

A Model for Design

The team develops a design methodology with the 2005 intake.



The “Phantom Welder” tries out the completed frame.

2005 Vehicle Takes Shape

Brad Schiller

While the 2004 slogan approaching competition was “make it to work,” heading into this season, it became apparent that the team slogan would have to be more definite. “Make it to work” meant make it lighter, stronger, and easier to manufacture compared to previous years. The 2005 design took these things to heart and, with the help of many new members, produced a much better end product.

(Continued on page 5)

James Cuseo
Chief Powertrain Engineer

You have to learn to walk before you can run. The MIT Motorsports powertrain team kept this adage in mind when approaching the design for the intake system on the 2005 vehicle. Rather than try to break new ground with a revolutionary design concept, the team used 2005 as a learning experience; spending just as much time on the improving the design process as designing the intake system itself. “Engineered simplicity” is a term that can be used to describe the fruits of our labor. A well thought out, thoroughly justified design based on time-proven concepts has allowed the team to not only design a solid vehicle component, but also a process that will enable future teams to develop the groundbreaking designs of the future.

Three high level goals were set for this year’s intake design. First, the design should be well justified, with each and every design decision backed up with engineering reasoning. Secondly, the design should be complete to the smallest detail at the earliest stages, with every sub assembly and fastener represented in the CAD model of the system. Finally, empirical experimentation should be used to verify any analysis performed.

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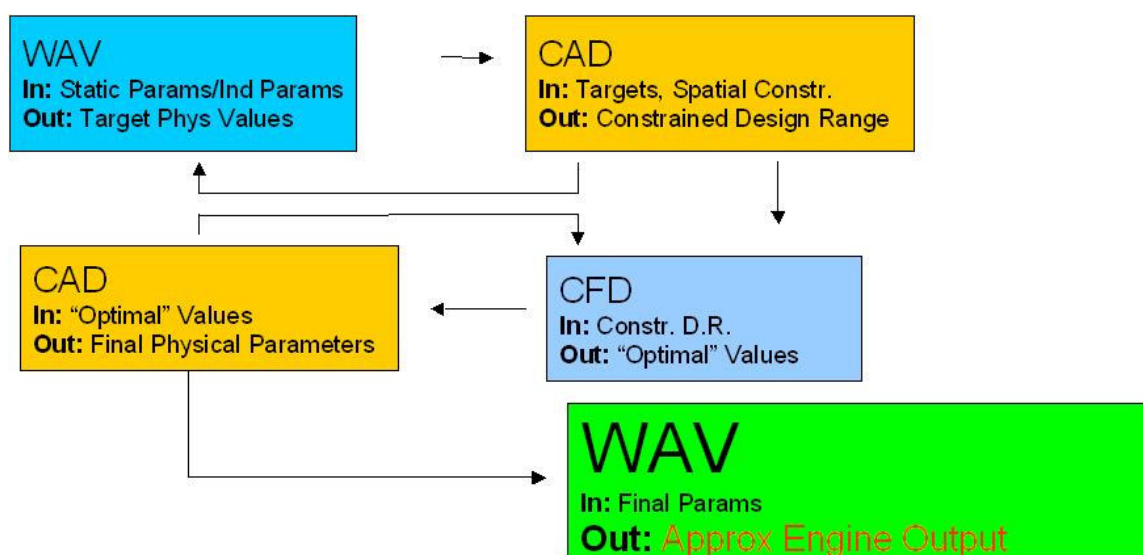
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The Tradition Begins . . .

(See page 6)

Intake Design Methodology (continued)

With these major objectives in place, it was time to begin the actual intake design – but where to begin? The intake design is a very complicated task with many parameters that must be optimized. Runner length, plenum volume, and restrictor configuration all affect airflow, and thereby horsepower, in a different way. Not only must these parameters be optimized, but they must be integrated into the tight packaging of the vehicle, constraining the range of our design. Even with all of the analysis tools at our disposal (engine simulation programs, CFD, CAD) it was not clear where to begin the process. It became obvious that before we could design an intake we would have to formulate a process of design. What we arrived at was an iterative method that coupled our analysis tools with an early CAD model of the chassis, which enabled us to optimize our design parameters given the spatial constraints of the vehicle. The system is detailed below.



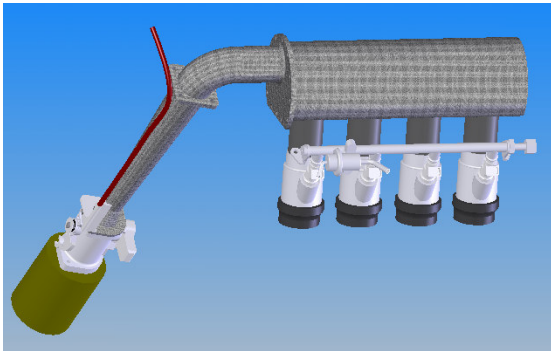
Since the design on the intake was based on a number of numerical models it was important to validate these models before the design could be finalized. If the models did not accurately represent the real world situation, all of the design decisions that were made based on the model would be incorrect. In order to validate our models, and evaluate hard to model phenomenon such as throttle response, a temporary mock-up of our design system was quickly fabricated and tested on our dynamometer engine. By comparing empirical data to model predictions, we were able to verify that our simulations were accurate to within an acceptable envelope. At this point, fabrication of a working prototype could begin with confidence the final intake would work as planned.

Early on in the design of the intake system the team made a conscious decision to concentrate on refining the process methodology behind the design. Strategies were developed and new manufacturing techniques were applied to a basic time proven design. The outcome of this effort is a well thought out, thoroughly justified and documented, highly capable intake system. This strategy has proven to be a wise move as it has allowed the team members to develop a variety of skills that will be put to use designing the groundbreaking induction systems of the years to come.

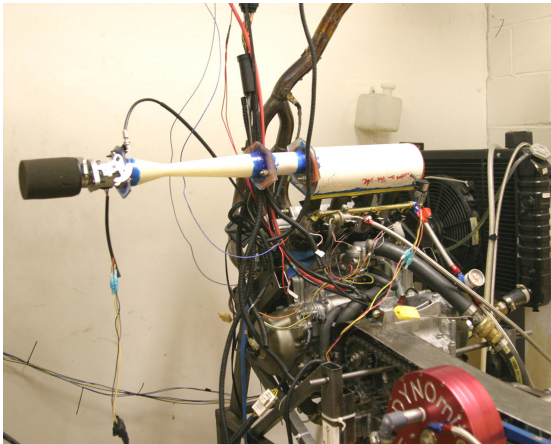
Member Spotlight

Taking the Initiative – Mike Beltran

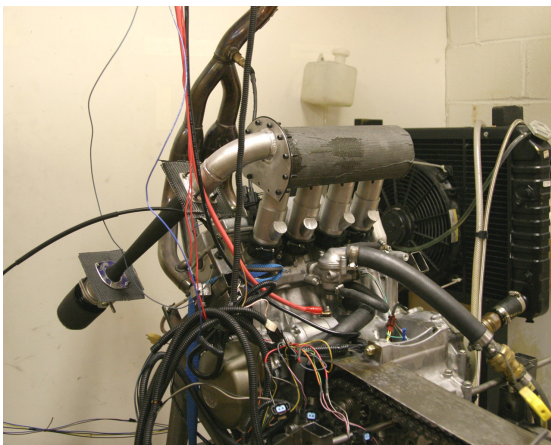
Joseph Audette
Project Manager



The design process required a 100% CAD model from the beginning to facilitate final fabrication.



The Mock-Up intake was used to verify the parameters determined during the CFD modeling.



The preliminary prototype installed in the dyno-cell. A final iteration will be produced for the competition.

In his senior year of high school, Mike Beltran visited MIT to learn about campus life and make his ultimate decision on college. While visiting in April, Mike was exposed to the MIT Formula SAE team in their rookie season. Since then, Mike, or “Tron” as the team knows him, has been a critical member in the development and expansion of the team in the past two years.

Tron came to MIT like many of our new members, unskilled. However, his enthusiasm and motivation during his first year drove him to quickly learn. Mike ground his way onto the team, literally. He would do whatever he could to help and gain experience, even if that meant spending several days grinding and filing suspension components during the final assembly in 2004.

Over the past year, Tron has assumed leadership of the Fueling and Cooling systems within the Powertrain Group. This area of the car is particularly challenging because it involves component design in addition to systems integration into the vehicle as a whole. The 2005 fueling and cooling systems have seen dramatic improvements in packaging, documentation, and fabrication methods under Tron’s guidance.

Mike’s hard work and effort over the past two years has not gone unnoticed. Mike will be spending his sophomore summer interning at General Motors Automotive in Michigan. Mike is excited and deserving to be working with one of the team’s top corporate sponsors.

Mike is already looking ahead to future leadership roles on the team. For 2006, he will replace the graduating Jim Cuseo as Chief Powertrain Engineer. This is a large responsibility that Mike has proven he will be able to handle. It is the perseverance and motivation of members like Michael Beltran that will continue to develop this team into a winning program in future years.

New Sponsors Pledge Support



www.spectro-oils.com

Spectro Oils manufactures and distributes oil and lubricants for a wide range of motorcycles. MIT Motorsports greatly appreciates Spectro's product donation to fulfill all of our lubricant needs for 2005.



www.snapdragonmotorsports.com

In January, members from the team traveled to Snapdragon Motorsports for a tour of their shop and the opportunity to experience a professional racing operation. MIT Motorsports is lucky to partner with Snapdragon Motorsports for technical consultation and fabrication support.

A Special Thanks to the Master Fabricators

Joseph Audette

I think the thing I will miss most from MIT after graduation is the access to top quality machine shops. MIT Motorsports is extremely lucky to have the support of the shops located on campus: The Lab for Manufacturing and Productivity (LMP), The Edgerton Center Student Shop, Pappalardo Labs, the Aero-Astro Student Shop, and Central Machine.

The team owes tremendous thanks to the machinists themselves. The highly skilled and generous individuals of these shops have been exceptional over the past three years; supporting our program and expanding our manufacturing capabilities. The team owes a great deal of our success to their guidance, technical consultation and support over the years.



www.gm.com

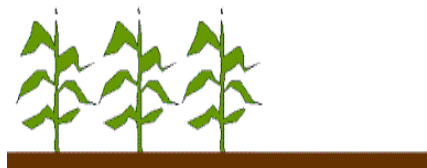
General Motors, the largest automotive company in the world, has graciously continued their support of the team for the 2005 year. MIT Motorsports looks forward to impressing their new sponsor in GM's own backyard this coming May.



<http://web.mit.edu/chancellor/>

The team thanks Chancellor Phillip L. Clay for his generous donation for the 2005 year. MIT students are privileged to have administrators like Chancellor Clay actively supporting students' extra-curricular efforts.

American Corn Growers Association



www.acga.org

The Formula SAE rules allow for the running of E-85 Methanol as an alternative fuel option. MIT Motorsports has teamed up with the American Corn Growers Association (ACGA) to explore the possibility of running this alternative fuel in the future.

Make it to Work (Continued)

The design of many of the 2005 components relied heavily upon techniques fairly new to MIT Motorsports. 2004 was the first venture into composites, with a carbon fiber intake plenum and fiberglass body. While the 2004 composite work was adequate, the lessons learned have allowed for significant advancements in the intake, seat, and body for the 2005 vehicle. The components have significantly decreased weight while at the same time increased strength.

Manufacturing techniques have expanded to increase the team's productivity and quality. For the frame this year, welded jigs allowed for a much higher level of precision along with decreasing overall manufacturing time. Similar methods were used to facilitate a-arm and exhaust manifold construction.

The most successful aspect of fabricating the 2005 vehicle came from new member involvement. Both undergraduate and graduate students were brought in to help with some of the higher level manufacturing and design work. Tony Scelfo's machining ability has been an invaluable asset to the team. Furthermore, freshman such as Matt Humbert have used their previous experience to greatly benefit the team. New members Alex Soo and Simon Jackson came to MIT with little experience but have worked hard to learn proper fabrication methods.

The enthusiasm of the new members has transmitted to the rest of the team as the vehicle neared completion. Through everybody's hard work and diligence, the 2005 car, for the first time in MIT Motorsports history, will be done over a month before the competition. The testing time will prove to increase our driver's skills while allowing us to prepare and tune for the May competition.

2005 is looking to be a watershed year in MIT Motorsports history. The team's excitement coupled with great leadership has put the team in a position to give a new meaning to "Make it to Work:" "Make it to Win."



Joseph Audette and Jim Cuseo sport their colors shortly after hearing about their offers from Ford.

Senior Members Move On

Joseph Audette

2005 has already proven a strong year for new members, but let us not forget the senior team members graduating this June and pursuing full-time careers in industry.

Chief Powertrain Engineer Jim Cuseo, Joseph Acar, and I will all relocate to Dearborn, MI to work for the team's Platinum sponsor: Ford. In addition, Jim and I will become members of Team Rehagen Racing, which fields two cars in the Grand-AM Cup Series. J.P. Kurpiewski will take his Master's Degree to Raytheon at their Sudbury, MA facility. Finally, congratulations to Keith Durand, who was recently admitted to graduate school within Mechanical Engineering.

MIT Motorsports to Launch 2005 Vehicle

Erik Lampe
Assistant Team Manager

On Wednesday April 20th, the MIT Motorsports Formula SAE team will unveil its finished car for the 2005 competition. The event will be held on MIT's campus in the Bush Room and Lobby 10. The team has worked hard over the past three years to build a competitive program, and it is now time to showcase our efforts to the MIT community.

The goal for the event is to gain publicity throughout MIT while also recognizing our sponsors for their continued support of our program. Faculty, staff, administration, and local sponsors will all be invited for a private unveiling of the 2005 car at 12:00.

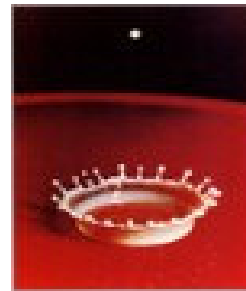
The event will kick-off at 10am with the display of the 41st-placing 2004 car in Lobby 10. At noon, lunch will be provided to distinguished guests as the team unveils the finished 2005 vehicle. At 1:00, the Bush room will be opened to the general public to allow them access to the car. The rest of the afternoon will include specific design presentations by the chassis group (1-2pm) and the powertrain group (2-3pm). At 5pm, the team will give a demonstration of the car if weather permits. The location for the demonstration is still to be determined.

The 2005 Launch will be the first time the team has presented the car to the MIT public. We are looking forward to presenting the fruits of our labor from the past year and hope you will be able to make this historic event.

We Thank Our Sponsors For Their Continued Support!



Ford Motor Company



The Edgerton Center



MIT Department of Mechanical Engineering

MIT Aero-Astro Department

Lab for Manufacturing and Productivity

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