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SCI-Arc/Caltech competes at Solar Decathalon

JESSICA STOLLER-CONRAD
Caltech Writer

-sciarc.edu

DALE is nearly ready to face the judges. The Dynamic Augmented Living Environment, Caltech's collaboration with the Southern California Institute of Architecture (SCI-Arc) is now on-site at the Department of Energy's 2013 Solar Decathlon competition site in Irvine, California.

The SCI-Arc/Caltech team has been planning DALE, its unique and completely solar-powered home, since its competition proposal was accepted in January 2012, along with proposals from 19 other American and international teams. Nearly 40 Caltech students participated in the design process, most of which took place in an engineering project course called Introduction to Multidisciplinary Systems Engineering, and offered during the 2012-2013 academic year. Of the students in this course, taught by Melany Hunt, Dotty and Dick Hayman Professor of Mechanical Engineering and a vice provost, seven stayed on, spending their summer actually building the sustainable house.

Once the majority of construction was complete in late September, the SCI-Arc/Caltech team had to pack up DALE and physically move the entire house from its construction site on the SCI-Arc campus in downtown Los Angeles more than 40 miles south to Orange County Great Park in Irvine, where this year's competition will be held starting on October 3.

While some of DALE's competitors had to employ the use of large cranes to transport their entries or coordinate weeks-long international transportation to the competition site, project manager Andrew Gong (BS '12) says that DALE only spent about three-and-a-half hours in transit.

"We picked up DALE with a heavy-duty forklift and placed it on long trucks," Gong says. "And there wasn't any damage other than expected small scrapes to the bottom from the forks."

DALE's design consists of two configurable, box-like modules—one kitchen and bathroom module, and one living and sleeping space module—that can move together or apart. When in the open configuration, DALE's design exploits the ambient outdoor temperature to heat or cool the house, helping to maintain a comfortable temperature within the house without using extra energy for heating and air-conditioning. This moving house was designed with sustainability in mind, but the modules also made it easier for team DALE to truck its house down the interstate to Irvine. "Since the house is composed of modules, it was actually fairly simple to pack up and ship. The main issue was just making sure everything got packed on time," Gong says.

The SCI-Arc/Caltech collaboration is one of 20 teams in the Department of Energy competition, each challenged to design and build affordable, attractive, energy-efficient houses that have the comforts of modern living but are powered only by the sun. As the name "Solar Decathlon" implies, teams will compete for the best total number of points in 10 contests. A panel of experts will use the contests to judge and score the entries based on features ranging from architecture and market appeal to affordability and each house's ability to host a movie night—called the Home Entertainment Contest.

The SCI-Arc/Caltech team wants DALE to score well in the overall competition, but the Caltech team members hope they score especially well in one particular aspect: the Engineering Contest. In this contest, a jury made up of professional engineers will judge each house based on the home's functionality, efficiency, innovation, reliability, and project documentation.

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Helping readers burst out of the Caltech bubble

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by *The Tech* Eds

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Syria removes chemicals	**1000** tons of sarin and sulfur mustard have begun to be removed	[BBC]
Strike ends in pay raise	**10** percent pay raise given to South African car factory workers	[BBC]
Bungee jump record set	**150** bungee jumps completed by Australian within 24-hour period	[BBC]
Deadly protest in Egypt	**44** civilians killed during Muslim Brotherhood protest in Cairo	[BBC]
Federal deficit update	**17** trillion dollars in total federal debt, from 1.4 trillion in 2009	[CNN]
Thousands left jobless	**800,000** people on unpaid leave since government shutdown	[CNN]

Food with Mannion!

Do you like eating food?
How about free food at nice restaurants?
Ever want to tell the world exactly what you think of said food?
The Tech will be beginning a new column to chronicle the foodie experiences of new writers every other week...The Catch: They'll be going head-to-head with Tom Mannion who will be reviewing the same restaurant. If you have ever thought you were more of a gourmand than our resident master chef, now's your chance to prove it!
Email us for a spot on the list at tech@caltech.edu

The California Tech

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NOMINATE YOUR FAVORITE PROFESSOR FOR THE FEYNMAN TEACHING PRIZE!

Here's your chance to nominate your favorite professor for the 2013-14 Richard P. Feynman Prize for Excellence in Teaching! You have from now until January 2, 2014 to submit your nomination package to the Provost's Office to honor a professor who demonstrates, in the broadest sense, unusual ability, creativity, and innovation in undergraduate and graduate classroom or laboratory teaching.

The Feynman Prize is made possible through the generosity of Ione and Robert E. Paradise, with additional contributions from an anonymous local couple. Nominations for the Feynman Teaching Prize are welcome from faculty, students, postdoctoral scholars, staff, and alumni.

All professorial faculty of the Institute are eligible. The prize consists of a cash award of $3,500, matched by an equivalent raise in the annual salary of the awardee. A letter of nomination and detailed supporting material, including, but not limited to, a curriculum vitae, course syllabus or description, and supporting recommendation letters should be emailed to kkerbs@caltech.edu or directed to the Feynman Prize Selection Committee, Office of the Provost, Mail Code 206-31, at the California Institute of Technology, Pasadena, California, 91125. Nomination packages are due by January 2, 2014.

Additional information including guidelines for the prize and FAQ may be found at http://provost.caltech.edu/FeynmanTeachingPrize. Further information can also be obtained from Karen Kerbs (626-395-6039; kkerbs@caltech.edu) in the Provost's Office.

Caltech students unveil solar house design

This artist's rendering of DALE, the SCI-Arc/Caltech entry into the 2013 Solar Decathalon, depicts the solar-powered house on a placid, computer-generated beach.

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Continued from page 1

"In 2011, with CHIP—our first Solar Decathlon entry—we came in second place. With DALE, we took that second place as a challenge," says Gong, "because now we have to get first, obviously!"

To optimize DALE's energy efficiency, the Caltech members of the team spent months calculating and modeling the home's likely energy usage during the competition. Thirty years of Orange County weather data were used to predict heating and air-conditioning needs for the October competition. "The contests are held on different days of the competition, and we based the energy budget on the contests we will have on a given day: the cooking contest, movie night, heating and air-conditioning test, etc.," Gong says. "With our competition energy budget, we then modeled out the performance required from the solar panels to meet that energy demand," Gong says.

The SCI-Arc/Caltech team also designed an energy-saving mobile app for DALE that would allow its owner to monitor the home's real-time energy supply and consumption and take steps to use less energy. "As a team, we are aiming to create a house that is not only energy efficient by itself, but also encourages the inhabitants to live a greener lifestyle," Caltech electrical engineering student Do Hee Kim says on the DALE website. Visitors will be able to interact with DALE and explore its innovative features during public viewings scheduled for October 3–6 and 10–13 from 11 a.m. to 7 p.m. In addition, visitors arriving at 2:30 will get to see the home reconfigured in real time, a feature that sets DALE apart from the other Solar Decathlon entries. The winners will be announced on October 12, and just a few days later, the team will pack up for the move back to Los Angeles. After the competition, DALE will be displayed at the SCI-Arc campus. And for any house hunters visiting the competition, the SCI-Arc/Caltech team has good news: DALE is for sale and can be delivered to a new owner. Although the Department of Energy provides a limited amount of seed money for Solar Decathlon teams, fundraising is necessary to cover the actual costs of production; funds from the sale of the home will go to recoup some this year's competition costs.

See more at: http://www.caltech.edu/content/caltech-students-arrive-solar-decathlon-2013#sthash.KcRbsm1O.dpuf

Caltech Y Column: Look out for new events

PHOEBE ANN
LAURA SANTOSO
Contributing Writers

Hi everyone! This is the Caltech Y Column, designed to inform you about the Y and the opportunities we provide for you to inspire your passions, whether by participating in our programs or leading your own!

Founded by students in 1916, the Y was organized to provide extracurricular activities planned and implemented by students as an opportunity to gain leadership skills and discover their passions and themselves. The mission of today's Y remains the same—to provide opportunities that will prepare students to become engaged, responsible citizens of the world. The Y seeks to broaden students' worldviews, and raise social, ethical, and cultural awareness through teamwork, community engagement, activism, and leadership.

The Caltech Y's mission and core values stand on five key pillars: leadership, civic engagement, service, adventure, and perspective. Regardless of which pillars capture your interest, feel free to attend any of the below programs, or contact us to organize your own!

Here's a sampling of past programs held by the Y:

- Alternative Spring Breaks: Costa Rica, New York, Yosemite, San Diego, San Francisco
- Make-A-Difference Day: Hillsides Home for Children, LA County Arboretum and Botanic Garden, Children's Hospital Los Angeles (Coachart), Eaton Canyon, Lifeline for Pets
- Explore LA: Lakers game, Next to Normal musical, Norton Simon Museum trip

Upcoming Events:

1. Mt. Pinos Day Hike

Saturday | October 12th | 7:30 am - 6:00pm | Cost is $15

A trip is being organized for Sunday, September 15th to hike the summits of Mt. Pinos, Sawmill Mountain, and Grouse Mountain. The hike will be around 10 miles long with moderate elevation gain and the last section of the hike will involve a little off-trail hiking to reach the summit of Grouse Mountain.

It can take up to two hours to drive each way to the trailhead, so we will meet at the Caltech Y and leave early at 7:30am, hoping to return at around 5-6pm (return time can be delayed by traffic).

We do need drivers but you need to be registered with the Caltech Y before you can drive others in your car.

So if you are willing and able, it's easy to register: just send us an email for details.

To sign up, fill out this google doc: https://docs.google.com/forms/d/1VhySjM4rTNl7OsCV4yOtPDuvvUIaK97xdvQ7VMH4CcA/viewform. If you have questions contact Jeremy at jsandler@caltech.edu

2. Washington DC Science Policy Trip – Applications are available now, due Tuesday, October 15th by Noon

Monday, December 16th to Thursday, December 19th | Cost is only $550 (with round trip flight to DC and back to LA) or $325 (with one way flight to DC)

Dialogue with those who have played a role in setting and implementing science policy for the United States including: Academics, Lobbyists, Scientists, Politicians, and Caltech Alumni. Join us for an exploration into Science Policy on this exciting trip to the Nation's capitol. This four day trip includes flights, lodgings, some meals, discussions with science and policy leaders… and of course the sites and experiences of Washington D.C.

The small group sessions will be ideal for exploring relevant issues for our time in the context of national policy. The DC Science Policy Trip is coordinated by the Caltech Y with generous support from the George Housner Fund. Questions and applications may be directed tocaltechy@caltech.edu. Applications are available at www.caltechY.org now!

3. Rise Tutoring Program

Mon.-Thurs. | 4-6pm | Winnett, 2nd Floor

The Caltech Y Rise Program is currently accepting new tutors. The Rise Program is an afterschool math and science-focused tutoring program that serves public school students between grades 8 and 12. The tutoring takes place on the Caltech campus Monday-Thursday from 4pm-6pm. For more information about the program and to apply please visit our website at: http://caltechy.org/programs_services/tutoring/.

4. Hathaway Sycamores

Saturday | October 12th | 1:30-4:30pm | Highland Park

Volunteer at Hathaway-Sycamores, a group that supports local underprivileged but motivated high school students. Some of the subjects being tutored are AP Chemistry, AP Physics, and AP Calculus.

For more info and to RSVP Email Josie Kishi atjkishi@caltech.edu.

If you have any questions at all, feel free to contact the Caltech Y at (626) 395-6163 or caltechy@caltech.edu. Feel free to drop by at one of our weekly meetings at the Caltech Y at the Caltech Y (505 S. Wilson, next to CEFCU), time TBA.

Go to http://caltechy.org/lists/ to self-subscribe to announcement lists for upcoming events and sign-up information.

For a student's perspective, feel free to contact Phoebe Ann at phoebe.ann2@gmail.com or Laura Santoso at santoso.laura@gmail.com.

Caltech and MOOCs Part I: An Introduction

CONNOR ROSEN
Contributing Writer

On June 15, 2012, Caltech awarded a total of 526 degrees at graduation, bringing the total of living alumni to a little over 23,000. Thirty-two days later, Caltech announced a partnership with a recent internet startup, Coursera, which in the three months since its launch had boasted more than 1.5 million course enrollments and visits from more than 680,000 students in 190 countries. This September, Caltech announced that it would begin offering courses on edX, a consortium of universities that claims over a million users as well. In little more than a year, Caltech's educational reach has expanded by orders of magnitude.

Coursera and edX are two of the most visible entities in the rapidly expanding, well-publicized field of online education. Online education has been around almost as long as the World Wide Web itself and educational research on online education dates back to the early nineties. What distinguishes Coursera and edX is the scale of education they aspire too. The companies administer "MOOCs" – Massive Open Online Courses. As the name suggests, these online courses can reach tremendous numbers of students, with large MOOCs enrolling more than 200,000 students, and average courses reaching 50,000 students.

MOOCs are very new to the field of education, and many follow a similar style. Typically, students enrolled in a MOOC watch video lectures that are significantly shorter than traditional college lectures, often less than fifteen minutes. Students' attention is checked by in-lecture quizzes, which are often very simple questions designed more to ensure the student was listening than to test for deep conceptual understanding. Additionally, readings and links may be posted to the website alongside the lectures. Students then take online quizzes or homework assignments, and at the end of the course usually receive a certificate denoting their completion of the MOOC.

The New York Times dubbed 2012 "The Year of the MOOC." It has been a meteoric rise for the platform: a Stanford course called "Introduction Into AI" taught by Sebastian Thrun and Peter Norvig, arguably the first modern MOOC, was taught in the fall of 2011. edX and Coursera launched in 2012, as did Udacity, another large for-profit competitor. Universities scrambled to get involved, so much so that Coursera began rejecting universities that wanted to post courses to its platform. Our partnership with Coursera initially included three courses offered in the 2012-13 academic year, as well as a substantial financial contribution. This last piece of information was left out of the initial announcement to the Caltech community.

> "...There has been, to my knowledge, no student involvement in these strategic decisions, despite their importance to the entire campus community. Data supporting the many claims made by proponents of MOOCs have not been made public."

Caltech and the University of Pennsylvania combined to invest $3.7 million in Coursera, which at the time accounted for more than 16% of the total investments in the company. At the same time, Caltech professors were investing hundreds of hours of their time in providing Coursera with course material at no cost to the company. Additionally, there has been, to my knowledge, almost no student involvement in these strategic decisions, despite their importance to the entire campus community. Data supporting the many claims made by proponents of MOOCs have not been made public.

This article is the first in a series where I examine Caltech's investment and involvement with MOOCs. I will cover a number of aspects of MOOCs, Coursera, and edX – including issues of certification, the effectiveness of MOOCs, and the potential conflict of interest between Caltech's mission and that of a for-profit educational company.

Brad/Chad Couture: Trying out color combos

BRAD CHATTERGOON
Contributing Writer

Rotation is finally over! I hope everyone got into a house that they were hoping to be in and I wish all the frosh well at their respective new homes. A special shout out to my new Pageboys.

Now that that headache is over with, there should be a bit more free time in everyone's schedules to try something new. I will be discussing a couple fashion trends that can be successfully incorporated into anyone's wardrobe.

The first is mono-color layering.

The idea here is picking one color from the ROY-G-BIV spectrum (i.e. Red-Orange-Yellow-Green-Blue-Indigo-Violet) and pairing a variety of shades of that color throughout an outfit.

As you can see in this week's picture, I have opted to use blue as the central color for my outfit and have chosen several different shades of blue ranging from light to dark and have even incorporated my shoes into the look.

Blue is a particularly easy and currently popular color to choose.

Because the most common color of jeans is blue, this makes it very easy to pair with any blue shirt and sweater. Bear in mind that this can also be achieved with a tee over a shirt or an open shirt over a tee.

I recommend using at least one dark shade and at least one light shade in this particular trend, and mixing in one patterned item if desired.

The second is color-blocking. (I hope that you're reading this Jackie Maslyn)

This is a fairly popular trend and one of my personal favorites. Color-blocking involves the use of opposite or near opposite colors on the color wheel.

An example of such a pair of colors would be red and green or red and blue.

This look is very popular during the summer when brightly-colored shorts are in season but can also be used during the fall/winter with deep or strong shades of color.

It's a very simple concept: wear contrasting colors in solid "blocks". As you may have already guessed, in this particular style, patterns are generally avoided in favor of solids. Feel free to experiment with bright colors in your pants, tops, outerwear, and for the ladies, your shoes.

I hope that this encourages some of you to take a step out of your comfort zone and try one of these two easy to pull off looks.

A Request:

I see more than enough of myself everyday so I don't want to also see myself in the paper every week. I would like to ask that those of you who like to dress on the more stylish side do so.

Hopefully I will run into you on campus and have you featured in the paper. If this becomes regular then perhaps there can be a prize (TBD) at the end of the term for best dressed.

Brad Chattergoon relaxes in the Ricketts Lounge while demonstrating mono-color layering.
-Stanford Schor

'Tech alumna's film *Josh* inspires audiences

MALVIKA VERMA
Staff Writer

Not all of us are going to impact the world with our scientific prowess. According to Wikipedia, Frank Capra waited tables, worked at the campus laundry facilities, and played the banjo at nightclubs when he was a Techer. Within 25 years after graduating, he received 3 Best Director Oscars.

Similarly in the world of cinema, but in an entirely different language (Urdu), alumnus Iram Parveen Bilal is making her mark. This past summer, I had the opportunity to catch her first feature film at the London Indian Film Festival. Titled "Josh (Against the Grain)," it is not only the first Pakistani film to be shown at the festival, but it is also the first selection with a female director.

Inspired by a woman Parveen Syed who runs food kitchens around Karachi, the film has a powerful message: one person can make a huge difference in the world. Fatima (Aamina Sheikh) is a privileged teacher in her 20s living in a comfortable home in Karachi. Her mother died when she was a child, so she was raised by her nanny Nusrat-bi (Nyla Jafri) while her busy lawyer father provided her with a sheltered upper-class lifestyle. One day, Nusrat-bi does not return from a holiday visit to her home village. Against the wishes of her family and friends, Fatima goes to investigate the disappearance of Nusrat-bi. Fatima's life changes when she discovers what has happened to Nusrat-bi (I won't spoil it), and she leads an entire village in a clash against an oppressive feudal lord.

What really stood out about the film was the extraordinary cinematography by Nausheen Dadabhoy. We are introduced to the hustle and bustle of Karachi by following a basket being lowered from a home to a vegetable seller. Dadabhoy captures the dichotomy of developing cities as shots sweeping across crowded city streets contrast with the vastness empty expanses of the poorer villages on the outskirts of the city. The audience gets a sense of what it is like to live in Karachi, and this helps keep them captivated. During the Q&A following the screening, several natives from Karachi complemented Iram on depicting their city so beautifully.

Iram Parveen Bilal answers questions at Cineworld Haymarket in London.
-Stanford Schor

There are, though, a few things I think could have been better. Side stories were half-baked, a suggested love triangle was unnecessary since it was left undeveloped, and transitions between scenes were abrupt. The shots of the moon and grain were beautiful, but it sometimes felt like they were just thrown in to end a scene instead of driving the film forward. Overall, these are minor issues, and the festival audience and I were fully engaged throughout the film.

Josh is thought-provoking and is already inspiring people to make a difference. In Iram's words: "Change can be thought. Change can be action. Change can be two people. Change can be two million people. With the film though- An example: We screened in Melbourne on election day with a packed house… they were so moved that they arranged a fundraiser for Khana Ghar and they raised enough food for 120 people. That was change in action."

Don't miss *Josh* when it stops at Caltech.

Rating: 8/10

The Tesla Model S: What all the fuss is about

CASEY HANDMER
Contributing Writer

Push the accelerator. Feel the power tilt you over and suck your eyes into your head. In complete silence. Electric cars are the future, and in Tesla's revolutionary Model S, the future is here.

For those who live under a rock, Tesla has successfully brought their second generation sedan to market. Sleek, slippery, sexy, and stuffed with semiconductors, it may finally be the computer industry's answer to Detroit.

Tesla's CEO Elon Musk gave the Caltech commencement address in 2012. In case you forgot, he mentioned that in building the Model S, Tesla set out to create a car that was superior to its competitors in every way. One year later, it has scooped three major industry awards, including Car of the Year from both Automobile Magazine and Motor Trend. The third was self-awarded, when an analysis of their test results revealed the Model S was the safest car ever tested by the National Highway Traffic Safety Administration (NHTSA).

Whereas most other electric cars on the market are glorified golf carts with all the performance and allure of Caltech's own electric fleet, Tesla somehow managed to optimize in the opposite direction. An analysis of this achievement is illustrative for anyone with an engineering or problem-solving bent. Indeed, in proving the naysayers wrong Tesla finagled a short squeeze of their own stock, enabling a follow-on stock offering and the raising of an additional $1.1b.

The most prominent electric car released since the Tesla is BMW's i3. While its carbon fiber chassis does feature some reasonably innovative ideas, its styling is an echo of the pre-Tesla era. All car manufacturers that operate in the United States have to deal with interlocking state-by-state compliance issues of Byzantine complexity.

One of the most effective is California's requirement that a certain number of electric cars be produced, presumably to spur technology development by reluctant and largely calcified giants that only five years ago required taxpayer-funded bailouts to remain solvent. The general response to this was to produce a series of cars of underwhelming utility, price, and attractiveness. Unsurprisingly and, indeed, by design, these cars have not sold well, despite aggressive and loss-inducing cuts in price.

-teslamotors.com

After the compliance car program ran its course, it is a safe bet that industry lobbyists would be parroting their 'market has spoken' mantra, with dismal sales figures across the board, suggesting that California's absurdly green and possibly communist electric car policies be repealed. In case the crummy range and worse performance of these mostly compact conversions wasn't enough to do them in, designers gleefully decked them out with a variety of gag-inducing styling decisions. No doubt this appeals to the particularly hard-core Hollywood advocate types, in that owning one of these cars (the Mitsubishi iMiEV comes to mind) is incontrovertibly honest, signaling that you are very, very serious about the environment.

Can you imagine being a recently-graduated engineer assigned to work on one of these hopeless Potemkin car electrification projects? I wonder how many of them were caught vainly licking the terminals of a 400V battery pack.

When the Nissan Leaf and Chevy Volt were designed, Tesla was a peculiar Silicon Valley venture producing a few hundred fast and quiet Lotus Elises (the Roadster) a year. In 2008 they laid off many people and nearly went out the back door. By the time BMW sat down with their designers, Leaf and Volt sales data all but confirmed that the consumer wasn't biting. All that was needed was an unsuccessful offering from one of the most respected manufacturers in the world, and by the end of 2014, these cars would be nothing but a footnote in a book about unsuccessful meddling in the free market.

I can almost imagine a meeting amongst the BMW i3's product development people. Someone who's new on the job asks "But what about the Tesla WhiteStar?" The room erupts in laughter. The Roadster was out of production. A few rumors swirled around robots in the old NUMMI plant. Tesla stock was the most shorted on the exchange and lurched unsteadily even lower.

The CEO was rambling about launching rockets, but so far had mostly only blown them up. Even people signing parts supply deals with Tesla were buying good insurance and were snickering behind their hands. Several respected automotive industry analysts had predicted that Tesla would produce no more than 3000 cars before inevitable problems, glitches, and perhaps a fatal fire or two would trigger the final death spiral.

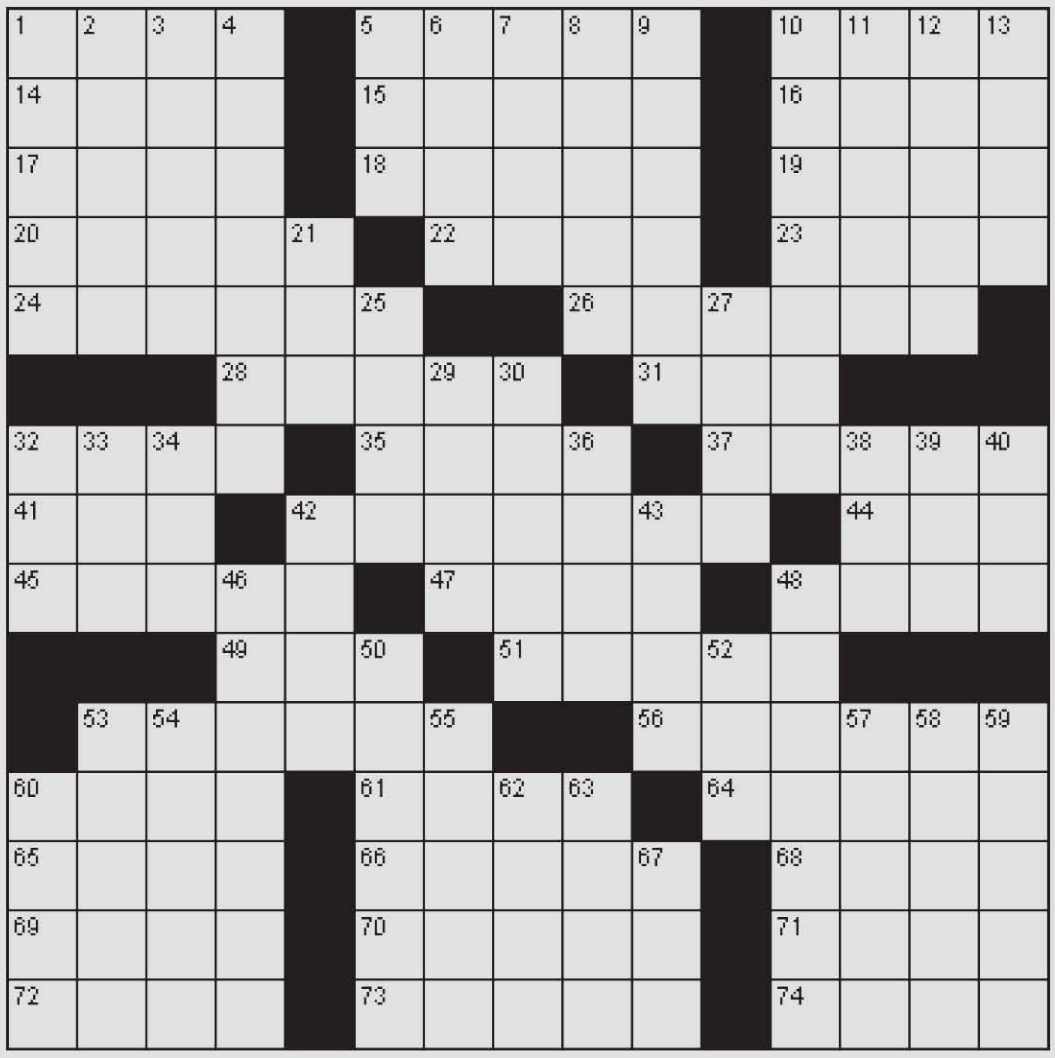
If I had to guess at what point the phones started ringing, I would guess May 8, 2013. Tesla had forecast a profitable third quarter. Instead, the sale of emissions credits had pushed it over the line in the first quarter. Within days, panicked hedge funds had tried to close their short positions, and a deep lack of share availability had pushed the price up by a factor of three. Suddenly Tesla went from 'the next Solyndra' to 'the next Apple'. As the cars became more available (nearly 20,000 have been built to date), competitors' engineers would have got their hands on one and finally seen what they were up against.

At BMW, it was too late. You can tell their i3 launch promotional material is hastily redesigned to be as forgettable as possible. Industry blogs changed tack from 'when will Tesla finally declare bankruptcy' to 'Tesla's competitors hot on their heels.' As we shall soon see, Tesla has already set the standard. From here, they have only themselves to beat.

Against this maelstrom of chaos and confusion, two prominent car makers have been relatively calm and collected.

Continued on page 6

Today's Puzzle: Crossword



[www.puzzlechoice.com]

Across

1. Evanesce
5. Item of information
10. Military vehicle
14. Mountain goat
15. Asinine
16. Flair
17. Incline
18. Danger
19. Flower
20. Kind of weasel
22. Fleece
23. Memorization by repetition
24. Court game
26. Apprise
28. Velocity
31. Misery
32. Fiesta
35. Affirm
37. Fragrance
41. In the past
42. Cabin attendant
44. Delved
45. Bird shelter
47. Reconstruct
48. Boundary
49. Pasture
51. Acquire knowledge
53. Paper fastner
56. Spice
60. Narrow secluded valley (Scottish)
61. Earlier time
64. Public transport
65. Nobleman
66. Characteristic of birds
68. Reverse an action
69. Part of a church
70. Stringed instrument
71. Stalk
72. Cervid
73. Awry
74. Counterweight

Down

1. Number one
2. Lessen in intensity
3. Fiend
4. Wide scope
5. Brief immersion
6. Afresh
7. Tropical starchy root
8. Combination
9. Unhurried and relaxed
10. Hunting dog
11. Remote in manner
12. Offensive
13. Hinge joint
21. Gratuity
25. Furniture item
27. Amphibian
29. At any time
30. Holds two adjacent pieces together
32. A considerable distance
33. Self
34. Also
36. Walk through water
38. Peculiar
39. Drinking container
40. Mature
42. Pace
43. Horse description
46. Defamation
48. Put into the care of someone
50. Domesticated llama
52. Groove or furrow
53. Gradient
54. Laconic
55. Roof overhang
57. Large tropical ray
58. Type of duck
59. Legendary creature
60. Cheerful and bright
62. Smooth fabric
63. Narrative
67. At present

What you need to know about the Model S

Continued from page 5

Daimler and Toyota both bought stakes in Tesla during its years of perdition, and both have now produced unoffensive though unspectacular cars using the Tesla drive train. From here, Tesla's aggressive rollout of supercharger technology could well mean the creation of an ecosystem which will become the de facto national standard. Provided they suffer no major missteps, theirs is the market to dominate. Friendly manufacturers like Toyota and Daimler can exploit their business relationship and leverage their access to superior technology, while their competitors face a more stark choice, between participation by licensing at the market rate and an inevitable slide into obsolete irrelevance. A third option, aggressive innovation and competition, is also possible and, broadly, a desirable outcome. Either way, Tesla's aim of creating and insistently growing the electric car market is assured.

At this point I should mention that Hyundai's strategy for sustainable transportation was through research and IP development in hydrogen fuel cells. Battery technology was better than hydrogen could ever be four years ago, so I really hope they have something else in the works by now.

Car	Base price ($)	0-60mph (s)	Range (miles)	Safety
Tesla Model S	69,900	4.2	265	★★★★★
Chevy Spark	27,495	7.6	82	★★★★
Nissan Leaf	28,800	9.8	75	★★★★★
BMW i3	42,275	7.0	80	★★★★★
Ford Focus EV	39,995	9.5	76	★★★★★
Smart Electric	25,750	22.4	65	★★★★
Fiat 500e	32,500	9.1	87	★★★★★
Toyota RAV4 EV	49,800	7.0	103	★★★★
Mitsubishi iMiEV	29,125	11.9	62	★★★★
Honda Fit	36,625	8.4	70	★★★★
Renault Zoe	27,250	8.2	60	★★★★★
Rimac Conc. 1	980,000	2.8	300	NA
Tesla Roadster	109,000	3.7	244	NA

Thus far I've heaped praise and scorn in equal measures, so let's get to the nitty gritty.

In the above table, the safety rating is poorly resolved. It's worth noting that your actual outcome in a two-car collision is highly dependent on your mass. The Tesla weighs more than an SUV, and has, so far, hit a Honda Accord, a power pole, and a restaurant and won. Most of the other electric cars are compacts or sub-compacts, and their safety rating should be taken as such. It was during consideration of the Tesla Model S's safety tests that I realized the sense in which the BMW i3 and the Tesla are actually comparable.

The resemblance is uncanny.

Almost all of Tesla's competitors use third-party systems provided by either AC Propulsion or A123 systems. The same A123 whose exploding batteries caused it to enter bankruptcy.

They re-registered the company as B456, not realizing of course that B456 is a common fire extinguisher specification. How apt.

On the other hand, Tesla has a bunch of its own IP on technology. Not wanting to be hamstrung when ramping up volume, they developed technology that does not depend on rare-earth materials, heavy batteries, or any other highly specific technology. Their battery packs are made of around 7,800 laptop cells. Instead of large, expensive, and specific 'automotive' batteries, the 18,650 package provides the benefits of enormous mass production, scalability, and statistical reliability. Coupled with intelligent battery management software, a much more versatile pack results. When performance degrades, problematic cells can be substituted robotically, giving a cheap upgrade. The Tesla battery pack also forms part of the car's chassis, increasing stiffness and also providing for battery swapping capability. Each cell provides 3100mAh of electricity at 3.7V, and together the battery can provide 1200A at around 340V, delivering 310kW to the power train. In charging it can accept 120kW (at around 250A) for a ~40 minute charge.

When optimizing electric motors, the usual approach is to use high voltages and thin wires, combined with powerful magnets. Tesla uses a liquid cooled AC induction motor. It doesn't have permanent magnets, and thus its power depends on high current. The Tesla motor is optimized for low voltage, high current, and high torque, something the battery pack can readily provide.

Of the many innovations developed in the Model S, the last I'll present is the user interface software. Tesla uses a large touch screen to operate everything except the hazard lights and the glove compartment. Software updates can be downloaded via mobile networks. The car can be upgraded, fixing issues, adding functionality, and altering the mood with time. The modular, software-based approach will redefine the usual lifecycle of a car as a consumer product.

With any luck, we'll see these obvious (in hindsight) ideas applied in future cars across the industry. But what does the future hold for Tesla?

Going forward, Tesla plans to ramp production of the Model S to meet demand in Europe, North America, and Asia. Starting late 2014, Tesla will begin production and delivery of the Model X crossover. Based on the Model S chassis, though somewhat longer and taller, the Model X will seat 7 adults and their luggage, and leverages continuing advances in battery technology for a similar range. The Model X will have an AWD option, which will also flow to the Model S, and may see its 0-60 time reduced even further.

Further ahead, Tesla plans to bring a third generation vehicle(s) to market in about 2017. Based around a smaller common chassis and starting at $35,000, these cars will be produced at a rate of half a million per year, aiming for about 5% of global market share.

Disclosure: I am long TSLA.

Caltech runners set personal bests

GoCaltech

In their final tune-up before SCIAC competition, the Caltech cross country teams lined-up at the Pomona-Pitzer Invitational on Saturday morning.

In the men's race Adithya Bagvathi set a personal best 8K mark. His time of 26:45 was a 27 second improvement from his previous best collegiate time at the distance. The sophomore has been Caltech's best finisher in all three races this season.

Alex Pien was close behind as he finished second among Beaver harriers with a time of 26:52.

Ian Koss, competing on this course for the third time, set a personal best mark at the event by crossing the finish line in 27:51.

Jared Forte continued his solid comeback from an injury by scoring points for the time since his first-year with the squad. The junior was the fourth Caltech finisher with a time of 27:55.

Rounding out the scoring runners for Caltech was Michael Ignatowich (27:57).

During the women's race Stephanie Reynolds continued her steady running by placing first among Beaver runners with a time of 24:14.

Senior Marlyn Moore, one day after her birthday, had a personal best course of 25:03 in her final run at the Invitational.

Juliette Becker's time of 26:41 was good enough for third best among the Beaver runners.

First-year Emily Mazo continued her solid campaign by running the 6K course in 27:36 while Rachel Thorp rounded out the scoring runners with a time of 27:44.

The Beavers' next meet will be the SCIAC multi-dual on Oct. 18th at La Mirada Park.

Alex Port, Jeffrey An and Roel Rodriguez run the course at the Pomona-Pitzer Invitational.

-Sheila Lo

Soccer team plays solid defense

GoCaltech

The Caltech defense came up strong time-and-time again but the Redlands men's soccer team did just enough to grab a 1-0 win on Wednesday evening.

"Today was our most complete game. We played a full 90 minutes. Even though they had a lot of shots we played defense well. We put J.D. in a good position to make the saves he had to make," head coach Rolo Uribe said.

"We took another step forward today and we are becoming a more mature team," he added.

The game's lone goal came in the 12th minute when Evan Keny-Guyer scored on a rebound inside the box from five yards out.

While the Bulldogs put 10 shots on goal during the game, the combination of solid back line defense and goal play allowed the Beavers to stay in the contest.

Caltech's best chance in the first period came in the 25th minute when Pedro Ojeda made a run down the right side but his shot from about 15-yards out was blocked aside by Andreas Silva. Late in the half Jared Reed had a shot blocked aside by a Redlands defender inside the box.

The home standing Beavers played rock-solid defense in the final 45 minutes as they kept the visitors off the scoreboard.

Ojeda had another opportunity to score but his attempt in the 61st minute was saved again by Redlands' Silva.

The Beavers next shot to get in the win column comes on Saturday afternoon at 4 p.m. when they host defending SCIAC champion Claremont-Mudd-Scripps.

The men's soccer team defended the goal through the entire game, letting through only one goal.

-gocaltech.com

Weekly Scoreboard

Women's Volleyball
vs. Whittier
L, 3-0 Final

Men's Water Polo
at La Verne
L, 11-19Final

Women's Volleyball
at Cal Lutheran
L, 3-0 Final

Men's Water Polo
vs. Washington & Jefferson
L, 18-12 Final

Men's Soccer
vs. Claremont-Mudd-Scripps
L, 6-0 Final

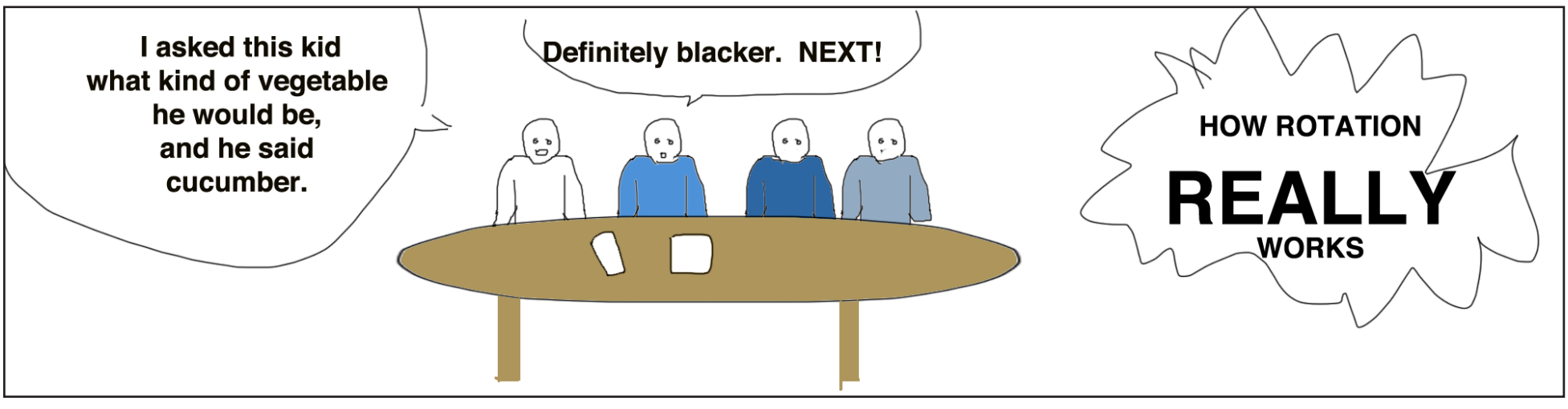
Men's Water Polo
vs. La Verne
L, 19-11

Men's Water Polo
vs. Notre Dame
L, 15-5

Men's Water Polo
vs. Penn St. Behrend
W, 9-8

Acquired Taste

Dr. Z



The Tech would like to apologize to all who felt offended by a comic that was printed last week. Our lack of thought on the issue was unacceptable, and we aim to ensure that such content will not be found in the Tech in the future.

For more photos, videos, and archives of previous issues, check out the Tech website!

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