Technical Regulation

0. Preliminary remarks

This regulation originates from the willingness of gathering and unifying good local experiences and, above all, strengthening the spirit of belonging to the European Community engaged to spread through
the partecipation of its citizens, in particular
young people processes
of improvement, as indicated by the European
Commission, in order to achieve 20% of energetic efficiency, 20% of renewable's employment, 20% of CO2 emmissions' reduction by 2020.

We believe that a European championship of electric and solar powered ships could satisfy these goals, triggering virtuous crosssector
and transversal processes which
will end up in generating unexpected results of knowledge.

1. General

The rules stipulated herein apply to every Solar Boat Challenge, hereinafter referred to as SC (Solar Challenge).

The SC competition will be conducted subject to the provisions of

- the Notice of Event, (hereinafter referred to as the 'NoE'),
- this Technical Regulation of the Solar Boat Challenge (hereinafter referred to as the 'TR'),
- the Competition Rules of Solar Boat Challenge (hereinafter referred to as the 'CR') and
- the Inland Navigation Police Regulations ('INPR').

Collectively these rules and regulations are referred to as the Rules with possible subsequent additions and/or amendments to be implemented by the event organization. Each Challenge organizing committee may enact further rules refer to the features of the challenge site, in accordance with the Rules of this Regulation.

All participants in the event are expected to have read and agreed to the Rules. The organization will penalize all participants and teams that ignore or violate the Rules.

All questions concerning the interpretation of the Technical Rules must be submitted to the organization in writing. The Rules will be published on the website and are binding for all participants. In the case of a discrepancy between the other U.E. languages and the English text, the English text shall prevail.

Liability and Insurance (recall from the NoE)

The Organizing Authority and any other party involved in the organization of the Solar Boat Challenge will accept no liability whatsoever for any personal or material damage (including but not limited to death, injury, consequential damages, etc.) sustained prior to, during or after the event.

All participants must have valid third party liability insurance, effective for the duration of the event.

2. Technical specifications

All participants are at all times responsible for the technical condition and safety of their boats during the course of the event. Technical details have to be reported in the "Passport of the boat" (attached to this document). Approval of participation of the boat to the event and approval during the inspection will under no circumstances exempt the participant of due responsibility.

5. The Boat

The boat will be inspected for potential hazards.

5.1 All solar powered boats must be fitted with solar panels, which will serve as the sole source of energy. The use of wind energy and / or energy derived from manpower will not be permitted.
5.2 No prescriptions apply to the use of materials with the exception of the following limitations:
The
use of flexible materials that might serve as sails is not allowed.
The
use of materials that may pollute the water is not allowed.
5.3 The use of energy storage systems, other than batteries, is allowed (e.g. flywheels). The latter types of energy storage may not be started prior to the actual official start of the event. In the case of the use of capacitors for energy storage purposes, the participant(s) must also provide a system were the capacitors can be emptied immediately prior to the start of the event. The maximum allowed capacity in this case is 30 Farad.
5.4 The skipper must have a clear field of view at all times.
5.7 All boats must be fitted with a commercially available and approved dead man's switch that will remain fully functional at all times while the skipper and/or other crew members are on board. This will be tested during the inspection.
5.8 If the boat is designed with a closed cabin, the cabin must be fitted with an air supply/flow system that will ensure that the crew member will at all times have access to fresh air during the course of the event; all subject to the discretion of the technical committee.
5.11 All rotating components in or on the boat must be adequately shielded to prevent unintentional contact. This applies both on the water and on land. In the case of the use of a flywheel for power storage purposes, it must be fitted into a protective housing that is capable of containing all released components in the case of disintegration of the system. The latter characteristic must be demonstrated by means of a suitable test or calculation.
5.12 All boats must be designed to ensure that all crew members will be able to evacuate the boat without any form of outside assistance. The dead man's switch must also be activated simultaneously during the evacuation without having a delaying effect of any nature whatsoever on the evacuation.
5.13 The use of safety belts is not allowed on board the boats.
5.15 All fastening systems used on board the boat must be mechanically secured. All connections that may rotate during operation must be secured with the use of a cotter pin.
5.18 All boats must be fitted with a fastening point for a towline. The fastening point must be capable of holding a minimum load of at least the boat's own weight. The minimum internal diameter of the fastening point must be 15 mm. All boats must be provided with a floating towline of a minimum length of 10 m and a minimum diameter of 8 mm. Multihull
boats must be fitted with a towline attached to each of
the hulls. Towlines may not be manufactured with steel wire or any other type of material that is hard to cut in the case of an emergency situation. The towline(s) must be attached to the front of the hull(s), such that the line will be pulled out when tugged at and such as to remain attached at one side to the hull.
5.19 All boats must be fitted with two types of signalling systems; namely an orange warning flag and an audible warning system, such as a ship's horn.
5.20 All boats must be fitted with a marker buoy, connected to the boat with a rope of at least 5 meters.

5.21 All boats must be fitted with at least one paddle with a minimum length of 60 cm, a minimum blade length of 30 cm and a minimum blade width of 13 cm. The paddle must be fastened and sealed in an easilyaccessible
location on board the boat.
The paddle may exclusively be used in emergency situations
5.22 All boats must be fitted with an approved fire extinguisher with a minimum capacity of 1 kg of extinguishing material suitable for extinguishing fires, including electrical fires (category E). Due to the fact that it is hard, if not impossible to find category E extinguishers, participants are also allowed to use category A (solid materials) fire extinguishers.
5.23 In the case of the occurrence of a (technical) failure on board, the participants are entitled to repair and/or replace the failed or flawed components. Wherever possible this must be done under the supervision of the organization. In the case of major repairs/replacements, e.g. in the case of the replacement of a battery, the organization will determine the need for a time penalty. All repairs to the boats' electrical systems must be reported to the organization in advance. Repairs to other parts of the boats must be reported subsequently. Replacement of batteries will result in the issuing of a time penalty of one minute per remaining stage for each percentage point of the allowed maximum battery mass. Stages that have already been started
will be counted as complete stages (e.g.: installing a new leadacid
battery of 10 kg
during the second stage will yield a time penalty of 10 kg/25 kg x 1000;0 x 5 stages x 1 minute = 200 minutes).
5.24 All boats must be fitted with four lifting hook eyes. The hook eyes must be positioned such as to make it possible to lift the boat, with the installed solar panels, in and out of the water.
The distance between the lifting hooks is minimum 1 meter and maximum 4 meters. In the latter situation the boat must remain horizontal to the greatest extent possible. A maximum deviation of 10 degrees from the horizontal position is allowed. The structural integrity of the boat must not be compromised during hoisting.
5.25 The average speed of the boat must be at least 6 km/h. The latter characteristic will have to be reported in the Passport and will be subject for testing during the first day of the event.
6. Solar panels
Registration in the following category (see detailed definitions below):
O EuroClass Experimental
boats up to 1 kWp PV panels
O EuroClass Efficiency
up to 2 kWp PV panels
O EuroClass Electric
powered boats, less than 200 Wp PV panels
O EuroClass Open
class, all other electric or solar powered boats
The surface area of the solar panel is determined by the total combined active area of the solar cells.
6.1 All participants in. The technical specifications for the panels will have to be reported in the Passport for the SC.
6.2 No prescriptions apply with respect to the installed power of the solar panels used in the EuroClass Open
class.
6.3 The solar panels must be placed horizontally on all boats. The maximum deviation

from the horizontal position is 10 degrees. The use of adjustable systems is allowed provided they are exclusively operated on electrical energy deriving from the solar panels or the main battery.
6.4 Each applied solar panel must be mechanically secured to the boat, either in a frame or otherwise. The design of the fastening system must be such that it will be windresistant
in all directions.
6.5 Every SC organisation can choose wich EuroClasses to invite for the challenge that it is organizing, depending on local settings and circumstances.
6.6 The champions of every EuroClassA will be nominated at the end of all the challenges (in 2009, Ente Parco Naturale dei Laghi di Avigliana will register and publish in his website the scores and the list of the winners. Others organizing committees may contact Ente Parco Naturale dei Laghi di Avigliana in order to publish the results in their own website too.
7. Electronics
The type and mass of the battery pack will be evaluated during the technical qualification.
7.1 The boats may be fitted with a battery pack with a maximum nominal capacity of 1 kWh in EuroClass Experimental.
All further references to the battery pack will
refer to the 'main battery'. The nominal capacity is based on a discharge time of 20 hours. To be able to properly judge this requirement the figures in the list below are used to evaluate the different types of batteries. The battery pack will be weighed during the technical inspection in order to determine whether the battery capacity exceeds the maximum allowed values.
Leadacid
and leadgel
batteries 25.0 kg (40 Wh/kg)
NickelCadmium
20.0 kg (50 Wh/kg)
Nickelmetal
hydride 14.3 kg (70 Wh/kg)
SilverZinc
8.0 kg (125 Wh/kg)
NickelZinc
15.2 kg (66 Wh/kg)
NickelIron
20.0 kg (50 Wh/kg)
Standard LithiumIon
7.1 kg (140 Wh/kg)
LithiumPolymer
6.0 kg (167 Wh/kg)
Note that battery systems need expertise and in some cases dedicated charging technology.
7.2 Participants found to have installed battery power in excess of the maximum allowed levels will be issued a time penalty. The time penalty consists of 1 minute per day per percentage point of the excess amount of allowed maximum battery mass. The same penalty will apply in the case of the replacement of (part of) the battery pack.
7.3 A properly functioning Battery Monitoring System is mandatory for all batteries other than leadacid

and leadgel
batteries. The system must monitor both the battery's
voltage and temperature, and must also be capable of shutting the system down when necessary. The Battery Monitoring System must be designed to monitor all individual battery panels. The mass of the Battery Monitoring System is not incorporated into the battery mass while determining the battery mass. The participants must make sure that the batteries can be weighed separately.
7.4 The maximum allowed system voltage is 60 V DC or 75 V AC RMS.
7.5 The maximum allowed voltage of the (composed) main battery is 48 VDC.
7.6 The main battery may only be charged with the use of the installed solar panels. At the start of the event may a fully charged main battery is allowed. All solar energy available during the event may be used for purposes of propulsion and or to recharge the main battery. The solar panels may also be used in the mornings before the start of the next stage and in the evenings after the completion of the day's stage to use the available sunlight to generate electricity to charge the batteries. From the start of the first stage up to and including the end of the final stage, solar energy is the only energy allowed to recharge the batteries. The use of other forms of energy to charge the batteries during the course of the event will result in disqualification.
7.7 It is allowed for a team to install extra batteries for safety reasons where it deems this necessary. This is however subject to the provision that the energy stored in those batteries is not used for propulsion. If a participating team wishes to make use of such extra batteries, it is bound to submit a properly motivated application to that effect to the technical committee by no later than Step 4 of the design process. The technical committee will then decide whether to allow this or not. If the technical committee permits the use of extra batteries, this needs to be specifically mentioned at the technical inspection prior to the event, at which time it will be inspected.
7.8 The design of the electrical wiring and circuitry must be based on standard colour coding. All energy conducting parts must be fully insulated such as to prevent the occurrence of hazardous situations in the case of contact and exposure to water (for instructions on how to do this, please refer to the NEN/DIN standards for example).
7.12 All energy conducting cables must be designed in suitable dimensions to cope with the anticipated voltage and power currents. The system design must provide for a safety margin of 5070 above the maximum expected power that will be used.
7.10 Every team is responsible for its own batteries. All batteries used in the event must be commercially available. The batteries may under no circumstances be modified in any way whatsoever. The participants must disclose all data related to the batteries in the Passport. The specified battery data must at least include a detailed description of the type of battery to be used and the socalled
"safety data sheet".
7.11 The batteries must be mounted in separate ventilated housings, such as to eliminate the risk of direct contact between the crew and the batteries.
The batteries and the fastening systems must be designed and manufactured such that they will remain fixed in their positions in the case of the boat capsizing. The battery ventilation system must be designed such that upward spray and rainwater will not be able to make direct electrical contact with the battery.
7.13 All boats must be fitted with an emergency mains switch to cut the power supply to the engine in emergency situations. The switch must be capable of breaking the electrical power supply under full load. The switch must be clearly marked as an engine switch and the 'on' and 'off' positions must be clearly displayed.
7.14 The electrical system must be provided with a fuse in serial connection with the main battery. The fuse may under no circumstances carry more than *200%* of the

expected power.
7.15 The batteries must be connected to the boat construction by means of a belt of a minimum width of 3.5 cm or a suitable alternative fastening system.
7.17 It must be possible to seal all electrical connections between the solar panels, the propulsion system and the energy storage systems. The organization will apply seals to a number of these systems during the technical inspection. If a participant needs to break the seal, he or she is bound to notify the organization as soon as possible. The boat is prohibited from racing from the moment the seal has been broken. The boat may only return to the event once it has been subjected to a technical reinspection and a new seal has been installed.
8. Boat Appearance
8.1 All boats must be supplied with an identification number, which will be allocated by the organization, clearly visible to both side of the boat. The organization will provide all participants with two stickers.
8.2 Participants are allowed to finish the boat design with aesthetic embellishments of their own choice. Participants are also allowed to display their sponsors, under to the provision that such displays are not in conflict with sound moral standards and the interests of the organization; all subject to the sole discretion of the organization.
9. Inspections and Passport.
9.1 The organization is entitled to conduct technical inspections of the boats at any time of its own choosing. The participants are bound to cooperate with such inspections.
9.2 The technical committee will inspect all boats for full compliance with the required passport (see Annex A to the TR) and requirements prior to the start of the Challenge. All participants will be notified in advance of the time and location of the inspections. The organization will invite the participants for an inspection.
Boats that fail to comply with the applicable requirements will be disqualified from participation until the time they do come into compliance and this has been confirmed by means of a reinspection.
All modifications to the boat, made after the inspection,
will be subject to reinspection.
All boats may be subjected to random additional
inspections during the course of the event.
9. Participants are at all times responsible for the technical condition and safety of the boat during the course of the event. Approval during the inspections will under no circumstances exempt participants of their due responsibilities. National regulations must be observed.
10. 9.4 The Technical Passport is part of Technical Regulation and is defined in Annex A. Everyone who wants to join this European Championship has to fill, with no modifications, Annex A. The Technical Passport is the basic document for the checking of conformity and the signature on the bottom of it has the value of a declaration. When the SC organisation will notice a difference in the boat from what is written in the Technical Passport (checking the boat before or after a competition), then the Technical Passport will be invalidated and the participant disqualified. The ones who do not give their Technical Passport to SC organisation will be disqualified.
8. Competitions:
The following are the competitions of the SC *(see also the Competition Rules)*:
- Durability; length and duration of the competition from village to village
- Manoeuvrability; short track in front of public around buoys or island
- Speed; Sprint event in front of public

• Speed; StartStop
competition in front of public
9. Solar and Electric Boat categories
The SC event is open to the following categories of solar and electric boats:
O EuroClass Experimental
boats up to 1 kWp PV panels
O EuroClass Efficiency
up to 2 kWp PV panels
O EuroClass Electric
powered boats, less than 200 Wp PV panels
O EuroClass Open
class, all other electric or solar powered boats
See Annex A of the NoE for further information about the EuroClasses.
10. Additional information
Passport indication of technical specifications requested by the SC organisation (includes a declaration of minimum speed of 6 km/hr), must be delivered within the date indicated by the organisation itself.
10.1 All participants must present their boats for a technical inspection at one of the times and dates stipulated by the organization. The organization will announce all locations and times directly to the participants at a later stage.
10.2 Participants are required to report to the organization with their boats before the start of the SC.

Annex A

PASSPORT for EURO CLASSes for electric and/or solar powered boats
The major aim of the Solar Challenge is to demonstrate the ability to use on board generated solar electricity for transport on lakes and canals. Each participating boat in the SC event is required to provide a Passport that includes description of the participating team and technical specifications of the boat.

Annex B

Definitions

What is an electric and/or solar powered boat?
An electric powered boat is a boat which propulsion is by means of an electric motor that consumes electric energy delivered by a battery(pack)
charged from the grid
and/or by electric generators on board such as PV panels (or diesel power generator).
A solar powered boat distinguishes itself from an electric powered boat in the fact that the electricity delivered to a (usually installed) battery is generated solely by a photovoltaic generator carried by the boat. The battery is not charged from the grid (apart from initial conditions).
In general an electric and/or solar powered boat has a light weight design and special caution is required to maintain stable conditions; the boat should not become itself a sailing boat due to the surface area of solar panels.
Efficient use of available energy in relation to the total mass of the boat is an important issue and therefore the mass of the PV electricity generators and storage system is critical.
Maximum voltage: The maximum voltage, measured in Volts, which is measured with a volt meter set between the earth connection of the electrical system and any other point in the electrical system.
Battery: The device that is used to store the electrical energy. The following types of

batteries are distinguished in the framework of the Solar Boat Challenge: Leadacid, Leadgel,
NickelCadmium,
Nickelmetal
hydride, NickelZinc,
Silverzinc,
NickelIron,
Lithiumion
en Lithiumpolymer.
Nominal battery voltage: The nominal value of the voltage of the battery. At maximum 48 Volt
Dead man's switch: A device that is designed to cut the power supply to the engine as soon as the skipper loses control of the boat or when the skipper leaves the boat, whether voluntarily or involuntarily.
Fully loaded: The condition of the boat in which all systems have been mounted, all systems have been installed and all systems are operational, all the necessary ballast has been installed and the crew member(s) on board have been issued with the prescribed safety devices.
Freeboard: Distance between the waterline and an imaginary line above which openings (like the edge of the deck, drain holes, open end of a pipe, cable feed through) have been made, in fully loaded condition.
Passport: technical description provided by the team responsible
Mass without crew members and solar panels, but including batteries and fastening constructions for the panels. Note that No maximum mass is prescribed for the boats.
The length is the overall length from the front end of the boat up to and including the rear end of the boat, and including the propulsion system. Exceeding the maximum length by more than 0.5% of the allowed length will result in disqualification.
The height above the waterline must be limited to the specified height or it must be possible to reduce it to the specified height during sailing.
Event: the event is an announced happening of electric and/or solar powered boats on a lake, river or canal in a form of a competition to demonstrate technical capabilities if these boats. The duration of the event can be from half a day up to more than a week.
Specific rules may be defined by the local event organizers.
Competition: part of the event when all participating teams compete with each other according to the specified competition rules in the specified classes.
Rules: The rules of the event and the Inland Navigation Police Regulations together constitute the Rules, as well as any subsequent additions and / or amendments implemented by the event organization.
Organization: The organizing committee is represented by the project leader. The organizing committee is supported by volunteers and organizational executive personnel. The organization also includes the communication and PR personnel appointed by the project leader. The organizing committee may set up subcommittees such as technical committee or jury.
Team: The group of entrants registered as participants with the organization that will jointly bring a boat to the event.
Crew member: participant who takes position in the boat during the competition.
Support crew: participants who are part of the team
Solar panel: PhotoVoltaic energy source for a solar powered boat. No specific prescriptions apply to the type of the solar panels (.
Solar system: The PV electricity generator system composed of several solar panels

connected in series and/or parallel.
System voltage: The maximum voltage, which is measured with a volt meter set between the earth connection of the electrical system and any other point in the electrical system.
Source voltage: The nominal value of the voltage of the battery.
Dead man's switch: A device that is designed to cut the power supply to the engine as soon as the skipper loses control of the boat or when the skipper leaves the boat, whether voluntarily or involuntarily.
Battery: The device that is used to store electrical energy. The following types of batteries are distinguished within the framework of the event:
Leadacid,
Leadgel,
NickelCadmium,
Nickelmetal
hydride, NickelZinc,
Silverzinc,
NickelIron,
Lithiumion
and Lithiumpolymer.
Fully loaded: the condition of the boat in which all systems have been installed and are operational. The crew member(s) on board have been issued with the prescribed safety devices.
Skipper: The member of the team who is qualified, according to the Rules, to pilot the boat during the event. Note that participants under the age of 18 (but 16 years or older) are required to submit a letter of permission to participate from their parent(s) or guardian(s). The aforementioned letter of permission must be submitted to the organization prior to the commencement of the event.
Paddock: An area allocated by the organization where the boats are to be kept during the event in the periods for preparation, technical inspection and when they are not actually engaged in the competition or are not qualified to participate.
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