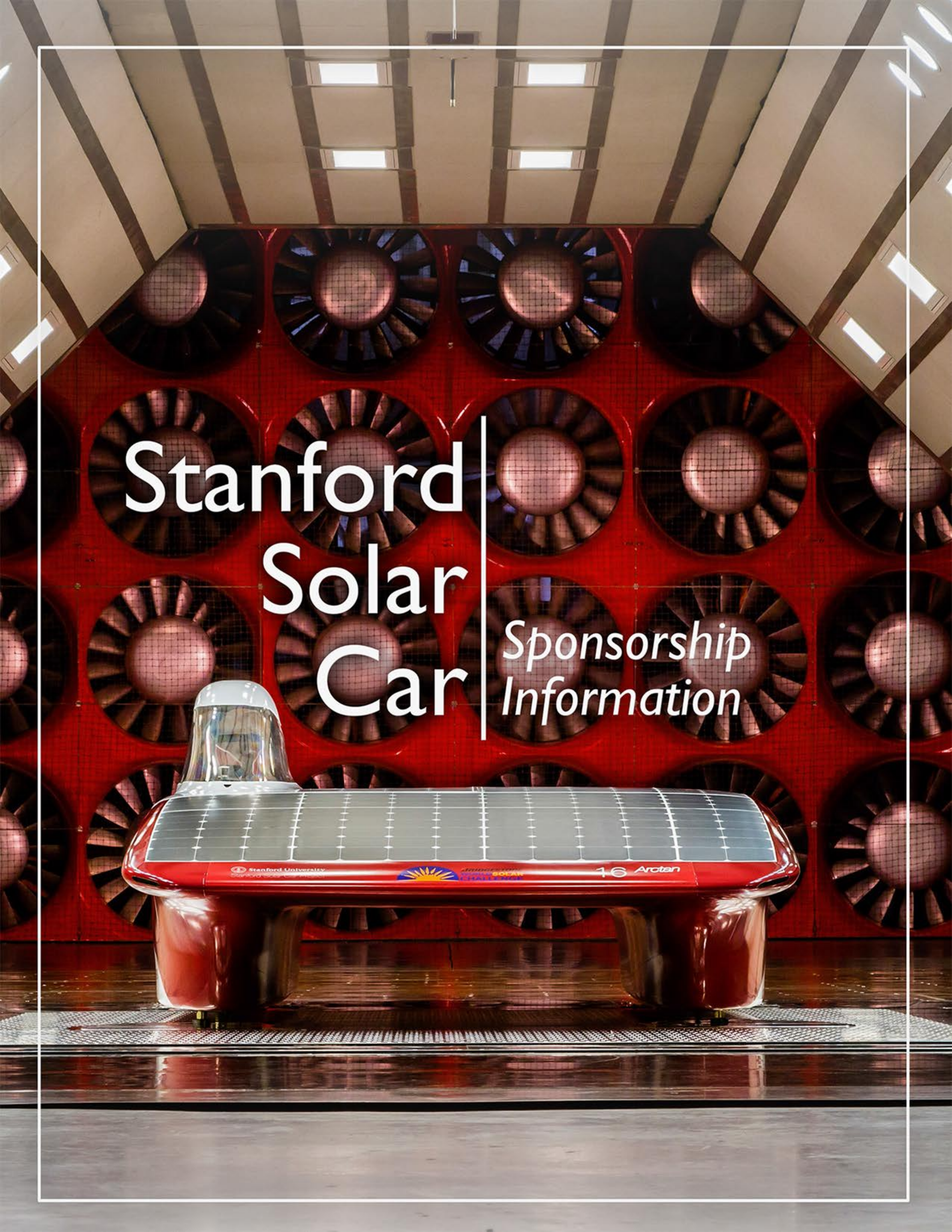
Stanford Solar Car

Sponsorship Information



A Note from our Team Leader

STANFORD SOLAR CAR PROJECT

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Dear Prospective Sponsor,

Please allow me to introduce the Stanford Solar Car Project. We are a primarily undergraduate solar car racing team from Stanford University. We are comprised of the next generation of talented engineers and designers, a dynamic team that puts in thousands of volunteer hours to create a competitive solar-powered vehicle using cutting-edge technology.

SSCP competes in the World Solar Challenge, a 3000-kilometer marathon of a race across the Australian Outback. This is the premiere international solar car competition, bringing together dozens of teams from around the world to put their hand-crafted vehicles to the test over five grueling days. Despite having no full time or graduate level engineers, SSCP continually punches above its weight, finishing near the top in recent years and improving in every metric. With your help, we hope to achieve our goal of becoming a top contender.

SSCP offers Stanford undergraduates the opportunity to put the theoretical skills they learn in the classroom into practical use. It takes a diverse team to tackle the logistic and engineering challenges inherent in designing, building, and testing an experimental super-light race car: our members major in mechanical and electrical engineering, computer science, economics, and a range of other fields. To sponsors, we provide the opportunity to invest in the future of alternative energy and automotive design, not to mention the chance to recruit from our talented pool of students and to associate your brand with innovation.

SSCP seeks long-term, mutually beneficial relationships with our sponsors and we look forward to getting to know you. Please don't hesitate to reach out to us if you have any questions about what we are working on or how to get involved. We hope you'll join us on our journey, and thank you for your time and consideration.

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ABOUT THE STANFORD SOLAR CAR PROJECT

Founded in 1989, the Stanford Solar Car Project is an entirely student-run, non-profit organization fueled by its members' passion for environmentally sustainable technology. We provide a unique opportunity for Stanford undergraduates to gain valuable hands-on engineering and business experience while raising community awareness of clean energy vehicles. The team operates on a two-year design and build cycle and enters the finished car in a trans-continental solar race.

Members usually join SSCP as undergraduates with little to no engineering background and gradually build their knowledge while working on a vehicle. Coordinating a project of such large magnitude also requires considerable management and planning, allowing students to develop these vital business skills in an engineering environment. With this approach, the team has fostered ten generations of award-winning vehicles, proving that a hands-on education in creative design and execution produces impressive results.

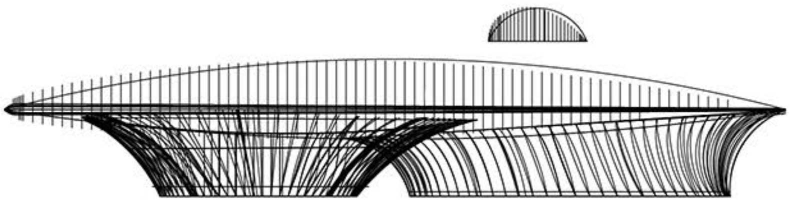
Members who graduate from SSCP go on to work with cutting-edge firms such as Tesla Motors, Google X, Boeing, Goldman Sachs, Apple, and other companies they encounter while part of SSCP. Even in fields as diverse as cancer therapeutics research and software marketing, former team members leverage the many skills they developed while working with SSCP.

Designing a Solar Car

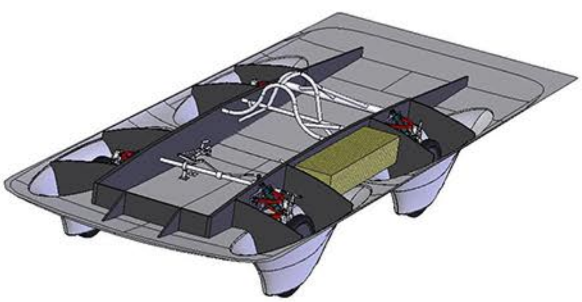
Aerodynamics
Mechanical
Composites
Electrical & Code

Aerodynamics

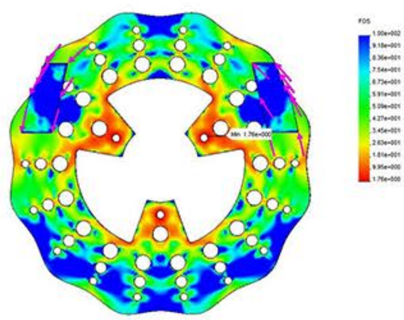
We spend the first year of our cycle designing and modeling the major components of our car so that even before it is built, we know generally how it will perform. The first major task of our design cycle is to create the exterior aerobody of the car, a process that involves multiple steps of software modeling and thousands of hours of super-computer time to determine the lift and drag for each design iteration. However, we do more than just aim for the lowest drag coefficient - we also try to develop the most stable car possible and ensure that all mechanical components fit within the aerobody.



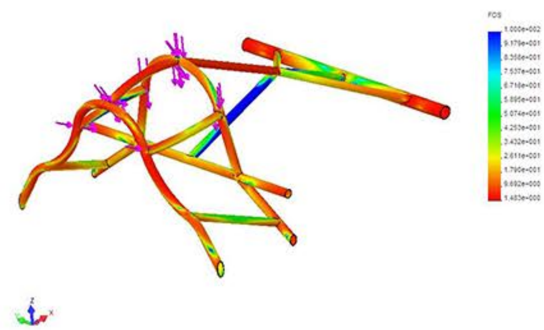
Vector Illustration of Apogee



Mechanical Mockup



Rotor Thermal Simulation

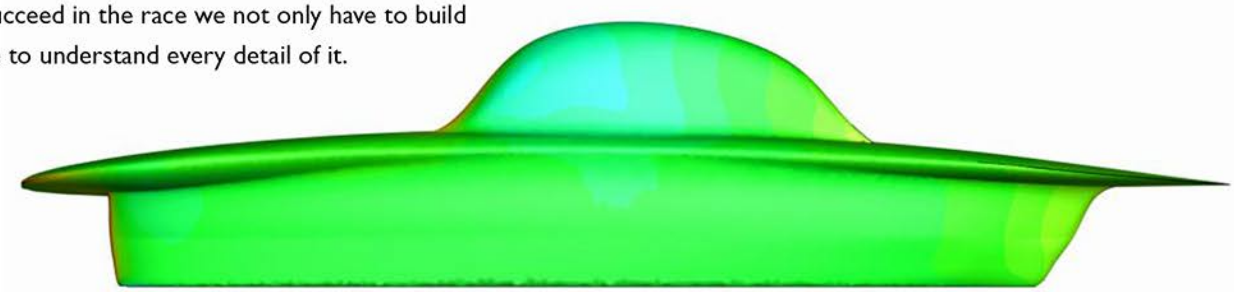


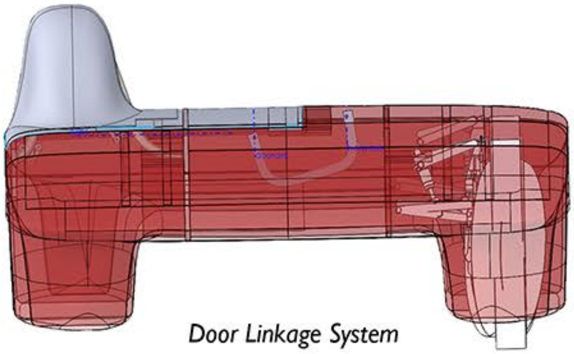
Roll Cage Compression

Modeling

At all points in the design process, and even after the car has been built, we run software models to predict how it will drive in various conditions and how much power it will take to drive. This involves tracking every bolt or dot of glue that goes onto the car and monitoring the energy use of the electrical system in practice, not just in theory, as well as characterizing the performance of the solar array we build and the aerodynamics of the actual car. Once we have all of this information, we create a strategy model that allows us to predict how best to drive in various conditions during the race so we can maximize our potential. In order to succeed in the race we not only have to build a great car, but we also have to understand every detail of it.

Computational Fluid Dynamic Simulation of Arctan





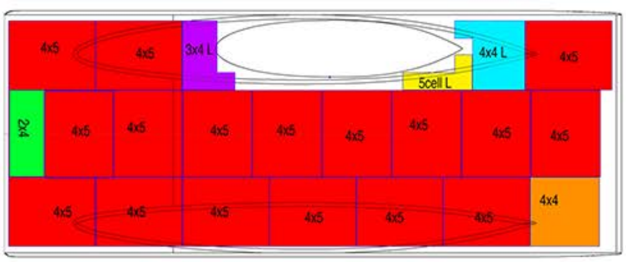
Door Linkage System

Solar Panels

Solar panels are composed of many individual solar cells. Each cell is like an LED in reverse: instead of using power to create light, it uses light to drive power through a circuit. A solar cell is a diode where free charge carrier pairs are generated by a photon impact. Those free carriers are swept away by the intrinsic electric field within the device to generate a current. Solar cars usually use one of two types of solar cells: terrestrial silicon-based cells or triple junction gallium-arsenide "space" cells intended for orbital satellites. Due to race regulations, it has historically been advantageous to use the silicon-based cells.

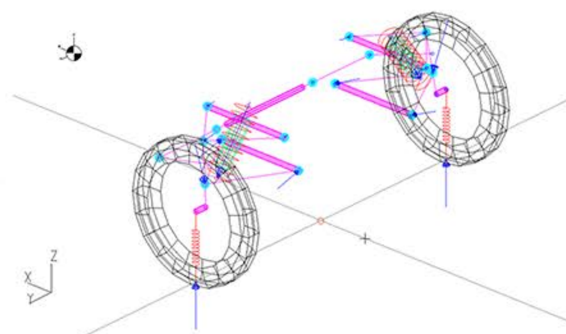
Lithium Batteries

Lithium batteries smooth out the power produced by the solar panels. If there is an excess of energy, the batteries store it for use during the evening or during bad weather. If there is a deficiency, the batteries provide the necessary energy to keep the car moving. When fully charged, Arctan's battery pack can power a hair dryer for roughly 4 hours or drive the car about 200 miles. At current California utility rates, it would cost about $0.75 to charge up the pack.



Solar Array

Battery Module



Wheels and Suspension

Motor Controller

The motor controller performs the inversion from the DC battery pack to the three-phase AC of the motor. It also controls the torque and speed, and can even change the mode of operation of the motor so that it charges the batteries under braking, recovering energy usually lost when slowing down.

Motor Controller

It's All About Efficiency

When light hits our solar cells, it energizes electrons, creating a voltage for the car's electrical circuit. Most of those electrons go straight to our motor controller and motor, generating the power needed to propel the car forward, and any extra energy is used to charge our state-of-the-art battery pack. In order to process this energy and use it in the most efficient way possible, we employ a host of specialized electronics. Maximum Power Point Trackers (MPPTs) continually check the current flowing from the array to ensure that the batteries extract the maximum possible power from the solar panels. A cruise control system allows us to maintain constant speed, and thus constant power consumption. And the Battery Management System (BMS) protects our batteries from damage during charging and discharging. During the race, the Telemetry system allows our team to remotely monitor the status of the electrical system in real time by tracking over 100 different variables. Essentially, our solar car is an extraordinarily efficient electric vehicle with a built-in solar charger. At today's energy prices, our car gets the equivalent of about 1000 mpg.

2015 - Arctan

After designing the individual components of the car, we put them all together and bring it to life. Building the solar car is a long and arduous task – it takes thousands of man hours and an extreme attention to detail to make it a reality. Everything from the carbon fiber body to the suspension and electronics is fabricated in-house by undergraduate students, and we believe that building a high-performance vehicle teaches students how to work with complex engineering systems at a level that is impossible to acheive in a classroom.

Machining and Prep

Carbon Fiber Work

Battery Assembly

Solar Array Installation

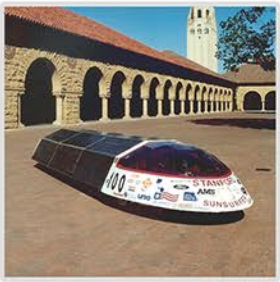
The Official Unveiling of Arctan

When we built Arctan, our goal was to make it better than our previous car in every respect, and the final product has completely fulfilled that goal. Significant improvements in the most important areas (aero-dynamics, electrical efficiency, and solar array) made us one of the best undergraduate teams in the world.

In the 2015 World Solar Challenge Arctan placed a close 6th out of 30 teams while also reducing our time behind the winning team by 50%, from ~6 hours in 2013 to ~3 hours in 2015 – a small gap considering that this is a 40+ hour race. What we are most proud of, however, is the fact that Arctan ran a flawless race, never breaking down over the entire 3022km. This is an accomplishment that few teams in the race can claim, and we believe it is due to our rigorous and extensive testing practices. After all, one of our team mottos is “Test It Again”.

A History of Innovation

1990



SunSurfer, SSCP's first vehicle, placed 7th in the 1990 Sun-Rayce, the first North American Solar Endurance Event

1997

AfterBurner II, SSCP's third vehicle, took 3rd place overall in 1997 World Solar Challenge.

2003

Back-2-Back Burner, the team's sixth vehicle placed 2nd in the two-seater class of NASC 2003.

2005

In 2005 SSCP raced its seventh car, Solstice, in the NASC, a 2500-mile race from Austin, Texas to Calgary, Canada. At the end of the ten-day challenge Solstice took first place in the stock car division, clocking the fastest time ever for a stock car in American solar racing history.

2007

Equinox was SSCP's eighth vehicle, capable of a top speed of 83 mph and over 200 miles on a single charge. Its electrical system was based on a nodal network of micro controllers and was powered by an aerospace-grade solar array. Equinox raced in the 2007 Panasonic World Solar Challenge.

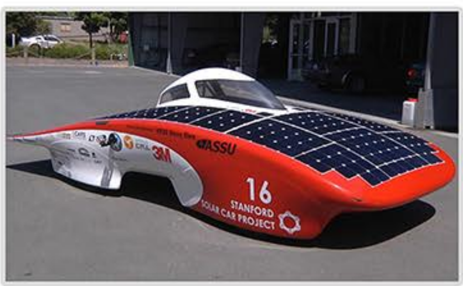
2009

Apogee, the team's ninth car, was one of the most reliable and electrically advanced cars we have ever built. After sucessfully completing the 2009 Global Green Challenge in Australia, Apogee placed fourth in the 2010 American Solar Challenge.

2011

Xenith, the team's tenth car, had one of the most efficient arrays of all the cars competing in the 2011 World Solar Challenge. Xenith finished 11th in the Challenger Class.

2013

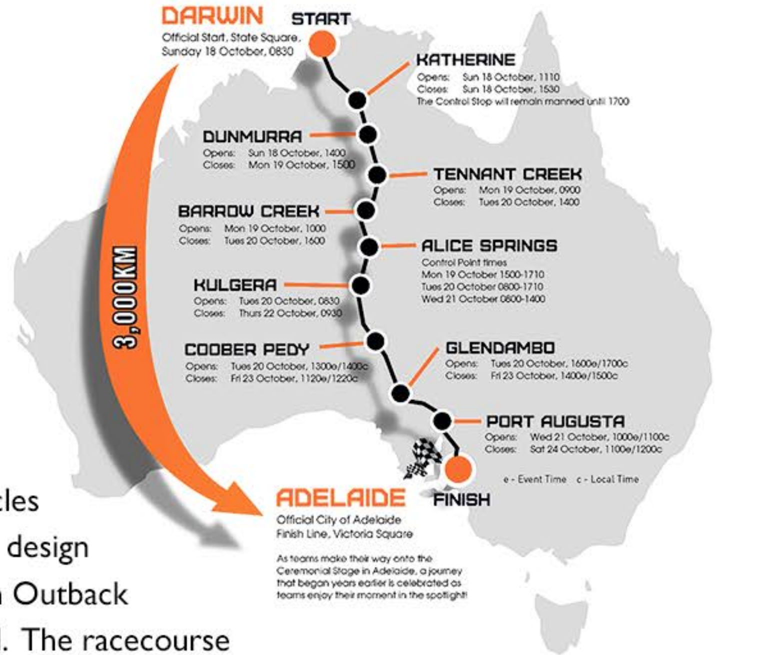


Luminos, the team's eleventh car, raced in the 2013 World Solar Challenge and placed 4th in the Challenger Class. Luminos was the fastest solar car in the world built by undergraduates.

'17

The Race

World Solar Challenge *2015*



The World Solar Challenge (WSC) is the premier international showcase of hyper-efficient electric vehicles and sustainable energy innovation. The objective is to design and build a solar car capable of crossing the Australian Outback at the highest average speed using only sunlight as fuel. The racecourse starts in Darwin and finishes in Adelaide, traversing over 3000km of open road. Finishing is alone quite a challenge. The event occurs every two years and attracts corporations, research, and educational institutions from all around the world. In October 2015, SSCP successfully raced Arctan across the Australian Outback and averaged 83.14 km/h.

Sponsorship Overview

SSCP is a unique sponsorship opportunity, providing a fusion of both education and exposure opportunities to a prospective sponsor. As a solar endurance racing organization of the highest caliber, SSCP is widely respected by many teams, universities, and companies worldwide. The team also actively promotes clean energy awareness and engineering education, essential pursuits in striving towards a cleaner future. It is rare that an endeavor can unite these aspects of education and achievement in one environmentally responsible mission, but SSCP does just that. The public and media recognize this, and SSCP's vehicles turn heads wherever they go.

Furthermore, SSCP is educating the next generation of young, environmentally-minded engineers and business leaders about to enter the workforce. Former members take the skills they develop here and become assets at some of the most exciting projects underway today. In supporting the team, companies can begin to build their name and forge relationships with some of the future leaders of the technical world.

- Recruiting Pool
- R&D Test Platform
- Opportunities for Collaboration
- National and International Exposure

With an advanced project of this scale, SSCP is looking for significant support in order to bring our team to the next level. This involves both monetary contributions and in-kind donations, covering everything from construction materials and design consulting to airplane tickets and race supplies. Contact us to find out more about how to make a contribution.

Media & Exposure

About the 2015-2017 Cycle

One of SSCP's most valuable assets is its thorough understanding of photovoltaics and the rapid advances occurring in this area. To stay competitive in the solar racing world, SSCP team members constantly research and investigate the cutting edge of solar technology. The organization then brings this knowledge of the latest developments in academia and industry to the public.

PROJECTED EXPENSES FOR OUR NEW CAR

Electrical	
New Solar Array and Encapsulation	*$108,000*
Battery Pack	*$20,000*
Electric Motor Development	*$60,000*
Motor Controller Development	*$9,000*
Steering System Development	*$19,000*
Electronic Components	*$33,000*
PCB Production	*$7,000*
Driver Interface	*$5,000*
Composites	
Molds for the Aero Shell	*$105,000*
Raw Materials for Composites	*$35,000*
Composite Panels	*$20,000*
Mechanical	
Machining Costs	*$25,000*
Custom Machined Rims	*$16,000*
Roll Cage	*$4,000*
Brakes and Suspension	*$7,000*
Fasteners	*$2,000*
Small Parts	*$2,000*
Operating Costs	
Housing	*$10,000*
Miscellaneous	*$10,000*
Tooling	*$8,000*
Design Software	*$300,000*
Capital Equipment Repairs	*$20,000*
Test Drive Trips	*$15,000*
2017 World Solar Challenge	
Car Shipment	*$15,000*
Race Supplies	*$5,000*
Race Entry Fee	*$8,000*
Support Vehicle Expenses	*$20,000*
Publicity Materials	*$2,000*
Lodging	*$13,000*
Meals	*$5,000*
Satellite Phone and Internet	*$1,000*
Emergency Funds	*$10,000*
PROJECTED TOTAL:	$919,000

> Participating in the Stanford Solar Car Project was a wonderful experience for me that really taught me how to make an engineering design function in the real world in a way that classes never could. For me this was one of the best ways to learn these hands-on lessons that I am still using today.
>
> JB Straubel
> CTO, Tesla Motors
> Stanford Solar Car Project Alumnus

PROJECT TIMELINE

2016

JUNE

- Race rules released
- Start mechanical & electrical designs

DECEMBER

- Complete aerobody design
- Finalize suspension geometry

FEBRUARY

- Finalize electrical system
- Receive aerobody molds

2017

MARCH

- Aerobody composite layups
- Finish BMS design

APRIL-MAY

- Chassis & suspension construction
- Solar panel encapsulation
- Wire electrical system
- Program car's microcontrollers

JUNE-AUGUST

- In depth, on-road testing

SEPTEMBER

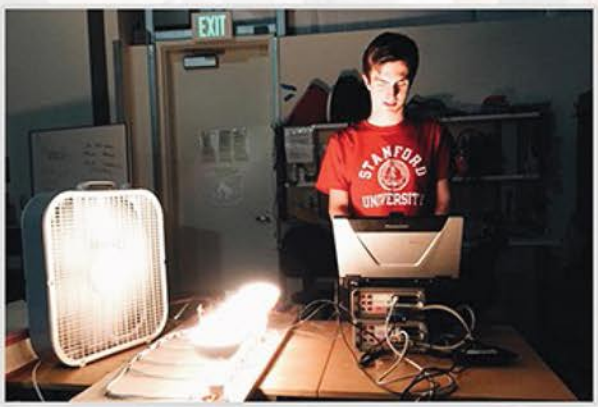
- Ship car to Australia

OCTOBER

Compete in the 2017 World Solar Challenge

Sponsorship Options

** Subject to change*



Diamond – $80,000+

- *Platinum tier benefits plus:*
- Extra large logo on the solar car
- Large logo on SSCP trailer
- Significant social media coverage
- Priority access to recruiting events and workshops
- *Tailored benefits for substatially large contrbutions*

Platinum – $40,000-$79,999

- *Gold tier benefits plus:*
- Large logo on the solar car
- Logo and description on SSCP website
- Increased social media coverage
- Access to recruiting events and workshops
- Ability to have our car at corporate events

Gold – $20,000-$39,999

- *Silver tier benefits plus:*
- Medium logo on the solar car
- Name on SSCP race uniform
- Access to recruiting events
- Access to the SSCP resume book

Silver – $5,000-$19,999

- *Bronze tier benefits plus:*
- Logo on the solar car
- Social media exposure

Bronze – Below $5,000

- Logo on SSCP trailer
- Logo and hyperlink on SSCP website

Mentors

- Additonal recognition for intangable contributions to the team (joint engineering sessions)

Thank You To Our 2014-2015 Sponsors!

2016-2017 Sponsors to be updated soon

Platinum Sponsors

Leland Stanford Junior University
3M
Cathay Pacific
HSMWorks — The CAM solution for SolidWorks
Harry Elam
Stanford | Engineering
Altium
Linear Technology
ASSU

Gold Sponsors

ST life.augmented
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AeroDyn Wind Tunnel
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SpaceX

Silver & Bronze

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- Henkel
- MC Gill
- Geico
- Amber Composites
- Keller Industries Inc.
- Intersolar North America
- Williams F1 Advanced Engineering
- IAR Systems
- Italix
- Michelin North America
- Weatherzone
- Sierra Circuits
- ClickBond

Thank you to our long-time sponsors: the Stanford Solar Car Project could not have reached where we are today without your support. We look forward to continuing to innovate, promote understanding of solar technology, and develop energy solutions for the future together, and we genuinely appreciate all that you've done for us and all that you will do in the future. As usual, we love to hear from you. If you have any questions or want to drop by our shop to check out what we're working on, don't hesitate to reach out. On behalf of all of us on the team, thank you!

Kelsey Josund
Stanford Solar Car Project Team Lead (2016-17)