ASC 2018 REGULATIONS

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FEB 3, 2017
ASC 2018 REGULATIONS

OBJECTIVES

- High Level Summary of ASC 2018 Regulations
- Changes from ASC 2016
- Potential Amendments
ASC 2018 REGULATIONS

PRINCIPALS FOR ASC 2018 REGULATIONS

- Commonality with other ISF events (i.e. WSC 2017)
- Integrate Cruiser class

- *Net Effect - likely one of the largest shifts in the regulations in recent history*
ASC 2018 REGULATIONS - ORGANIZATION

SECTION 1 - ADMINISTRATION
Ch. 1 - Purpose
Ch. 2 - Administration
Ch. 3 - Safety
Ch. 4 - Entries
Ch. 5 - Technical Documentation
Ch. 6 - Event Components
Ch. 7 - Vehicle Classes

SECTION 2 - TECHNICAL
Ch. 8 - Power
Ch. 9 - Solar Car Body
Ch. 10 - Mechanical
Ch. 11 - Driver & Passenger Requirements

SECTION 3 - OPERATIONS
Ch. 12 - Tour
Ch. 13 - Multi-Occupant Vehicle Judging
Ch. 14 - FSGP/Qualifier Operations
VISION / PURPOSE
• Promote, celebrate education excellence & engineering creativity
• Spirit of friendly competition & team work

ADMINISTRATION
• IEF
• Officials - Event Director, Chief Inspector / Regulations Mgr.
• Inspectors, Observers, Staff, Track Steward
• Jury
• Interpretation of Regulations (official, unofficial interpretations)
  • ascregs@americansolarchallenge.org
SAFETY

• You are responsible for the safety of your team and roadworthiness of your car
• Team Safety Officer - can not be the team manager, or a driver
• Trained in CPR/First Aid
• Recommend - to get more than 1 person trained

• Safety Kit
  • First aid kit
  • Fire extinguishers
  • Safety vests
  • Cones
  • Battery MSDS
  • Spill kit....
  • PPE
ASC 2018 REGULATIONS - CH.4 (ENTRIES)

**ENTRIES**

- Initial Registration Package - Oct 15, 2017
  - $1,500
  - PVDR
  - Participation Agreement
  - Insurance
  - Team Entry Form

- Track Registration Package - Dec 15, 2017
  - $3,000
  - VDR

- Road Registration Package - Mar 15, 2018
  - $3,000
  - Entry fees consider 15 team members

**Other Dates**

- Refund Cut-off: May 15, 2018
- Team Data Sheet, Photo: May 1, 2018
- Public Release of Data: May 15, 2018

**Communication**

- Advisor included
- General email address for your team
- Insurance - do not leave this to the last minute
- Advisor - key individual
- Solar Car #s
TECHNICAL DOCUMENTATION

• PVDR
  • First look at solar car
  • Key Mechanical Details - note Mechanical Form to complete
  • Key Electrical Details
  • Solar Cell Approval Form

• VDR
  • Detailed look at solar car
  • Five general sections
  • Mechanical - note Mechanical form to complete
  • Electrical Systems
  • Battery - note form to complete
  • Battery Protection System
  • Solar Cell / Array - note form to complete

• Grading
  • Green - Accepted
  • Yellow - Some Revisions Required
  • Red - Late or Rejected - Significant revisions to the report or design required

• Technical Questions
  • ascregs@americansolarchallenge.org
EVENT FORMAT

• Scrutineering
  • Green on pre-event submissions & paid fees etc.
  • Inspection of cars at multiple stations across 2-3 days
  • Priority given to teams who completed pre-event submissions in a timely manner

•Qualifier / FSGP
  • Track rally and qualifier at the same time
  • Does sometimes result in competing goals
  • Need Green or Blue in Scrutineering to participate

• The Tour
  • Road event for those who satisfy Scrutineering, Qualifying
VEHICLE CLASSES

• Single-Occupant
  • Solar car designed for one driver
  • i.e. WSC Challenger Class

• Multi-Occupant
  • Solar car designed for a driver and one or more passengers
  • i.e. WSC Cruiser Class

• Grandfathered
  • ASC/FSGP 2016, FSGP 2017, other ISF event vehicles (within 4 years time)
  • Can participate in FSGP 2018
  • Demonstration in ASC 2018 Tour portion
  • Will be scrutineered to a set of regulations
POWER

• Solar Array (*heavily revised from ASC 2016*)
  • Can use commercially available Silicon, Ga/As, multi-junction cells

<table>
<thead>
<tr>
<th></th>
<th>Single-Occupant</th>
<th>Multi-Occupant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon</td>
<td>4.000 m²</td>
<td>5.000 m²</td>
</tr>
<tr>
<td>Ga/As</td>
<td>3.560 m²</td>
<td>4.440 m²</td>
</tr>
<tr>
<td>Multi-junction</td>
<td>2.640 m²</td>
<td>3.300 m²</td>
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</tbody>
</table>

• Can use concentrators - area of aperture can’t be greater than areas above.
• Supplementary arrays

<table>
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<th>Multi-Occupant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon</td>
<td>2.000 m²</td>
<td>0 m²</td>
</tr>
<tr>
<td>Ga/As</td>
<td>1.780 m²</td>
<td>0 m²</td>
</tr>
<tr>
<td>Multi-junction</td>
<td>1.320 m²</td>
<td>0 m²</td>
</tr>
</tbody>
</table>
POWER

• Solar Array
  • Hybrid array - allowed - area ratio
  • Array stands need to be carried in the solar car (new for ASC 2018)
  • Unlike WSC - ASC does not have the requirement that the array is deployed into the stand position by the driver only

• Batteries (revised from ASC 2016)

<table>
<thead>
<tr>
<th>Battery</th>
<th>Single-Occupant</th>
<th>Multi-Occupant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li-S</td>
<td>15.00 kg</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Li-Ion</td>
<td>20.00 kg</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Li-Polymer</td>
<td>20.00 kg</td>
<td>Unlimited</td>
</tr>
<tr>
<td>LiFePO$_4$</td>
<td>40.00 kg</td>
<td>Unlimited</td>
</tr>
</tbody>
</table>
POWER

• Supplemental Batteries
  • Different than WSC - more uses
  • Power switch, radios, driver ventilation fans, horn etc.
  • May be used to power BPS momentarily to verify safe state parameters
  • Power battery fans during BPS trip

• Protection Circuitry
  • Lithium based - Active protect for OV, OT, OC, UV
  • Supplemental - Passive protection for UV if charged remote to solar car. Active protection required if charged in the solar car
  • No Li supplementary allowed
  • Passive - driver monitoring and react
  • Active - automatic control without human intervention (reviewing no reset-on-the-fly)
  • BPS is one area of discontinuity with WSC
POWER

• Enclosure
  • No more than 2, Isolated, marked
  • Ventilated, Mounted - secure
  • Sealed
  • External cooling

• Impound Box

• Main Fuse
  • DC Rated Fuse (not a circuit breaker), 1st in series

• Main Power Switch
  • In the battery enclosure
  • Normally open/non-latching
  • Driver must have overriding control
  • BPS must have overriding control in the event of a BPS fault

• External Power Cut off Switch
  • External switch, visible, left hand side

• BPS Fault Dash Indicator
  • alert driver

• Accelerator
  • Must return to zero (0) position
  • Cruise control allowed but also must shut-off (when driver intervenes, or when driver is out of the car)

• Control
  • Driver control only
  • no control/uploading to the car
ASC 2018 REGULATIONS - CH.9 (BODY)

BODY

• Size *(slightly revised from ASC 2016)*
  • Revised (L x H x W - 5.0 m, 1.6 m, 2.2 m)
  • Added Ground Clearance of 50 mm

• Lighting *(revised from ASC 2016)*
  • DRL - white lights on nose
  • Front Turn, Side Marker, Rear Brake, Rear Turn, High Mounted Brake
  • BPS Fault - white strobe
  • 30 m visibility in varying viewing angles

• Visibility *(unchanged from ASC 2016)*
  • 8 m front, 12.2 m ahead + 6.4 m above, 100 deg either side
  • Rearwards
**ASC 2018 REGULATIONS - CH.9 (BODY)**

- **Egress**
  - Primary (10 s) + Secondary directions (15 s) - directions more than 90 separate
    (*this is new from ASC 2016*)
  - Unchocked, unassisted

- **Ballast (*revised from ASC 2016*)**
  - Each occupant shall have a ballast box within 300 mm of hip point (horizontally)
  - Common box is allowed and sealed into the car
  - Teams provide your own ballast (steel shot, lead shot, coins)

- **Markings (*revised from ASC 2016*)**
  - #’s, Institution, sponsors
  - Event Logo
  - Front signage space for smaller Event Logo and Institution Name
  - National Flag
• Covers and Shields
  ▪ Moving parts shall be covered
  ▪ No interference - no rubbing (fairings on wheels)
  ▪ Array Attachments 2 methods (revised from ASC 2016)

• Tires & Wheels (revised from ASC 2016)
  ▪ 4 wheels
  ▪ Tires/Wheels shall be as per mfg recommendations and for intended use and DOT approved or equivalent

• Occupant Space (heavily revised from ASC 2016)
  ▪ Seat (head restraint position defined) - 800 mm / 750 mm from hip point
  ▪ Angle of shoulders, hips, knees > 90 degrees
  ▪ Upper torso space defined as an arc 835 mm from hip point 45 degrees forward, 25 degrees rearward, 7 degrees laterally +/-
  ▪ Limitations on what can be within this space (no structure etc.)
  ▪ Seat belts - prescribed seat belt angles etc. (same as ASC 2016)
ASC 2018 REGULATIONS - CH.10 (MECH)

• Structural Chassis *(unchanged from ASC 2016)*
  - Crush zone regulations maintained from ASC 2016
  - *note this is one area of discontinuity with WSC*
  - Considering some form of equivalency option
  - Roll cage - encompassing full head motion (plus helmet)
  - Roll cage - forward roll cage angled backwards to deflect array

• Fasteners *(unchanged from ASC 2016)*
  - Flex-loc or other flexure style locking nuts (no nyloc, no interference style)
  - Castle nuts + cotter pins (axles)
  - Safety wired

• Steering *(unchanged from ASC 2016)*
  - Steering wheel profile is defined - enclosed perimeter
  - Steering stops must be provided
  - Limited backlash
ASC 2018 REGULATIONS - CH.10 (MECH)

• Brakes (generally unchanged from ASC 2016)
  • Dual, balanced braking system. Front/rear or front/front. Left/right redundant is not acceptable
  • Right foot braking
  • Special requirements for cars that have Front/Rear mechanical braking
  • Rear brake must hold 15% of the car weight (front wheels free moving / lifted)
  • Proportioning valves must be lockable and away from occupants
  • Note - WSC has gone to 4-wheel brakes - we have not followed this yet

• Parking Brake
  • 10% of the cars weight both forward and rearward
  • Non-tire or non-wheel contact style
  • Locking
  • Removed pad thickness and pad area requirements

• Dynamic (unchanged from ASC 2016)
  • Figure-8 = 12 m ID, 22 m OD, 9-sec per side
  • 3.5 m lane for 250 m at speed
  • Slalom 126 m long with cones every 18 m, 11.5 sec
  • Brake test 50 km/h + to 0 with deceleration > 4.72 m/s²
ASC 2018 REGULATIONS - CH.11 (DRIVERS)

**Occupants** *(Revised from ASC 2016)*
- 1 driver in the car (single-occupant)
- 1 driver + up to 3 passengers (multi-occupant)
- Team can define 2 to 4 drivers (18 years old, licensed)
- Team can define up to 8 passengers
- A driver can be a passenger + vice versa
- Ballasted to 80 kg
- Helmets (motorcycle - DOT etc), shoes (closed toe), water/fluids
- Seat time = 6 hrs max per day
- Communication - verbal, hands-free (applies to support vehicle drivers as well)
ASC 2018 REGULATIONS – CH.12 (TOUR)

• Road Event - Multi-stage
  • Shortest Elapsed Time = Winner
  • Will be revisited to potentially time based for all who finish entire distance, distance based for those that don’t

• Support Vehicles
  • Lead + Chase + Trailer (mandatory)
  • Scout + others (optional)
  • 2 drivers for each vehicle (min)
  • Other vehicles - can become an issue

Observers
  • Volunteers to be eyes+ears of the event

Radios, Communications
  • Observer can hear
  • Handsfree

• Impound
  • No impound during Checkpoints
  • Will look at impound time at stage points
ASC 2018 REGULATIONS – CH.12 (TOUR)

• Checkpoints
  • 45 min - 1 hour
  • No impound during checkpoint
  • Can do maintenance

• Stage Stops
  • 30 min charging before impounding, then release at impound time (will be reviewing this also)

• On Road Activities
  • Rules of the road
  • Passing of traffic
  • Support vehicles

• Trailering
  • Will be revisiting trailering penalties and how this works if we switch to a distance based event
ASC 2018 REGULATIONS - CH.13 (CRUISER)

Multi-Occupant Vehicle Judging
This section is in work. Will be released shortly

• Energy Equation
  • Time based?
  • Distance based?
  • Battery capacity, occupant (time & distance)

• Format of event
  • Stages etc?

• Practical Judging
  • Who, how?
  • Subjectivity?
ASC 2018 REGULATIONS - CH.14 (FSGP)

FSGP Event / ASC Qualifier

• Most Laps = FSGP Winner
  • Note - in past events especially with weather the FSGP event and ASC qualifications strategies conflict.

• ASC Qualifier
  ▪ 330 km (1 day)
  ▪ 495 km (2 consecutive days)
  ▪ 85 km / driver
  ▪ Provisional Qualification
  ▪ These distances will be reviewed

• Separate Classes
PENALTIES

• Merged ASC + FSGP penalty sections for convenience
• Pulled penalties discussed in technical sections into this chapter
• Penalty values are currently unchanged
• Will be reviewed in coming months
• Looking at how penalties will be done if we switch to time / distance metric for the event

Penalties for performance and technical aspects:
• Speeding, drafting, pushing, blocking etc.
• Oversize cars & arrays, replacement batteries etc.
ASC 2018 REGULATIONS

- This presentation is a summary of the regulations only and is non-binding.
- The regulations govern!

- It is recommended that you read the regulations thoroughly.
- Have alumni or other student teams scrutineer your car before you bring it to scrutineering
- Finish your car and test your car before the event!