informed about the exciting ideas and developments that make our team what it is today. This issue will mainly deal with our performance at the May 2005 SAE competition in Detroit, the car that we competed with, and what our approach to design will be this year based on lessons we learned from our previous entry. Thank you for taking the time to learn more about what we do, and we would love to hear reactions and feedback about the newsletter, design philosophy, or any other aspect of the team. Keep in touch, and be sure to check out our next newsletter which will include fabrication pictures of the 2006 car!

Lars Kanter

The 2005 Team and its pride and joy

The Competition

As this is the first newsletter our team has ever produced, we find it prudent to discuss the premise of the competition and our approach to design.

An annual, SAE (Society of Automotive Engineers) organized event attracting entries from 140 international universities, the competition is the largest collection of brand new race cars in the world. It takes place in Detroit, the automotive capital of the nation, and is supported mainly by General Motors, DaimlerChrysler, and the Ford Motor Company. The competition spans five days, and includes everything from a technical inspection to a rigorous design presentation, culminating in a grueling 22 kilometer endurance race. Events are broken down into static and dynamic categories and each are given a point weighting. Static events include a business presentation, design presentation, and cost presentation featuring an exhaustive cost
breakdown of each vehicle component. Through the static events, teams are challenged to prove that their car satisfies market demand for an amateur weekend autocross race car, was given sufficient technical consideration, and is cost competitive compared to other entries. Static events make up nearly a third of the possible 1000 points at the competition, with a total of 325.

Dynamic events include a skidpad test, drag race, autocross race, and endurance race. These are designed to test the steady-state cornering performance, straight line acceleration, transient vehicle performance, and the durability of the competing vehicle. They are equally a test of the driver's skill. To eliminate the dominance of a team with a disproportionately skilled driver, the dynamic events require a minimum of four drivers. Only 40 percent of the teams participating in the endurance on average complete it. It is an event that must be finished to be competitive, as the quickest competitor is awarded 300 points and the non-finisher awarded zero. Points for fuel economy are also awarded for the endurance event, 50 for the most efficient, zero for the car that burns more than 1.5 gallons, and scaled for amounts in between.

The Formula SAE competition is the most competitive collegiate design competition in the nation. It challenges the team's organization, technical competency, and its ability to provide an engineering solution to a real-world problem utilizing analysis, design, and manufacturing techniques widely used in the automotive industry today. Some say that a four year career in FSAE provides as much experience as several years in industry. We find it to be an incredibly demanding and rewarding experience that adds immense depth to the strong theoretical education we receive here at Brown.

Matt Gelb (left) and Saul Estrada (right), celebrate completion of the endurance event.
Team Outlook

Coming off a great 32nd place finish last year, we are excited to build on what was a tremendous learning experience. Given that we did not enter a car in the 2003-2004 academic year, lost the majority of the team’s experience with the senior class at the end of 2003, and underwent the most thorough technical overhaul in our program’s history, it is quite remarkable that we placed in the top 25% of all registered cars; this truly speaks of our potential for this year. Graduating only three team members from last year, we hope to take advantage of a largely intact knowledge base to improve upon last year’s design. We wish our graduates, Larsen Plano, Saul Estrada, and Kenji Harashima, the best of luck as they launch their careers in industry!

Spirits were high on our way back from the competition in Detroit, and after celebrating our achievement, we immediately began identifying improvements that could be implemented this year. It was clear that improvement in the dynamic events (autocross, endurance, skidpad, and drag) was needed in order to be more competitive, as an improvement in autocross and endurance scores would significantly improve our points total. We decided the best way to accomplish this was to get the car done as early as possible to maximize our testing time and allow for more driver training, reliability testing, and suspension tuning. To accommodate this plan, we set design goals for this year to emphasize simplicity and reliability, and significantly improve the quality of our driver controls including the shifting system, steering system, and pedals. At the top of the list in terms of simplification was the chassis, as the number of man hours to fabricate last year’s chassis was probably double or triple what we expected. We will concentrate on minimizing the number of tubes in the frame while still achieving adequate rigidity. It was also decided to allocate less resources to non-performance (pure reliability) based components such as the driveline, fuel storage and supply, and seat, and instead place more concentrated efforts on the systems that matter - suspension, powertrain, shifting, pedals, steering, and overall ergonomics.

Given the resources available to the team, it makes sense to shift from previously custom-made parts in the driveline, steering, powertrain, and brake systems to off-the-shelf purchased components. This will allow us to fully concentrate on and apply sufficient resources to the components that we choose to design and manufacture to our specification. As the team matures and our knowledge base grows over the next five years, we will gradually shift over to in-house components to maximize
the amount of engineering done by the students.

We wish to thank our sponsors on all levels for making this project possible. Without the funding, discounts, and in-kind donations they provide, our accomplishments would merely be dreams. Instead, we are able to realize our goals, and as a result gain experience and learn skills that will be useful throughout our careers. Needless to say, we do have quite a bit of fun as well!

The 2005 Car

I don’t believe our 2005 car was properly introduced, so here it is!

Chassis
Tubular space frame, powder coated red, a Brown tradition! 4130 steel tube, TIG welded, overall weight 65 lbs. Thanks to Plymouth Tube for their generous donation of the entire supply of tubing necessary to build our chassis!

Performance Electronics ECU, and was fully tuned on an engine dynamometer at Mason’s Automotive in North Scituate, RI.

Andrew De Donno setting up on the dyno

Bob Mason was able to provide us use of his facility and the benefit of his immense amount of knowledge for a minimal cost. With his help, we achieved a maximum of 85 horsepower through our mandated 20mm restrictor, up from 74 HP in 2003. Larsen Plano, one of our graduating seniors from last year, directed the design of the tuned carbon fiber/aluminum composite intake and titanium exhaust systems responsible for such a large improvement. We thank Larsen for his enthusiasm, dedication, and the mark he has left on this team.

Powertrain
2003 Honda CBR600 F4i 600cc motorcycle engine powered. Honda engineering has not failed us once as of yet. This year, our fuel injection and ignition was controlled by a
Drivetrain
Our pride and joy of the 2005 car. A custom in-house designed and fabricated limited-slip differential, drive shafts, CV housings, and drive flanges. Gears from a Ford escort open differential were modified to accommodate clutch plates for the Salisbury-type limited-slip system, and were housed in a custom aircraft grade 7075 aluminum housing. Drive shafts, CV housings, and splined drive flanges were all designed and fabricated by students from material donated by President Titanium. The use of titanium throughout the drivetrain resulted in the lightest drive system of any Brown FSAE car.

Suspension
A radical switch from our flagship solid-axle setup to SLA non-parallel independent suspension greatly simplified fabrication and design of our suspension linkages. Pullrod-actuated adjustable Fox racing shocks were packaged inboard and at the bottom of the chassis, driving down the center of gravity for improved handling and cleaner packaging. The move to welded steel sheet uprights from CNC machined aluminum uprights allowed for fabrication to be brought in-house, driving down costs significantly.

Steering
An in-house designed and fabricated billet aluminum alloy rack-and-pinion steering rack allowed for negotiation of the quick and windy autocross and endurance tracks at the competition.

Brakes
Student-designed CNC machined cast iron floating brake rotors on all four corners coupled with billet aluminum Wilwood calipers provided the braking torque necessary to quickly scrub speed off the car when entering a turn off a straightaway. Thanks to Texas Instruments for donating pressure sensors utilized in the analysis of braking performance.

Pedals
A two pedal setup allowed us to reap the benefits of left foot braking, eliminating time lost from transitioning between throttle and brake application.

Shifting
A sequential push-pull hand shifter teamed up with a hand clutch permitted the use of left foot braking while still providing an intuitive interface.

Seat and Body
A gorgeous one-piece carbon fiber, foam core, ergonomic seat provided plenty of lateral support and comfort for the driver during the grueling 13 mile endurance race. The carbon fiber body provided a lightweight and sleek looking means to protect the driver and compliment the aesthetics of the vehicle.