



July, 1990 Florida to Michigan

Rayce Regulations

Table of Contents

[1.0 Purpose of GM SUNRAYCE USA](#)

[2.0 Administration of Regulations](#)

[2.1 Effective Date of Regulations](#)

[2.2 Right to Reels Regulations](#)

[2.3 Acceptance of Regulations](#)

[2.4 Sponsor and Co-Sponsors](#)

[2.5 Organizer and Address](#)

[2.6 Selection of Event Officials](#)

[2.7 Authority of Event Officials](#)

[3.0 Entries - Entry Data Sheets](#)

[3.1 Teams and Drivers](#)

[3.2 Changing Entry Details](#)

[4.0 Official Start and Finish](#)

[5.0 Solar Car Regulations](#)

[5.1 Solar Car Dimensions](#)

[5.2 Structural](#)

[5.3 Power](#)

[5.3.1 Supplemental Batteries](#)

[5.4 Motors, Gear Ratios, Tires](#)

[5.5 Storage of Solar Radiation](#)

[5.5.1 Battery Type](#)

[5.5.2 Battery System](#)

[5.5.3 Battery Disconnect](#)

[5.5.4 Main Fuse](#)

[5.6 Solar Car Classification](#)[5.7 Seating Position](#)[5.8 Visibility](#)[5.8.1 Forward Vision](#)[5.8.2 Side Vision](#)[5.8.3 Rear Vision](#)[5.9 Braking](#)[5.10 Turning Radius](#)[5.11 Stability](#)[5.12 Windshield](#)[5.13 Lighting](#)[5.14 Audible Warning](#)[5.15 Safety Belts](#)[5.16 Throttle](#)[5.17 Air Circulation](#)[5.18 Ballast Carrier](#)[5.19 Covers and Shields](#)[5.20 Electrical Shock Hazards](#)[5.21 Radios](#)[5.22 Motor Switch](#)[5.23 Driver Cockpit](#)[5.24 Fasteners](#)[5.25 Graphics](#)[5.25.1 Solar Car Numbers](#)[5.25.2 Event Identification and Logo](#)[5.25.3 Size of Graphics & Lettering](#)[5.25.4 School Names](#)[5.25.5 Solar Car Names](#)[5.25.6 Team Sponsor Identification](#)[5.25.7 Inappropriate Graphics](#)[5.26 Solar Car Identification Number](#)[5.27 Two-Seat Solar Cars](#)[5.27.1 Power](#)[5.27.2 Egress](#)[5.27.3 Covers and Shields](#)[5.28 Umbilical Cord](#)[**6.0 Nature of the Event**](#)[**7.0 Dates and Locations**](#)[**8.0 Schedule - Race Time**](#)[8.1 Racing](#)[8.2 Charging](#)[8.3 Impound](#)[**9.0 Scrutineering**](#)[9.1 Name and Location](#)[9.2 Inspected Solar Cars](#)

[9.3 Solar Cars Not In Compliance](#)[9.4 Safety](#)[9.5 Spare Batteries](#)**[10.0 Qualifying](#)**[10.1 Time and Location](#)[10.2 Gradability](#)[10.3 Qualifying Time](#)[10.4 Speed](#)[10.5 Braking](#)[10.5.1 Passing](#)[10.5.2 Failing](#)[10.6 Handling](#)[10.7 Safety Requirements](#)**[11.0 Registration](#)**[11.1 Time and Location](#)[11.2 License Plates](#)[11.3 Participants](#)[11.4 Driver Restrictions](#)[11.5 Driver and Passenger Weigh-in](#)[11.5.1 Weigh-in \(Single-Seat Solar Cars\)](#)[11.5.2 Weigh-in \(Two-Seat Solar Cars\)](#)[11.6 Ballast](#)**[12.0 Racing - Starting Order](#)**[12.1 First Day of Racing \(July 9\)](#)[12.2 Other Race Days \(July 10-19\)](#)**[13.0 Course - Route](#)**[13.1 Course Changes](#)**[14.0 Scoring/Results](#)**[14.1 Dally Elapsed Time](#)[14.1.1 Teams Completing the Day's Course](#)[14.1.2 Teams Not Completing the Day's Course](#)[14.2 Teams Falling to Follow Official Race Course](#)[14.2.1 Teams Having Been off Course But Still Completing the Day's Official Race Course](#)[14.2.2 Teams Having Been off Course And Not Crossing the Official Daily Finish Line](#)[14.3 Official Elapsed Time](#)[14.4 Dally Results](#)[14.5 Event Winner](#)**[15.0 Drivers & Team Manager Meetings](#)****[16.0 Overnight Stops](#)**[16.1 Impound](#)[16.2 Garage](#)[16.3 Support Vehicle Parking](#)[16.4 Event Headquarters](#)

[16.4.1 Mailbox](#)[16.5 Accommodations](#)[16.5.1 Food Service Area](#)[16.5.2 Lodging](#)[**17.0 Observers**](#)[17.1 Record of Performance](#)[17.2 Inspection](#)[17.3 Authority](#)[**18.0 Mandatory Pit Stops**](#)[**19.0 Checkpoints**](#)[**20.0 Maintenance**](#)[20.1 Motors, Gears and Tires](#)[20.2 Batteries](#)[20.3 Reinspection](#)[**21.0 Accidents**](#)[21.1 Accident Reports](#)[21.2 General Motors-owned Vehicles](#)[**22.0 Withdrawals**](#)[**23.0 Pushing/Trailing**](#)[**24.0 Support Vehicles**](#)[**25.0 Overtaking**](#)[25.1 By Another Team](#)[25.2 By Other Traffic](#)[**26.0 Drafting**](#)[**27.0 Helmets**](#)[**28.0 Windshield wiper\(s\)**](#)[**29.0 Penalties**](#)[29.1 Disturbing Official Battery Seals](#)[29.2 Replacement of Batteries](#)[29.3 Non-Solar Charging of Batteries](#)[29.4 Failure to Stop at a Dally Pit Stop](#)[29.5 Failure to Allow other Traffic to Pass](#)[29.6 Traffic Volutions](#)[29.6.1 Non-Moving Traffic Violations](#)[29.6.2 Moving Traffic Violations](#)[29.7 Failure to Attend a Driver and Team Manager Meeting](#)[29.8 Conduct](#)[29.9 Failure to Comply with Regulations](#)[**30.0 Protests**](#)[30.1 Time Limit](#)[30.2 Opportunity To Be Heard](#)[30.3 Successful Protests](#)[30.4 Unsuccessful Protests](#)[**31.0 Jury**](#)[31.1 Meetings to the Jury](#)

[31.2 Jurisdiction](#)[32.0 Advertizing, Promotion & Publicity](#)[33.0 Prizes and Awards](#)[33.1 Dally Award](#)[33.2 SUNRAYCE USA Trophy](#)[33.3 Runner-Up Award](#)[33.4 The Sponsor's Award](#)[33.5 Other Awards](#)[33.6 Award Ceremonies/Banquet](#)[33.7 Logos and Identification Markings](#)[34.0 Service Brake Effectiveness Test](#)[35.0 Tilt Test](#)

1.0 Purpose of GM SUNRAYCE USA

"GM SUNRAYCE USA" is dedicated to the educational development of university engineering and science students across North America. on a broader scale, the race objective is to stimulate interest in technical education and careers among student of all ages.

-Robert C. Stempel President, General Motors Corporation

2.0 Administration of Regulations

The Regulations shall apply to GM SUNRAYCE USA hereinafter referred to as the "Event".

2.1 Effective Date of Regulations

The Regulations become effective immediately.

2.2 Right to Revals Regulations

The Sponsor, as defined in [Regulation 2.4](#) below, reserves the right to revise the Regulations at any time by providing the participants written notice of revisions in the form of Bulletins.

2.3 Acceptance of Regulations

All persons or groups selected to participate in the Event are assumed to know the Regulations. Their participation in the Event shall constitute acceptance of them.

2.4 Sponsor and Co-Sponsors

The Sponsor of the Event is General Motors Corporation ("GM"). The Co-Sponsors are GM's Chevrolet Motor Division, the U. S. Department of Energy ("DOE"), and the Society of Automotive Engineers ("SAE").

2.5 Organizer and Address

GM SUNRAYCE USA is organized and operated by AeroVironment, Inc. (the "organizer") located at 1615 S. Plaza Way, Flagstaff, AZ 86001. The mailing address is GM SUNRAYCE USA, P. o. Box 2458, Flagstaff, AZ 86003. The phone number for Event Headquarters is (602) 773-0230 and the Fax number is (602) 773-1916.

2.6 Selection of Event Officials

The organizer will select and announce the list of Event Officials for this competition. The Event Officials will be instructed in and be responsible for specific duties.

2.7 Authority of Event Officials

Event Officials shall have the authority and responsibility to apply the Regulations.

3.0 Entries - Entry Data Sheets

Each University has submitted technical and personal data sheets to the organizer. Such forms included solar car specifications with photos or artist illustrations. Specifications included height, width, length, weight, solar cell type, battery type, and type of braking. Proposed team members and designated drivers (the "Team") were listed. Such data is being used in Event brochures.

3.1 Teams and Drivers

A team may consist of any number of people, however during the Event a dozen members will be specified as core members. Each Team must consist of at least 50% undergraduates and one (1) Faculty Advisor. Drivers in the Event must be undergraduate students or 1990 baccalaureate graduates of the sponsoring university. Student status is determined by successful completion of two(2) semesters or three (3) quarters credit during the period between December 1, 1988 and July 1, 1990. There is a limit of six (6) drivers per single-seat solar car Team and four (4) driver/passenger crews per two-seat solar car Team.

3.2 Changing Entry Details

Teams may change specifications of the solar car and driver(s) up to the scheduled time of Scrutineering with the exception that battery specifications may not change after April 1, 1990, without specific approval by the organizer. Such changes may not be timely enough to appear in printed lists and/or brochures.

4.0 Official Start and Finish

The Event Officially starts at Scrutineering of each Team's solar car, as defined in [5.0 Solar Car Regulations](#) All solar cars will be inspected for compliance with these regulations.

5.1 Solar Car Dimensions

All solar cars entered shall have the following maximum dimensions: height = 1.6 meters + 1%, width = 2 meters + 1%, length = 6 meters + 1%. When turning corners, wheels and wheel fairings may exceed the dimensions.

5.2 Structural

Safety is the Sponsor's primary concern. with regard to the structural development and fabrication of the solar cars. All Teams were required to document, by calculation or testing, the structural protection provided for the driver (and passenger if a two-seater). The documentation was submitted to the organizer with the Teams' January, 1990 Progress Report. The report included sketches or photos with the calculations, which specifically addressed protection for roll-overs and side impact collisions.

5.3 Power

Sunlight is the only power source that shall be used for propulsion. The solar collection panel may be constructed in any way, provided that it lies entirely within a single right rectangular parallelepiped 4 meters long by 2 meters wide by 1.6 meters high. Please note that no tolerance will be allowed on the dimensions.

5.3.1 Supplemental Batteries

Any batteries which are used to power solar car accessories such as, but not limited to, radios, electronic speedometers, cameras, and memory devices must be totally isolated from the propulsion system of the solar car. At Scrutineering, such batteries and the devices they are in will be checked to assure that no possibility exists to convert the power into propulsion for the solar car. Supplemental batteries will not be allowed to power the following equipment: 1) lights, 2) horn(s), 3) windshield wiper(s), 4) telemetry transmission, 5) computer(s), 6) battery box air circulation fans.

5.4 Motors, Gear Ratios, Tires

There are no regulations concerning motors, tires or gear ratios. However, no change of these components may arbitrarily be made between Scrutineering and the start of the race on July 9, 1990.

5.5 Storage of Solar Radiation

All solar cars in the Event will be allowed to store solar generated energy.

5.5.1 Battery Type

Battery Type only secondary (electrically rechargeable) batteries are permitted. Fuel cells, primary batteries, or mechanically rechargeable batteries will not be approved. The total battery system energy capacity will be limited to five (5) kilowatt-hours, measured at a ten (10) hour discharge rate. There

will be no limit applied to the system voltage, number of cells, or modules.

5.5.2 Battery System

Batteries must be fully contained in separate enclosures. Such enclosures must provide a means for the organizer to seal the enclosure (thus sealing the batteries). Battery enclosures shall be equipped with a forced ventilation system, rated to at least ten (10) cfm. It must operate whenever the battery system is electrically connected to the solar car. Such ventilation systems will exhaust to the exterior of the solar car. All electrical cables must be properly sized to expected system currents.

5.5.3 Battery Disconnect

The battery system shall be equipped with a manually operated, high current switch to quickly disconnect the battery from the electrical system. The switch must be capable of interrupting the full load current. The switch shall physically be located as near the battery as practical and be operable from both the driver compartment and from outside the solar car. The switch must be clearly marked in ten (10) mm high letters as the "Battery Switch" and be plainly marked with "ON" and "OFF" positions in ten (10) mm high letters.

5.5.4 Main Fuse

A separate fuse (not a circuit breaker) shall be placed in series with the main battery and the rating shall not exceed two hundred percent (200%) of the maximum expected current draw.

5.6 Solar Car Classification

The Event will have no separate classes.

5.7 Seating Position

All seating must position the occupant's head higher than his or her feet. No head-first positioning will be allowed for the driver or forward person.

5.8 Visibility

In the normal driving position with ballast on board, all drivers' eyes must be a minimum of seventy (70) centimeters above the ground.

5.8.1 Forward Vision

From the position identified in [Regulation 5.8](#) above, all drivers must be able to see without artificial assistance: 1) a point on the ground eight (8) meters in front of the solar car; 2) a minimum of ten (10) degrees above the horizon on level ground.

5.8.2 Side Vision

From the position identified in [Regulation 5.8](#) above, all drivers must be able to see without artificial assistance: ninety (90) degrees to either side of center at all times. This must be unobstructed by the solar car structure. The intent is for the driver to see oncoming traffic, left and right.

5.8.3 Rear Vision

All solar cars must be equipped with a rear vision system which will allow all drivers to see a vehicle fifteen (15) meters directly behind the solar car.

5.9 Braking

Solar cars must have a dual braking system so that if one system should fail, the solar car can still be stopped. Solar cars will be required to stop at 0.43 G's (See Figure 1) in a straight line during qualifying (see [5.10 Turing Radius](#) Solar car wheels must be able to make a U-turn in a twenty (20) meter wide lane.

5.11 Stability

Solar cars must be able to sustain realistic lateral acceleration without overturning. This capability will be tested at Scrutineering by tilting the solar cars, loaded to gross weight, thirty-five (35) degrees on a tilting platform (See Figure 2).

5.12 Windshield

All Teams must have a windshield and windshield wiper(s) to mechanically clear the windshield of rain.

5.13 Lighting

Solar cars must have stoplights, front and rear turn indicators, and hazard lights visible from thirty (30) meters away. All Teams will be provided two (2) lights by Inland-Fisher-Guide Division which must be fully functional as stoplights, turn indicators, and hazard lights. Such lights must be used unmodified. The geometric visibility of each light should be forty-five (45) degrees inboard and outboard, and fifteen (15) degrees up and down.

5.14 Audible Warning

All drivers must be able to give audible warning to pedestrians and other vehicles of their presence. A horn will be provided by Delco-Remy Division to all Teams. The horns must be mounted so adequate warning can be heard at a distance of fifteen (15) meters and they must be used unmodified.

5.15 Safety Belts

All solar cars must be equipped with a minimum of a five-point lap, shoulder and crotch belt. The use of safety belts is mandatory for all persons in the solar car. The safety belts must be attached securely

to a strong component or main frame member in the solar car.

5.16 Throttle

Accelerator mechanisms on solar cars must be free moving and when released, must return to the zero current position. If the solar car is equipped with cruise control, it must be designed with an automatic shut-off when the brake is activated.

5.17 Air Circulation

Fresh air must be provided for the solar car's occupants.

5.18 Ballast Carrier

All solar cars must make provision for carrying a bag(s) containing lead shot ballast. The ballast carrier must be secured to a main component or frame member in or on the solar car, and have means to secure the bag(s) of ballast.

5.19 Covers and Shields

The solar cars revolving parts must be suitably covered to prevent accidental contact. All steering linkage must be shielded from the contact of the driver(s). If a flywheel is used, it must be covered by an NHRA approved scatter shield.

5.20 Electrical Shock Hazards

All exposed conductors operating at greater than thirty-six (36) volts must be properly insulated and marked with high voltage warning signs.

5.21 Radios

All solar cars must be equipped with a two-way radio to allow communications with the observer.

5.22 Motor Switch

All solar cars must have a switch wired to disconnect all power to the "motor". The device must be able to interrupt full load current. It must be clearly marked (10 mm high letters) as the "Motor Switch", and be within easy reach from both the driver's position and from outside the solar car. The switch must be plainly marked (10 mm high letters) "ON" and "OFF".

5.23 Driver Cockpit

The driver's cockpit must provide for the driver(s) unassisted exit within fifteen (15) seconds in case of emergency. The cockpit must be equipped with a full belly pan to isolate the driver(s) from the road.

5.24 Fasteners

All fasteners associated with the solar car's suspension, steering, brakes, seat belts, battery chassis, ballast carrier and drive train must be equipped with locking nuts, double nuts, or nuts secured with safety wire or cotter pins. Loctite may be used in areas of difficult accessibility, but must be accompanied by a written statement of application by the Team's Faculty Advisor.

5.25 Graphics

5.25.1 Solar Car Numbers

Each solar car will have an allotted number approved by the organizer. The number must be displayed on both sides of the solar car. Each number must have a minimum of five (5) cm of unobstructed background color on all sides. The colors can be black on white, white on black, or another high contrast color approved by the organizer. The numerals themselves must be a minimum of twenty-five (25) cm high, twelve (12) cm wide (except the numeral one [1]), and have a minimum brush stroke of four (4) cm. Numbers containing more than one numeral must have a minimum of two and one-half (2.5) cm spacing between them.

5.25.2 Event Identification and Logo

The Event identification and logo must be applied on both sides of the solar car. The logo will be provided by the Sponsor and measure no more than twenty (20) cm in height by thirty-two (32) cm in width and it must have five (5) cm of unobstructed background color on all sides.

5.25.3 Size of Graphics & Lettering

No graphics or lettering will be approved if it is over five hundred (500) square cm. in area or has lettering over eight (8) cm. in height

5.25.4 School Names

School names or approved abbreviations are optional for the Event.

5.25.5 Solar Car Names

Car names on the solar cars are optional.

5.25.6 Team Sponsor Identification

A maximum of three (3) advertising spots per sponsor will be allowed, each with the maximum size given above. No Team sponsorship graphics will be added after Scrutineering without the organizer's approval.

5.25.7 Inappropriate Graphics

The organizer reserves the right to disapprove any graphics, which, in its sole discretion, it deems as inappropriate or offensive. Decisions of the organizer are final.

5.26 Solar Car Identification Number

Each solar car must have a serial number either inscribed on the frame or indelibly printed on a durable plate which is attached permanently to the chassis. The serial number should consist of the school or manufacturers initials and chassis number.

5.27 Two-Seat Solar Cars

Two-seat solar cars may be entered in the Event. These two-seat solar cars must follow all the previous Regulations with the following modifications:

5.27.1 Power

The solar car size limits are the same, but the solar collection panel must lie entirely within a single right rectangular parallelepiped 6 meters long by 2 meters wide by 1.6 meters high.

5.27.2 Egress

Accommodations must be made to allow for the unassisted exit of both the driver and passenger within fifteen (15) seconds in an emergency.

5.27.3 Covers and Shields

The revolving parts and any steering linkage must be shielded from accidental contact by either person in the solar car.

5.28 Umbilical Cord

In order to position a solar car's solar array in a favorable position for charging, an umbilical cord may be used. The cord must not be longer than seven (7) meters and it must be carried in or on the solar car.

6.0 Nature of the Event

The Event is an eleven-day staged race with each day covering a course with specific Start and Finish lines. A "Route Book" will be provided each Team which will contain road maps and route instructions. The Team with the shortest cumulative Official Elapsed Time over the Official Course will be declared the winner. During the course of the Event, all state and local traffic laws must be followed. At Indianapolis Motor Speedway, a speed limit of 50 miles per hour will be in effect.

7.0 Dates and Locations

July 5,1990 Disney Village Conference Center
(Check-in and Mixer)

July 6,1990 Daytona InternatbnaL Speedway
(Scrutineering and Oualifying)

July 7,1990 Walt Disney World STOLport and Disney Village Conference Center
(Vehicle Testing and Registration)

July 8,1990 Walt Disney World STOLport and Disney Village Conference Center
(Registration, Team Meetings, Final Vehicle Testing)

July 9,1990 Start/EPCOT--Finish/Floral Park, FL

July 10,1990 Start/Floral Park, FL- Finish/Tallahassee, FL

July 11,1990 Start/Tallahassee, FL-Finish/MOntgomery, AL

July 12,1990 Start/MontgOmery, AL- Finish/Haleyville, AL

July 13,1990 Star/Haleyville, AL- Finish/Spring Hill, TN

July 14,1990 Start/Spring Hill, TN-- Finish/Bowling Green, KY

July 15,1990 Start/Bowling Green, KY--Finish/Louisville, KY

July 16,1990 Stan/Louisville, KY-Finish/Indianapolis, IN

July 17,1990 Start/Indianapolis, IN--Finish/Greenville, OH

July 18,1990 Start/Greenville, OH-Finish/Mason, Mi

July 19,1990 Start/Mason, Ml--Finish/Warren, Mi

8.0 Schedule - Race Time

Eastern Daylight Time is the "Official Time" for all days of the Event. regardless of time zone.

8.1 Racing

Each day of racing will begin at 0900 hours and all racing will stop promptly at 1830 hours. There are two (2) exceptions: 1) the first day will begin at 1100 hours; 2) the last day will end prior to 1600 hours.

8.2 Charging

Teams may charge their solar car batteries from 0700 hours until 2030 hours unless they cross the Official Finish Line for the day before 1830 hours. If a solar car crosses the Official Finish Line for the day before 1830 hours, the solar car's battery switch must be turned off (see [Regulation 5.5.3](#)). Charging will then be allowed from 1830 hours until 2030 hours.

8.3 Impound

All solar cars will be impounded under Event security as soon as possible after 2030 hours each day. The Teams will start removing their solar cars beginning at 0645 hours the next day.

9.0 Scrutineering

All solar cars will be inspected to verify compliance with the Regulations ("Scnutineering").

9.1 Name and Location

All Teams will be required to be at Daytona International Speedway for Scrutineering beginning at 0800 hours on July 6,1990. Prior to July 6th, each Team will receive a specific time to report. Additional inspections will be held at the Disney STOLport on July 7 and 8, 1990.

9.2 Inspected Solar Cars

All solar cars which pass Scrutineering will be allowed to Qualify and race in the Event.

9.3 Solar Cars Not In Compliance

Any Team not passing Scrutineering will be required to repair the deficiency or make necessary repairs prior to qualifying. Any solar car not in compliance with the Regulations will not be allowed to start racing.

9.4 Safety

Each Team is responsible for the road worthiness of its solar car; passing Scrutineering does not relieve the Team of any liability. All solar cars must be maintained in a safe, road worthy condition at all times.

9.5 Spare Batteries

Any spare batteries a Team wishes to utilize for possible replacement during the Event must be inspected and tagged during Scrutineering.

10.0 Qualifying

The primary purpose of Qualifying is to determine the eligibility of Teams to participate in the Event. Qualifying will be used to test the braking, gradability, handling, speed and qualifying Time of each solar car. Each Team will receive, no later than May 1, 1990, all necessary instructions for Qualifying. Such instructions will include a detailed format and scoring method.

10.1 Time and Location

Qualifying will begin at 1430 hours July 6,1990 at Daytona International Speedway. If necessary, additional opportunities for Qualifying will be held July 7 and 8,1990 at the Disney STOLport. Order of Qualifying will be determined by a drawing at a Mixer on July 5, 1990.

10.2 Gradability

Each solar car will be required to climb up a grade of no more than ten percent (10%) from a standing start for a distance of no more than ten (10) meters.

10.3 Qualifying Time

Each solar car will be timed over a qualifying course. Qualifying Times will be used to determine the starting order for the first day of racing.

10.4 Speed

During Qualifying and before the braking test, each solar car will be measured for speed in a trap.

10.5 Braking

For Qualifying, each solar car will be required to stop from its trap speed and may use all braking systems during the braking test. The distance it takes each solar car to stop will be measured.

10.5.1 Passing

To pass, the measured stopping distance must be within the guidelines stated in [Regulation 5.9](#).

10.5.2 Failing

If the measured stopping distance is not within the guidelines stated in [Regulation 5.9](#), it will be necessary to make modifications and be retested satisfactorily on July 7th and 8th at the Disney SToLport. Failing the braking test nullifies the Qualifying Time. Any solar car which does not pass the braking test by July 8th will not be allowed to start racing.

10.6 Handling

Each solar car will be required to run through a slalom course to observe the handling characteristics during the timed qualification run.

10.7 Safety Requirements

For added safety during Qualifying, all drivers and passengers will be required to wear: 1) a helmet with a Snell 85 rating or better; 2) an arm restraint system.

11.0 Registration

The purpose of Registration is to identify all participants and solar cars taking part in the Event.

11.1 Time and Location

Check-in and Registration will be held at the Disney Resort Village Conference Center on July 5, 7, and 8, 1990.

11.2 License Plates

Each solar car passing scrutineering will be issued a Florida license plate. The plate must be mounted to

be visible from the outside at the rear of the solar car.

11.3 Participants

Any person taking part in the Event must be registered by the organizer. This includes the media, Sponsor, Co-Sponsors. Team sponsors, Event Officials, guests and Teams. Badges will be issued and will be used to control access to restricted areas. The badges must be visible at all times.

11.4 Driver Restrictions

There is a limit of six (6) drivers per single-seat solar car Team and four (4) driver/passenger crews per two-seat solar car Team. All solar car drivers must have a valid drivers license, school I.D. and be in compliance with [Regulation 3.1](#). All drivers must be identified and badged at Registration. only drivers registered with the organizer will be allowed to compete in the Event.

11.5 Driver and Passenger Weigh-in

All solar car drivers and passengers must be weighed and will be assigned proper ballast to be designated as such.

11.5.1 Weigh-in (Single-Seat Solar Cars)

For a single-seat solar car, the Official driver's weight will be seventy-nine (79) kilograms. If the weight of the driver is less than 79 kg, ballast will be added to make up the difference. If the weight of the driver is over 79 kg, no credit is given. As stated in [Regulation 27](#), if a driver wishes to wear a helmet, it will be considered as part of his or her ballast. The ballast for the heaviest driver will be fixed in the solar car and all other drivers' ballast reduced accordingly.

11.5.2 Weigh-in (Two-Seat Solar Cars)

The combined weight of the driver and passenger in a two-seat solar car will be one hundred forty-nine (149) kilograms. If the weight of the driver and passenger is less than 149 kgs, ballast will be added to make up the difference. As stated in [Regulation 27](#), if a driver and/or passenger wishes to wear a helmet, it will be considered as part of his or her ballast.

11.6 Ballast

Drivers and ballast will be identified with unique identification tags. The ballast corresponding to the driver(s) must be carried in the solar car during competition hours.

12.0 Racing - Starting Order

Solar cars will be released from the Official starting point in thirty (30) second intervals. All solar cars will be timed from their assigned starting positions. If-a solar car fails to start in its assigned position, it will be moved to last place in the starting order.

12.1 First Day of Racing (July 9)

The starting order on July 9 will be based on the Qualifying Times set on July 6,7 and 8. All solar cars that qualified on July 6 will be started in the order of (qualifying Times from the shortest time to the longest time. Next will be the solar cars that qualified on July 7 and they will also be put in order from the shortest to longest qualifying Times. Finally, cars that qualify on July 8 will be put in starting order, again from the shortest to longest Qualifying Times. In case of a tie, the first Team to Qualify will precede the others in the starting line-up.

12.2 Other Race Days (July 10-19)

Other Race Days on July 10-19, solar cars will be started in the order of shortest to longest Elapsed Time from the previous day of racing. In case of a tie, the first Team to cross the previous day's finish line will precede the others in the starting line-up.

13.0 Course - Route

A Sunrayce Route Book will be distributed to each Team containing information to direct the Team along the correct route. It will specify days, dates, distances, directions, route numbers, maps, and points of reference. For a team to receive Official Time, they must follow the Official Race Course.

13.1 Course Changes

The organizer has made every effort to be as accurate as possible in the Route Book; but due to unforeseen events, it may be necessary to detour. If this becomes necessary, the organizer will correct the Official Distance accordingly.

14.0 Scoring/Results

Official times and distances are the responsibility of the Event Officials. Each day, all Support Vehicle odometers will be checked by an observer.

14.1 Dally Elapsed Time

A Team's Daily Elapsed Time will be Ule.actual elapsed time to cover the Official Distance if the Team complete's the day's course; a Team`s Daily Elapsed Time will be calculated if the Team does not complete the entire day's course.

14.1.1 Teams Completing the Day's Course

Teams completing the day's entire course will have their Daily Elapsed Time based on the actual time which has elapsed from their assigned Official Starting Time to the time at which the Team crosses the Official Daily Finish Line.

14.1.2 Teams Not Completing the Day's Course

Teams not completing the day's entire course will have their Daily Elapsed Time calculated as follows:

The allowed driving time for the day (typically nine and one-half [9 1/2] hours) plus two (2) minutes for every mile not covered on that day's Official Course.

- **Allowed driving time + (2 minutes x distance not covered) = Calculated Daily Elapsed Time**

Example: (based on 100 miles not completed)

- **9 1/2 hrs + (2 minutes x 100) - 12 hours =50 minutes**

14.2 Teams Falling to Follow Official Race Course

Any Team accidentally leaving the Race Course must return to the Official Course, by way of the same route(s) or as nearly as possible. The observer with the Team will note the odometer mileages and times at the point of turn around and at the point they re-enter the Official Course. The recorded times and distances will be used to calculate the Team's Daily Elapsed Time in the event that they do not cross the Official Daily Finish Line. (See [Regulation 14.1.2](#)).

14.2.1 Teams Having Been off Course But Still Completing the Day's Official Race Course

If the Team returns to the correct route and still completes the day's Official Course, its Elapsed Time will be the time from crossing the Starting Line until reaching the Finish Line. No credit will be given for the time the Team was off course.

14.2.2 Teams Having Been off Course And Not Crossing the Official Daily Finish Line

If the Team has been off course and does not cross the Official daily Finish Line, the recorded times and distances will be calculated to determine the Team's Official Daily Time (see [Regulation 14.1.2](#)).

14.3 Official Elapsed Time

Teams' awards will be based on Official Elapsed Times. The Official Elapsed Time will be calculated as follows:

- **Official Elapsed Time = Dally Elapsed Time + Penalties**

14.4 Dally Results

Each day, an award will be given to the Team with the shortest Official Elapsed Time for that day.

14.5 Event Winner

The winner of the Event will be the Team with the shortest cumulative Official Elapsed Time over the entire eleven (11) days of the Event.

15.0 Drivers & Team Manager Meetings

A meeting will be held at 0730 hours before each race day begins. Attendance is mandatory for a minimum of one (1) driver and the Team Manager (or a designated substitute). Due to limited space, attendance will be limited to a maximum of four (4) team members per Team. All Official statements, including starting order, will be made at such time.

16.0 Overnight Stops

At the finish of each race day, specific areas will be designated for Impound, Garage, Support Vehicle Parking, Event Headquarters and Food Service Area. Such areas will become the staging area for the start of racing the following morning.

16.1 Impound

The Impound will be a building or dry tent where every solar car will be secured under the direction of Event Officials (see [Regulation 8.3](#)). There will be no maintenance allowed on the solar cars while impounded and no Team members will be allowed in the Impound area except for placement and removal of their solar car. Solar cars transported to the overnight Stop and arriving after 2100 hours will be impounded immediately upon arrival.

16.2 Garage

The Garage will be an area for the charging and maintenance of solar cars before and after Impound. Only solar cars (no other vehicles), Event Officials, media and Teams will be permitted in the Garage area.

16.3 Support Vehicle Parking

All Support Vehicles must be parked in an area designated for the vehicles. Maintenance or repair on solar cars requiring close proximity to the Support Vehicles must be done in the Support Vehicle Parking area.

16.4 Event Headquarters

The Event Headquarters will be located near the Impound and Garage areas at each overnight Stop. All Official postings will be at the Event Headquarters area.

16.4.1 Mailbox

All Teams shall notify the organizer of their Team Manager's overnight location. This should be done each night by filling out the provided form and placing it in the mailbox at Event Headquarters.

16.5 Accommodations

All Teams are responsible for Team accommodations.

16.5.1 Food Service Area

The organizer will make an evening meal available to the Teams at each Overnight Stop. A meal ticket system will be used. The meal ticket packages will be for the entire Event (no partial packages) and must be purchased prior to July 9, 1990.

16.5.2 Lodging

Provisions have been made for camping at or near most overnight Stops. Teams are responsible for their own reservations.

17.0 Observers

Teams must allow an observer the entire seat behind the driver in the Chase Vehicle. All observers shall keep their assigned solar car in sight from leaving the Impound each morning to entering the Impound each evening. Observers will be rotated in their assignments at least daily. Each Team must adhere to the observer's instructions.

17.1 Record of Performance

The details of the activities of a Team will be recorded in a Log Book carried by the observer. The Team Manager will be asked to sign the book each day. Failure to do so, however, will not make any record invalid.

The records kept by the observer will be the Official starting position, timing (including Pit Stops), the distances traveled, and any penalties assessed.

17.2 Inspection

The observer must be allowed access to the solar car for inspection of seals and to otherwise determine compliance with all Regulations. The observer will witness all work done on the solar car.

17.3 Authority

Observers may not interpret Regulations or give advice. The observer has the authority to assign penalties for rule infractions, keep records of performance, and if necessary for safety reasons, require a Team to pull over and Stop.

18.0 Mandatory Pit Stops

A Pit Stop is a mandatory stop during the race day. Charging is allowed during the Pit Stop, but there will be no repairs allowed on solar cars during this time. Except the first and last days, one (1) Race Course Pit Stop will be designated and detailed in the Route Book. Such Pit Stop is for ten (10) minutes and is mandatory for all solar cars reaching the Pit Stop during racing hours.

19.0 Checkpoints

A Checkpoint will be established between the Official Daily Start and Pit Stop and another between the Pit Stop and Official Daily Finish Line in order to help the organizer track the progress of each day's race. No stop is required at the Check-points.

20.0 Maintenance

Solar cars may be repaired and maintained during most of the race day. The only time repairs and maintenance may not be performed is during Impound and at Pit Stops. Maintenance will only be done with an observer present. Any component of the solar car may be changed and repaired with the following restrictions:

20.1 Motors, Gears and Tires

A solar car's motor, gears and/or tires may be changed due to failure, but not arbitrarily between qualifying and the July 9th Race Start.

20.2 Batteries

Cells, modules, or battery packs may not be replaced for any reason other than malfunction or an accident. Decisions to exchange all or part of the battery should be formally communicated to the observer, who will release the required exchange and record the violation. If necessary, the penalty will be imposed over more than one (1) day of travel so that the full penalty is applied. The Chief Battery Scrutineer has the authority to impose further penalties if a Team, in effecting a battery replacement, has gained an unfair advantage over other Teams or has otherwise departed from the spirit of competition. The penalty will be computed as follows:

$$\text{Time penalty (minutes)} = M \times (1.25)^{(r-1)} \times (n/N)$$

where:

- M = mileage traveled during the day of the battery replacement
- r = number of battery replacement(s)
- n = number of replacement cells (or modules)
- N = total number of cells (or modules) in solar car pack

20.3 Reinspection

If a solar car is involved in an accident, it must be reinspected by the Chief Safety Inspector. Such inspection will be held no later than the evening at completion of that day's racing, or if safety is in

question. the observer may require reinspection prior to resuming the race. In all cases, the observer must approve further competition.

21.0 Accidents

21.1 Accident Reports

All accidents must be reported immediately to a GM observer, the GM Public Relations Staff and the Organizer. Failure to do so may result in expulsion from the Event. In the case of an accident involving personal injury and/or property loss, notification of the appropriate public safety Officials and the GM Public Relations Staff will take priority.

21.2 General Motors-owned Vehicles

In the case of an accident involving a General Motors-owned vehicle, a verbal accident report must be filed with the Chevrolet Marketing Department (313) 492-6709 within twelve (12) hours of the incident. Within twenty-four (24) hours, a written accident report must be completed and forwarded to Chevrolet Motor Division, Room 150-03, 30007 Van Dyke Ave., Warren, Michigan 48090, Attention: Mr. J. C. McKenna.

22.0 Withdrawals

Any Team which has agreed to participate shall fulfill such obligation, unless excused by the organizer. Any Team wishing to withdraw must notify the organizer, in writing, and if during the Event, will also notify the Director of Racing of its intent as early as possible.

23.0 Pushing/Trailing

Solar cars may be pushed into and out of Impound, but regenerative brakes may not be used during such times. During race hours, solar cars may not be pushed, except that in an emergency the solar car may be pushed off the highway. In the event that a solar car cannot make it to the Official Finish Line, it shall be moved by truck or trailer to the Official Finish Line.

24.0 Support Vehicles

Teams will be allowed three (3) Officially registered and marked Support Vehicles. Two (2) of the vehicles are supplied by the Sponsor. The two (2) supplied vehicles should be used as follows: a Chevrolet Lumina APV as Lead Vehicle, directly in front of the solar car, and a Chevrolet Beauville van as Chase Vehicle, directly behind the solar car. The Lead Vehicle must use roof-mounted, flashing amber lights to warn other traffic of potential hazards. The third Support Vehicle must avoid caravanning with the solar car and its Lead and Chase Vehicles. All other Teams' vehicles must travel separately and, if possible, use alternate routes to keep from congesting the Race Course.

25.0 Overtaking

Since the Event will take place on some two (2) lane roads, there will be times that solar cars and their Support Vehicles will need to pull over while being overtaken.

25.1 By Another Team

In the event that a Team is overtaken by another, the faster Team should signal its intention to pass by turning on the headlights of its Lead Vehicle. The slower Team must pull over as soon as safely possible and allow the faster Team to pass. Failure to do so will result in a penalty.

25.2 By Other Traffic

In the event that six (6) or more vehicles are lined up behind a Team's Chase Vehicle, the Team must pull over as soon as safely possible and allow traffic to pass. Failure to do so will result in a penalty.

26.0 Drafting

Drafting by a solar car is prohibited. A solar car will be considered to be drafting if it continuously follows behind another vehicle at less than sixty (60) meters. The only exception to this is in city driving at speeds of thirty-five (35) miles per hour or less. In such case, one car length per ten (10) miles per hour should be maintained between all vehicles.

27.0 Helmets

Helmets are not mandatory for the solar car drivers or passengers during racing. If a driver or passenger wishes to use one, a helmet will be considered as part of his or her ballast. As such, the helmet must be carried in the solar car during competition hours. Helmets are required during qualifying as noted in [Regulation 10.7](#).

28.0 Windshield wiper(s)

Windshield wiper(s) must be operated when it becomes necessary to use the windshield wipers on the Team's Support Vehicles. The observer has the authority to require the windshield wiper(s) to be activated. The wiper(s) need not be on the solar car in fair weather.

29.0 Penalties

Any Team failing to comply with the Regulations, as stated herein, will be penalized. Observers are required to record all violations of Regulations and assess penalties for violations of [Regulations 29.4, 29.5, and 29.6](#). Except for the last day, all penalties will be posted at Event Headquarters by 0730 hours the following morning and penalized time will be added to the Elapsed Time of the day following the penalized incident. On the last day of racing, penalties will be posted no later than 1730 hours and will be added to that day's Elapsed Time. Penalties will be assessed as follows:

29.1 Disturbing Official Battery Seals

A battery seal broken without Official Supervision, in a manner which would allow access to the batteries, will result in the Official Elapsed Time being figured as follows:

- **9 1/2 hours plus two (2) minutes for each mile in the day's course.**

29.2 Replacement of Batteries

A penalty will be assessed by the Chief Battery Scrutineer based on the number of solar car battery cells or modules being replaced.

29.3 Non-Solar Charging of Batteries

Any Team which charges solar car batteries after July 8, 1990 by any method other than the solar array or regenerative brakes will be disqualified by the organizers.

29.4 Failure to Stop at a Dally Pit Stop

All solar cars that reach the daily Pit Stops during racing hours must stop. If a solar car fails to stop at a required Pit Stop, it must return to the Pit Stop and make the required ten (10) minute stop. Any solar car which completely fails to make the required stop will have their Elapsed Time figured using [Regulation 14.1.2](#) with the distance not covered being the distance from the Pit Stop to the day's Official Finish Line.

29.5 Failure to Allow other Traffic to Pass

Any Team tailing to pull over in accordance with [Regulations 25.1 or 25.2](#) will be penalized twenty (20) minutes for each offense.

29.6 Traffic Volutins

Any Team committing a traffic violation will be penalized.

29.6.1 Non-Moving Traffic Violations

All non-moving traffic violations will result in a ten (10) ten minute penalty.

29.6.2 Moving Traffic Violations

Each moving traffic violation will result in a twenty(20) minute penalty. Any driver who commits three (3) moving violations over the course of the Event will be disqualified from the Event.

29.7 Failure to Attend a Driver and Team Manager Meeting

Any Team which fails to be properly represented at any mandatory Driver and Team Manager Meeting will be penalized twenty (20) minutes.

29.8 Conduct

The organizer may assess penalties ranging from ten (10) minutes to total disqualification for improper conduct. Such conduct may include, but is not limited to, improper language and obscene gestures.

29.9 Failure to Comply with Regulations

The organizer may assess penalties ranging from ten (10) minutes to total disqualification for a Team's failure to comply with any Regulation.

30.0 Protests

Any Team desiring to file a protest must do so by submitting an Official Protest Form to the Director of Racing at Event Headquarters. All protests will be heard by the Jury. The decision of the Jury is final and no further appeals will be allowed.

30.1 Time Limit

Except for the last day, all protests must be filed before 0830 hours the morning following the incident in question. on the last day of racing, a protest must be filed by 1830 hours the same day.

30.2 Opportunity To Be Heard

All protesting Teams have the right to be heard by the Jury at the soonest possible Jury sitting. It may be necessary in some instances for the Jury to postpone the hearing on a protest.

30.3 Successful Protests

If the Jury rules in the protesting Team's favor, it will notify the Event Officials to make the necessary adjustments.

30.4 Unsuccessful Protests

Except for the last day of racing, if the Jury rules against the protesting Team, a ten (10) minute penalty will be charged to such Team's next day's time, in addition to the penalty being protested. on the last day of racing, the penalties will be added to the same day's Elapsed Time.

31.0 Jury

The Jury will be made up of not more than five (5) nor less than three (3) members. It will consist of at least one (1) Chairman, one (1) Vice-Chairman and one (1) Recorder. Three (3) members will constitute a quorum and the decision by a majority shall govern.

31.1 Meetings to the Jury

The Jury will meet at a posted location each day. It will convene at 1830 hours to hear all protests filed by 0830 hours that day, except for the final day of racing. All protests filed on the final day of racing will be heard on that day.

31.2 Jurisdiction

The Jury will judge protests on the following: 1) penalties and 2) conformity with the Regulations. In addition, the Jury is empowered to decide cases not specifically covered or clarified by the Regulations.

32.0 Advertizing, Promotion & Publicity

All advertising, sales promotion and publicity material produced by the Teams or their sponsors concerning or referring to the Event shall refer prominently to the Event as "GM SUNRAYCE USA". All Teams shall, by entering the Event, specifically agree to abide by such Regulation. By entering the Event, all Teams and drivers associated with the Event shall agree to the use without compensation of their names and photographs in any publicity material that may be issued by the Event's Sponsor, the organizer, and their associated companies.

33.0 Prizes and Awards

The Sponsor and organizer of the Event will recognize all Teams' participation. In addition, the following awards will be presented:

33.1 Dally Award

Each day an award will be given to the Team with the shortest Official Elapsed Time.

33.2 SUNRAYCE USA Trophy

The winner of the Event will be the Team with the shortest cumulative Official Elapsed Time over the entire eleven (11) days of the Event. The Team will receive the GM SUNRAYCE USA Trophy. In addition, the Team will receive sponsorship to represent the Event in the 1990 World Solar Challenge and be duly noted as the Winner of the 1990 GM SUNRAYCE USA.

33.3 Runner-Up Award

The Runner-Up of the Event will be the Team with the second shortest cumulative Official Elapsed Time over the entire eleven (11) days of the Event. The Team will receive the Runner-Up Trophy. In addition, the Team will receive sponsorship to represent the Event in the 1990 World Solar Challenge and be duly noted as the Runner-Up of the 1990 GM SUNRAYCE USA.

33.4 The Sponsor's Award

An additional Team will be selected by the Event Steering Committee to receive the Sponsor's Award.

In addition, the Team will receive sponsorship to represent the Event in the 1990 World Solar Challenge. Such selection will be based upon criteria established solely within the discretion of the Steering Committee, and will not necessarily be based upon Elapsed Time or other performance criteria.

33.5 Other Awards

Other awards will be presented at various times during the Event.

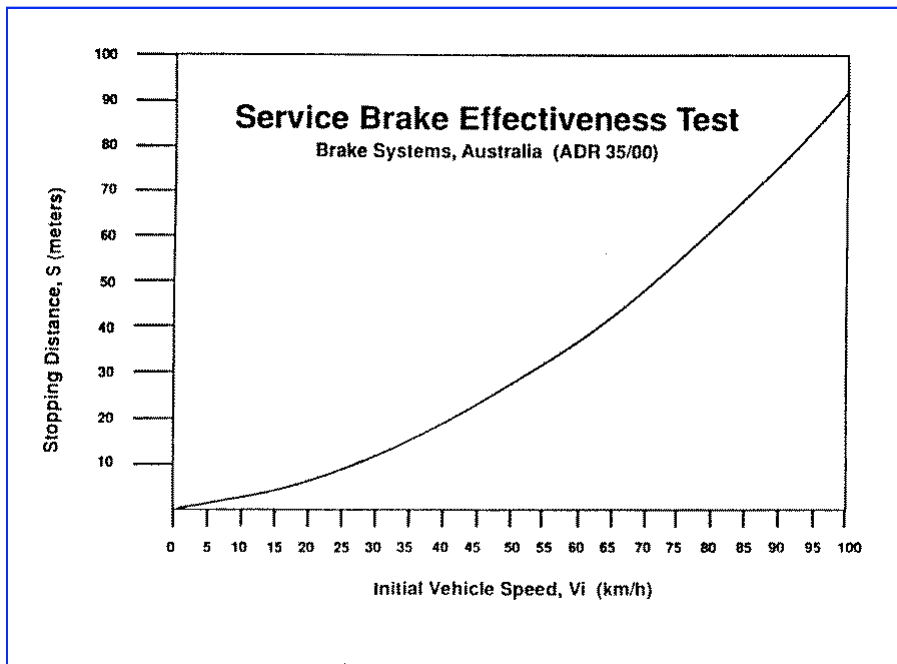
33.6 Award Ceremonies/Banquet

Award ceremonies will be held each evening during the Event. An Awards Banquet will be held at the GM Technical Center shortly after conclusion of the Event.

33.7 Logos and Identification Markings

The three (3) award winners, as identified in [Regulations 33.2 through 33.4](#) above, must retain the Event's logos and identification markings on their solar cars through the end of the 1990 World Solar Challenge.

34.0 Service Brake Effectiveness Test



35.0 Tilt Test

Tilt Test

