

JSS Table of Contents

Section 1

- 1 You are about to begin your trip...
- 2 JSS Info page
- 3 Loan agreement
- 4 JSS Middle school TEKS chart
- 5 JSS High school TEKS chart
- 6 Basic Car design Instructions
- 7 Basic car design page 2
- 8 Resources

Section 2

NREL intro to building a model solar car

Section 3

NREL classroom investigations

Section 4

NREL So... you want to build a model solar car

Section 5

NREL Teacher and Mentor Guide

Part 6

Troubleshooting advice from us
NREL Parts and construction tips

TRAVELING ENERGY EXPLORATION STATION

You are about to begin your trip in the world of Junior Solar Sprint with the Traveling Energy Exploration Station provided to you by the Watt Watchers of Texas program.

This guide contains information and lesson plans on how to build a Junior Solar Sprint model solar car.

Inside the station you will find a disposable camera – please take pictures of your students using the station so that we can share your experience with other teachers in the state. Enjoy your exploration with the Junior Solar Sprint station, if you have any questions or concerns please contact Watt Watchers of Texas, 1-888-928-8326 or by email at info@wattwatchers.org

Junior Solar Sprint

The U.S. Department of Energy's National Junior Solar Sprint (JSS) Program is a classroom-based, hands-on educational program. Watt Watchers has teamed up with the Texas Solar Energy Society to bring JSS to Middle School Teachers across Texas. We will be presenting workshops encouraging teachers to get involved in JSS. Teachers will learn to build a model solar car and race it against the other teachers in the workshop. Teachers will be provided all the information needed to start a JSS program in their district. The model solar car belongs to the teachers when he or she completes the class. The car is given to the teacher so that he or she can take it back to his or her respective district and show it to other district science teachers, leading to the district starting a JSS program.

The primary goals of the JSS program are to:

1. Generate enthusiasm for science and engineering at a crucial stage in the educational development of young people.
2. Improve students' understanding of scientific concepts and renewable energy technologies; and
3. Encourage young people to consider technical careers at an early age.
4. Have Fun!

Middle school students are invited to design, build and race Junior Solar Sprint (JSS) cars. The small model cars - powered entirely by solar energy and steered by wires - are built as team efforts guided by teachers.

Working in teams of 2-4, each team is provided with a kit consisting of a solar panel and a motor. The students design the chassis and the transmission and build them out of any materials they wish. The finished car must have a removable solar panel. Students are encouraged to use math and science principles together with their creativity in a fun, challenging program that stimulates enthusiasm for science at a critical stage in their education.

Watt Watchers has a Junior Solar Sprint Traveling Energy Exploration Station for teachers to check out for 6 weeks for FREE. This station contains model car kits and other parts and supplies. This station will allow you to have a set of solar panels and materials so that your students can work in teams to build cars and then hold a solar car race of your own. When your race is complete take the cars apart and return the station to Watt Watchers. For more information about the JSS Traveling Energy Station or the teacher workshops please contact us.



Watt Watchers of Texas

Home Office: P.O. Box 68660, El Paso, Texas 79968 1-888-US WATTS
Regional Office: 8718 Toulouse, San Antonio, Texas 78240 1-888-WATTEAM
www.wattwatchers.org



Traveling Energy Exploration Station JSS Loan Agreement

By signing this Loan Agreement I understand that the Traveling Energy Exploration Station must be returned within six weeks from the date it arrived at the school. I also understand that the contents of the box must be returned to Watt Watchers in the same condition that it was loaned to the school. If the Traveling Energy Exploration Station is returned with broken or missing articles the school will be responsible for the cost of replacing the item.

Contents of this Station:

Teaching Aides

- Educators Guide – includes: information on the JSS program, instructions on how to assemble the cars so that the station can be returned and used by other schools and background information on solar energy
- Car Building Supplies
- 16 motors
- 16 wheel kits
- 8 Solar Panels
- 4 glue guns
- 4 matte knives
- 1 roll velcro
- Camera

Teacher

Principal

Return to Watt Watchers at:

Mail: 1026 Redfish
Bayou Vista, Texas 77563
Fax: 210-682-3284
Attn: Amy Neblett

Classroom Investigations from the NREL JSS Manual correlated to the Texas Essential Knowledge and Skills

			Transmission Investigations	Friction Investigations	Aerodynamics Investigations	Structure Investigations	Photovoltaic Investigations
Math	6th grade	2C	x				
		3ABC		x	x	x	
		6A		x			x
		8B	x	x	x	x	x
		11ABCD	x	x	x	x	x
		12AB	x	x	x	x	x
	7th grade	3b	x	x	x	x	
		9 all	x	x	x	x	
		10AB			x		
		13ABCD	x	x	x	x	x
		14AB	x	x	x	x	x
	8th grade	7B			x	x	
		11BC	x	x	x		
		14ABCD	x	x	x	x	x
		15ABCD	x	x	x	x	x
Science	6th grade	1AB	x	x	x	x	x
		2ABCDE	x	x	x	x	x
		4A	x	x	x	x	x
		6A	x		x	x	x
		6B	x				
		9AB	x	x			x
	7th grade	1AB	x	x	x	x	x
		2ABCDE	x	x	x	x	x
		4A	x	x	x	x	x
		6AB	x	x	x	x	
	8th grade	1AB	x	x	x	x	x
		2ABCDE	x	x	x	x	x
		4A	x	x	x	x	x
		5ABC	x	x	x	x	x
		7A			x		
10AB					x		

Classroom Investigations from the NREL JSS Manual as correlated to the Texas Essential Knowledge and Skills

		Transmission Investigations	Friction Investigations	Aerodynamics Investigations	Structure Investigations	Photovoltaic Investigations
IPC	1AB	x	x	x	x	x
	2ABCD	x	x	x	x	x
	4ABCD	x	x	x	x	x
	6CD					x
Physics	1AB	x	x	x	x	x
	2ABCDEF	x	x	x	x	x
	4C	x	x	x		
	5BCD	x	x	x	x	x

Junior Solar Sprint Basic Car Design Instructions

Many teachers receive this box of supplies and don't know where to start. The JSS cars are easy and fun to build and with added investigations into solar power, transmissions, friction and aerodynamics, very educational. These instructions are meant as a starting point, a way for you as the teacher to build a car before your students begin their investigations and modifications. This is by no means the only way to build a Junior Solar Sprint car, just a suggestion for getting one under your belt. The power point presentation found on the National Renewable Energy Laboratory website http://www.nrel.gov/education/jss_hfc.html has illustrations and directions for their basic car design as well.

Chassis- the car's frame

- Cut out a base from your building material that is a 4.5x 13 inch rectangle.
- Write front and rear at either end of the rectangle.
- Draw a line 1.5 inches in from either end of the base. This will be where you attach the axles.
- Cut out a notch on either side of this line to allow space for the wheel attachments.
- At the rear end of the base, draw a line perpendicular to the axle line about 1.5 inches in from the side. Cut out this line so your hole is approximately .25 inches wide. This space will accommodate the gear.

Solar panel riser- the car will run better if the solar panel is at an angle

- Cut a piece of construction material 7 x 1.5 inches.
- Draw a line 1.5 inches in from each end.
- Score along that line through 2/3 of the material.
- Bend at the lines to form a U. Place this on the chassis in front of the notch made for the gear.
- Glue the riser to the chassis with the arms of the U pointing toward the front of the car. The lines you drew should be on the bottom of the car.
- Place the solar panel on top of the car and angle it down toward the front end of the car. Shave off the arms of the riser to reach your desired angle.
- Place a one-inch piece of "fuzzy" side (loop) Velcro on top of the riser and at the front of the car.
- Place the solar panel on top of the car again, making sure that the metal connectors are at the rear of the car, and mark the bottom of the panel where the Velcro should line up.
- Attach pieces of "scratchy" side (hook) Velcro to the solar panel on your marks.
- Your solar panel may have come with Velcro already attached. In that case, you would line up the Velcro pieces of the solar panel with the riser before gluing it to the chassis.

Front wheels and axles

- Put the front axle and wheels together from the kit.
- Create or attach bearings to the axle.
- Flip car over and attach bearings to the chassis along the line you drew at the front of the car, making sure to allow the axle free rotation.
- Ideas for bearings:
 - o Use a piece of paper or cardstock to “bridge” the axle
 - o Fold a piece of tape over on itself and wrap around the axle
 - o Place the axle through a tube or straw and attach the tube to the chassis

Rear wheel assembly

- Place the axle through the largest gear found with the wheels. Then attach the wheels to the axle.
- Line up the gear with the notch you made in the chassis.
- Attach the axle to the chassis using the same method as the front wheels.

Motor- using gear driven transmission

- Set the motor in the base by placing the shaft through the large hole and securing with a screw. Check the vent hole to be sure it is visible before securing the motor.
- Attach the largest gear found with the motor to the shaft.
- Place the motor next to the gear attached to the rear wheel assembly so that the gears line up.
- Attach the motor to the chassis

Connections

- Place your solar panel back on the car and connect the motor wires
- Place the motor wire leads in between the metal connectors on the solar panel (also called leads). Create a secure connection by placing a binder clip over each one.
- Expose to sunlight and test connections. If your wheels are running backwards, switch the wires and reconnect using the binder clips.

You have successfully built your first solar powered Junior Solar Sprint car. For more construction tips, read Inside Tips on Parts and Construction portion of your JSS materials. For troubleshooting advice, see the power point presentation on the NREL website. Happy Building.

Junior Solar Sprint

Resources

- NREL maintains the web site that has student/ teacher resource material and ordering information.
- National Site: <http://www.nrel.gov/education/natjss.html>
- Colorado competition:
<http://www.nrel.gov/education/cojss.html>
- Chimacum School District No. 49:
<http://eagle.chimacum.wednet.edu>
- How a Photovoltaic Cell Works:
<http://www.eren.doe.gov/pv>
- Alternative Fuel Matters – Florida Solar Energy Center:
<http://www.fsec.ucf.edu/ed/teachers>
- Minnesota Renewable Energy Society's JSS Site:
<http://tcfreenet.org/org/mres/carmanual>
- Iowa's Energy Center Solar Car
www.energy.iastate.edu/renewable/solar/ravses/index2.htm