



SOLAR CAR CONFERENCE

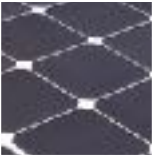
FEBRUARY 3-5, 2017

OVERLAND PARK, KS



ASC 2018 REGULATIONS

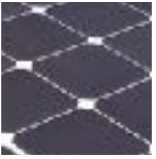
Greg Thompson
FEB 3, 2017



ASC 2018 REGULATIONS

OBJECTIVES

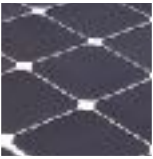
- High Level Summary of ASC 2018 Regulations
- Changes from ASC 2016
- Potential Amendments



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

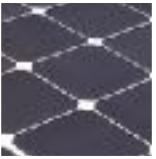
Ch. 11 - Driver & Passenger
Requirements

SECTION 3 - OPERATIONS

Ch. 12 - Tour

Ch. 13 - Multi-Occupant Vehicle
Judging

Ch. 14 - FSGP/Qualifier
Operations



ASC 2018 REGULATIONS - CH.1 & 2 (ADMIN)

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



ASC 2018 REGULATIONS - CH.3 (SAFETY)

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



ASC 2018 REGULATIONS - CH.5 (TECH. DOC.)

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



ASC 2018 REGULATIONS - CH.6 (FORMAT)

EVENT FORMAT

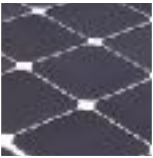
- Scrutineering
 - Green on pre-event submissions & paid fees etc.
 - Inspection of cars at multiple stations across 2-3 days
 - Priority given to teams who completed pre-event submissions in a timely manner
- Qualifier / FSGP
 - Track rally and qualifier at the same time
 - Does sometimes result in competing goals
 - Need Green or Blue in Scrutineering to participate
- The Tour
 - Road event for those who satisfy Scrutineering, Qualifying



ASC 2018 REGULATIONS - CH.7 (CLASSES)

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



ASC 2018 REGULATIONS - CH.8 (POWER)

POWER

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

	Single-Occupant	Multi-Occupant
Silicon	4.000 m ²	5.000 m ²
Ga/As	3.560 m ²	4.440 m ²
Multi-junction	2.640 m ²	3.300 m ²

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

	Single-Occupant	Multi-Occupant
Silicon	2.000 m ²	0 m ²
Ga/As	1.780 m ²	0 m ²
Multi-junction	1.320 m ²	0 m ²

ASC 2018 REGULATIONS - CH.8 (POWER)

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*)

	Single-Occupant	Multi-Occupant
Li-S	15.00 kg	Unlimited
Li-Ion	20.00 kg	Unlimited
Li-Polymer	20.00 kg	Unlimited
LiFePO ₄	40.00 kg	Unlimited



ASC 2018 REGULATIONS - CH.8 (POWER)

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*



ASC 2018 REGULATIONS - CH.8 (POWER)

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*)
 - Unchoked, 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



ASC 2018 REGULATIONS - CH.10 (MECH)

- 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 $> 4.72 \text{ m/s}^2$



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

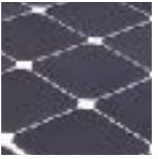
- Most Laps = FSGP Winner
 - Note - in past events especially with weather the FSGP event and ASC qualifications strategies conflict.
- ASC Qualifier
 - 330 km (1 day)
 - 495 km (2 consecutive days)
 - 85 km / driver
 - Provisional Qualification
 - These distances will be reviewed
- Separate Classes



ASC 2018 REGULATIONS - CH.15 (PENALTIES)

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!