

Introducing the Utility Solar Vehicle Educational Program

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A Proposal

This document describes an educational program for science and vocational skills training. The program uses an interdisciplinary project-centered lesson plan in combination with internet based distance learning. The program is termed the “Utility Solar Vehicle Educational Program”, or "USVEP".

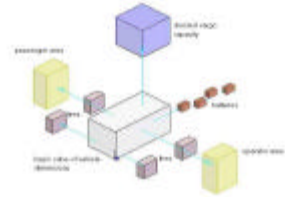
A prototype vehicle has been designed and built to provide illustrative drawings and photos as examples throughout the program. Participants in the program design and fabricate their own vehicle from initial concept to finished fabrication and testing. The program is approximately 80% finished and is expected to be ready for market within three to six months.

We are seeking individuals and institutions that can benefit through participation in the program. Opportunities range from establishing marketing and distribution to sponsorship of various aspects of the program. We are offering an opportunity to provide input into the program in a manner that will reflect individual or corporate needs of our future working partners.

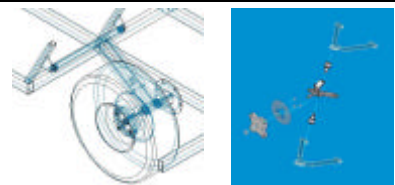
This document provides a brief introduction to the program through selected samples of text, drawings, and photos contained within the lesson plans of the product.



Our program takes participants



from a concept layout



..to working drawings,



..and classroom fabrication,



*.. in an ordered sequence of steps,
completely through building and
testing a finished vehicle.*

Description of the Product

The USVEP product consists of a manuscript accompanied by an internet based online virtual classroom, selected hardware, and technical support. The manuscript can be used as a stand-alone educational product. The online component is used as support to the publication through distance learning techniques administrated through telecommunications networks. The hardware package is an optional product to provide participants with components to build an actual vehicle.

The manuscript

The core of the USVEP is a manuscript of approximately 450 pages containing a detailed step-by-step sequence of lessons leading participants from initial conception of a utilitarian vehicle, through finished construction and testing of the vehicle. Imbedded within the text are approximately 70 CAD drawings illustrating design principles and 50 photos of assembly of our concept vehicle along with component specifications.

The online component

Under the mandate of portfolio standards, students are called upon to present their accomplishments to their community. The SolarQuest[®] Virtual Schoolhouse is an interactive learning facility that uses an online database modeled after the standard classroom protocol of curriculum, assignments, student reports, teacher feedback, and student recognition. Teachers and program managers can create their curriculum online, provide regular assignments, and participate in contests to encourage student participation. The system's built-in news service and editorial suite -- essentially an online newspaper -- enable links from the USVEP program's home page to selected reports of student accomplishments.

Through the Virtual Schoolhouse, participating teachers may set up on-line assignments for their students to submit their work through the world-wide web and share their accomplishments with the entire community of interest. Likewise, our support staff is able to provide online support to teachers, for example, by supplementing classroom materials with web postings based on photos of the actual working model.

The hardware package

The hardware package is an optional element of the program intended to provide access to components necessary to complete the vehicle designed by student participants. These components include such items as an appropriate motor, controller, meters, and solar equipment that may not be readily available locally where the program is being implemented.

Our Offer to Working Partners

We have identified industries that will benefit greatly through a working partnership in this program as follows:

- Publisher

We are seeking a publisher with whom we may contract the core manuscript of the USVEP for publication in textbook form.

- Educational Products Distributors

We are seeking national and international distributors for our product.

- CAD Software Manufacturer

Our product extensively employs CAD drawings. We are seeking sponsorship from an appropriate software manufacturer whose CAD product can be integrated into our offering.

- Manufacturers of components used in Electric Vehicles and Solar application

We offer manufacturers of these components an opportunity to promote their products throughout the entire national and international areas of distribution.

- NGO's focused on environmental protection issues

Training the next generation of engineers to work with solar electric technologies and alternatives to gasoline powered vehicles is a necessity for environmental protection, independence for developing nations, and world peace. In this respect, the USVEP addresses topics that are critical to the aims of every NGO concerned with these issues.

- Corporate Sponsors

Our program will gain high level publicity in every region where it is implemented due to the unique and topical subject matter it addresses. We can offer corporate sponsors outstanding public relations opportunities.

Utility Solar Vehicle Educational Program Sample Selections

The following section presents selections from the actual manuscript to give an idea of the quality of the finished product, beginning with the table of contents and general introduction. We then present a selection from the program as offered to participants and an example design segment. We conclude this introduction with some photos of our concept vehicle which serves as an example of prototype that participants will design and create. The actual configuration and resulting vehicle built by participants in the program will vary substantially, as the object of the USVEP is to teach design and fabrication of a unique concept that they will develop.

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Section 1 - General Concepts and Project Analysis

- Lesson 1.1 – Orientation and General Outline
- Lesson 1.2 – Portfolio Requirements
- Lesson 1.3 – Introduction to the Virtual Schoolhouse
- Lesson 1.4 – Preliminary Design Concepts
- Lesson 1.5 – Individual Components, Principles, and Related Studies
- Lesson 1.6 – Introduction to Solar in Vehicle Applications

- Lesson 1.7 – Components of an Electric Vehicle Drive System

Section 2 – Project Planning and Designing a Utilitarian Solar Vehicle

- Lesson 2.1 – Selecting a Utilitarian Application
- Lesson 2.2 – Establish Vehicle Application Specifications
- Lesson 2.3 – Create a Work Plan
- Lesson 2.4 – Preliminary Drawings & Engineering Data
- Lesson 2.5 – Preliminary Project Proposal
- Lesson 2.6 – Fundamental Concepts Quiz

Section 3 – Final Selection of Components

- Lesson 3.1 – Assembly of Technical Information
- Lesson 3.2 – Integrating Component Specifications to the Vehicle Design

Section 4 - Frame Fabrication and Installation of Components

- Lesson 4.1 – Organization of Tools and Work Area
- Lesson 4.2 – Test Modeling of the Frame
- Lesson 4.3 – Frame Construction
- Lesson 4.4 – Installation of Components

Section 5 – Design and Fabrication of the Solar Power Assembly

- Lesson 5.1 – Principles of Solar Electric Systems
- Lesson 5.2 – Designing the Solar System
- Lesson 5.3 – Fabrication of the Solar Array
- Lesson 5.4 – Assembly of the Solar BOS Components

Section 6 – Testing

Section 7 – Analysis and Revision

LESSON 1.1 – Orientation and General Outline

Suggested study procedure:

- Reading and general study of lesson 1.1 through 1.7
- Outside research to supplement information presented in lessons 1.1 through 1.7
- Layout daily log and commence daily log entries
- Participant team discussion to identify intended Vehicle Application
- Participant team consensus to establish Application Specifications
- Establish work groups and assign specific subdivision tasks
- Individual work group study to produce estimates of subassembly specifications
- Team consensus to produce Preliminary Project Proposal
- Submit Preliminary Project Proposal for administrative review

Participation Requirements

In the USVEP, participating students will design and fabricate an electric vehicle engineered to serve an identified utilitarian application and capable of being recharged by its own solar electric generator.

The vehicle must conform to two specified sets of requirements. The first set is the “Boundary Conditions”, which are a program requirement. The second set is the “Application Specifications” which will be established by student participants to configure their unique vehicle design for its intended use in their “Preliminary Project Proposal”.

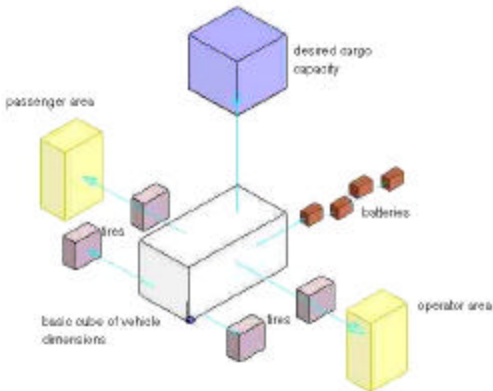
Participants’ first work task is to establish the Application Specifications. Using this and the Boundary Conditions two sets of specifications, participants will then produce a “Preliminary Project Proposal” to serve as a basis for all subsequent design and engineering work.

The Preliminary Project Proposal including the Application Specifications will be the first entry and “base feature” of the Engineering Portfolio. This Proposal is due upon completion of the entire Section 2 Lesson Plan sequence. The individual lessons within Section 1 and 2 introduce the material needed to complete this task. Participants are encouraged to make notes in their daily log as they encounter principles and considerations felt to be valuable to their unique vehicle application during study of each sequential lesson. These notes will prove valuable in development of the preliminary project proposal.

LESSON 1.4 – Preliminary design concepts

The text of this section is limited here for brevity. We present a selection of graphics and drawings to illustrate the content of our program. The preliminary design section requires participating students to analyze the concept and layout for a vehicle that fits their chosen application. Basic CAD system and/or drafting techniques are introduced in this section.

Introductory sample graphic



Block diagram representing major components that determine vehicle configuration

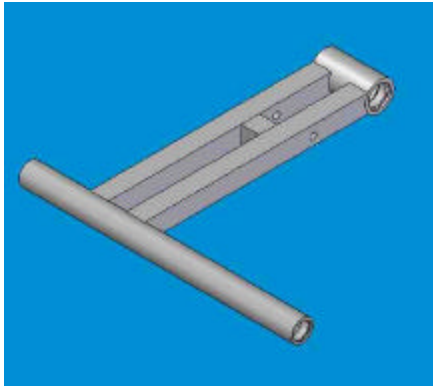
The blocks in this diagram represent how elements of the vehicle with the largest volume requirements fit within the basic cube of vehicle dimensions.

Each block is drawn to scale based on dimensions of a seated person, tires and batteries of known specifications, and cargo capacity desired to serve the chosen application.

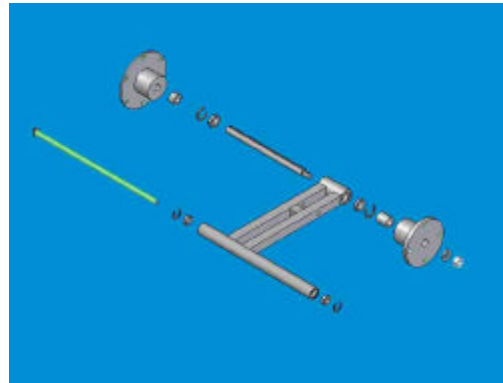
LESSON 2.4 – Preliminary Drawings & Engineering Data

Participating students then proceed to actual design exercises employing more extensive use of chosen drafting systems. This section proceeds through a breakdown of every subassembly necessary to build the concept vehicle. The following drawings and text exemplify our integration of drawings and written explanations that guide students toward completion of their projects.

Creating drawings to scale that contain every small part conceived to be needed in an assembly enables the designer to calculate accurate dimensions for each part to be fabricated. The dimensions of standardized components such as bearings, axles, nuts and bolts, snap rings and a host of others used in building an assembly are excellent finite, known data upon which to scale a unique part. Failure to consider each small item will often result in needing to rebuild the entire part or modify a related part during fabrication when the need for the omitted part becomes apparent.



The swing arm design



Exploded view of complete trailing arm assembly showing all parts and their relationship to each other.

The exact design for our trailing arm system was the result of considering virtually every aspect of the vehicle concept. In order for it to function properly, it must transfer a variety of forces adequately and travel through its entire range of movement without obstruction. Among those forces is the drive system of the vehicle, part of which impinges directly on the trailing arm assembly.

Earlier in the design conceptualization, we had chosen a chain drive operating off of a fixed differential to be mounted in front of the two swing arms. The outer extremities of the swing arms are to be supported by coil-over-shock absorbers. We have not yet determined the exact placement of the drive and shock systems, but we do know within a reasonable proximity based on our early concept sketches, which were sufficiently complete to determine a fixed mounting point for the swing arms.

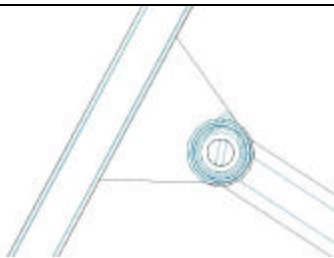


Figure 1 Above: a simple welded bracket is used to support the ends of the swing arm.

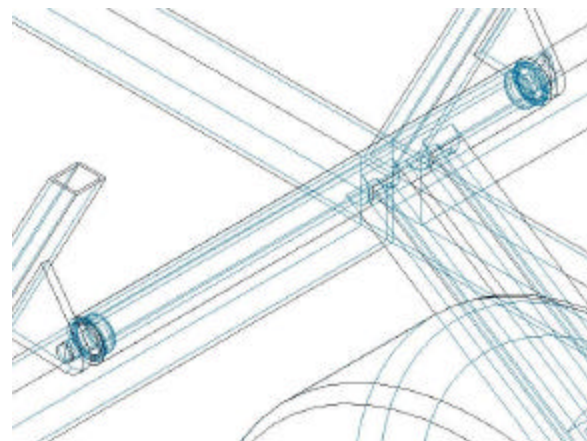


Figure 2, right: Supported by the two end brackets, the swing arm rotates around bearings fixed into the ends of the swing arm support tube.

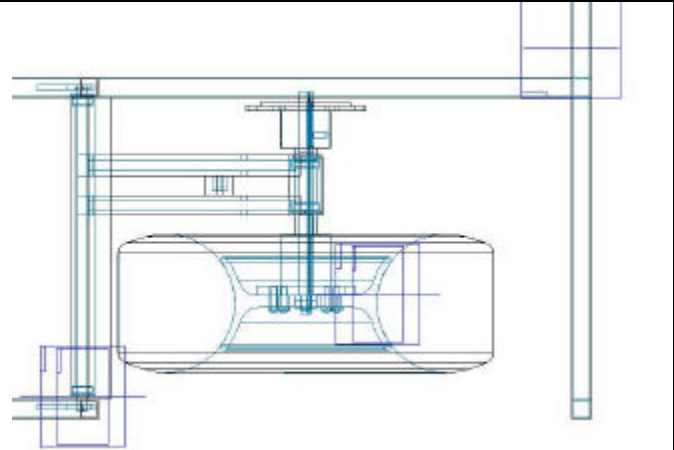
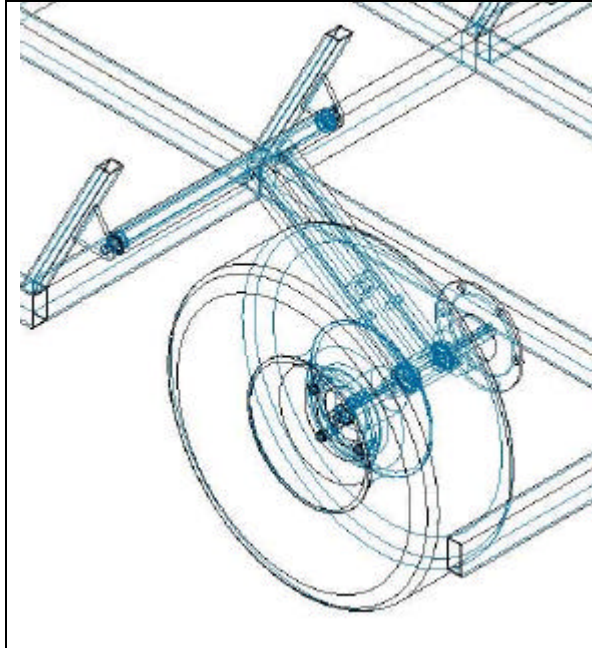


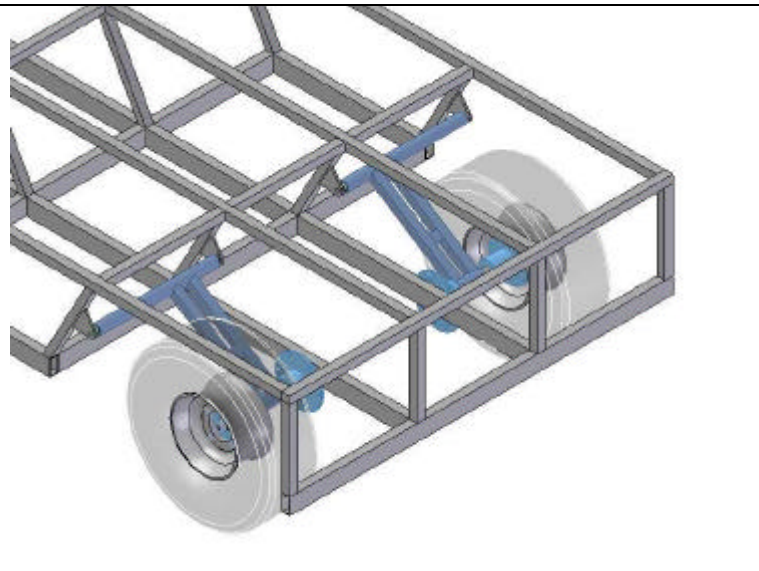
Figure 3, left: Isometric view of entire trailing arm assembly, except springs & shocks.

Figure 4: Top view

Figure 5: The complete mounted trailing arm assembly except shocks and springs.

Dimensions have been omitted from these drawings for clarity. The working drawings we took to the fabrication shop consisted of dimensioned multiple views of each part to be constructed in addition to these renderings.

Multi-view dimension drawings provide necessary information from which the part can be made and renderings give a more vivid mental picture of the end product.



[End of selection]

From the design section, our program proceeds to actual fabrication of the vehicle that has been designed by student participants. We provide example photos of our concept vehicle to match the drawing examples we have used. This serves the purpose of illustrating the fabrication process as well as demonstrating the need for an integrated approach to design and construction. Some sample photos follow.

Installation of subassemblies and mount plates



Installation of Differential unit



Installation of Steering Subassembly



Installation of Electronics Module mount block



Installation of Front Suspension assembly



Installation of Seats and Splash Panels



Concept vehicle nearing testing phase

From fabrication of the student designed vehicle, we proceed with design and installation of the solar power assembly in a similar manner. We omit this section for brevity, providing here an outline of the section contents and contents of the concluding sections.

Section 6 – Testing

During testing it was discovered that solar panels made the concept vehicle “top-heavy.” We are considering numerous expeditions to San Jose where we can explore things more fully.



Section 7 – Analysis and Revision

The program concludes with an analysis of the process as well as the designs created by the student participants. Optional modules may be made available to continue with the program in a multi year educational course.