

INTERNATIONAL SPACE SOLAR POWER STUDENT COMPETITION | 2023

ANNOUNCEMENT

2023 International Space Solar Power Student Competition

1 February 2023

Dear Colleague(s),

The need to advance the goals of STEM (science, technology, engineering & mathematics) education is especially important in encouraging the emergence of future generations of researchers, technologists, entrepreneurs and innovators in the space sector in general, and in particular in the special fields of expertise required for the successful exploration, development and eventual settlement of space. The critical topic of *Space Solar Power* (SSP) – harvesting solar energy in space affordably and delivering it to markets in space and on Earth – has been studied as a vision for Humanity's future for almost 50 years. This topic has never been more important as Climate Change issues become increasingly clear and the need for energy in cis-Lunar space becomes critical.

If *Space Solar Power* – which is both critical to space development and settlement and an increasingly important option in efforts to mitigate Climate Change – is to become a reality, this must change.

SPACE Canada¹, the International Astronautical Federation (IAF) Power Committee, Commission III of the International Academy of Astronautics (IAA), the National Space Society (NSS) International Space Development Conference (ISDC) SSP Track, and the Space Generation Advisory Council (SGAC) in a cooperative effort have organized an annual faculty-advised, student-conducted international research and engineering research/paper competition on the topic of *Space Solar Power*.² The early years of the Competition have been highly successful – involving many dozens of project proposals and multiple university / college participants and dozens of students; leading to original research studies that were presented at the annual IAF Power Symposia of the International Astronautical Congress (IAC) annually over the past several years. On the basis of these prior years, the participating organizations have decided to continue this effort with a dual track during 2022 to 2025 with a focus on development at the local student level, the social community level and the systems level.

¹ SPACE Canada is a non-profit, non-governmental organization based in Canada; the purpose of the organization is to promote international dialogue on and understanding of the topic of Space Solar Power.

² It is anticipated that with time some organizations may be added as participants in implementing the annual competition, while others may choose not to be involved; as the foundation of the competition, SPACE Canada is the principal sponsor of the effort, and the prizes. Cooperation has been established among SPACE Canada, the IAF Power Committee, the IAF Power Committee, the ISDC SSP Track organizers, the SGAC.

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This letter is the announcement of that competition.

This year of this new competition will be staged this year in three rounds:

- **Step 1:** Initial proposals and selection of project teams to participate initially in the competition.
- **Step 2:** Presentations of initial project results by the chosen semi-finalists. For those able to travel, semi-finalists projects shall be presented in person at the International NSS Space Development Conference (ISDC), to be held this year during May 25-28, 2023 in Dallas-Frisco, Texas. For those unable to travel due to restrictions, online presentation options will be arranged, for example using zoom.
- **Step 3:** Presentations of the finalists' project results will be at the International Astronautical Congress (IAC 2023) Space Power Symposium – this year to be held in October 2-6, 2023 in Baku, Azerbaijan – followed by selection of a winner for the year. Again, it is expected that for those able to travel, finalist projects will be presented in person at the IAC 2023;

The following additional details are also announced:

1. Up to six teams will be considered for selection as semi-finalists (Step 2 above) following which the Judges will select the finalists in this year's competition.
2. Support for travel to the ISDC in Dallas-Frisco, Texas, USA will be provided for semi-finalist teams totaling **up to USD \$1,500 per team in expense reimbursement**, with the actual amount to be determined based on the location at which the student team is based.
3. Support for travel to the IAC 2023 will be provided for the finalist teams totaling **up to \$4,000 per team in expense reimbursement**, with the actual amount to be determined based on the location at which the student team is based.
4. For teams that are unable to attend events above due to travel restrictions, **cash prizes** will be awarded; these cash prizes will **not exceed 50%** of the travel support amount per team as shown above. Specific amounts will be determined on a case-by-case basis.
5. IAC 2023 submitted papers and presentation slide decks from all teams will be posted on the SPACE Canada website to become part of the literature of space solar power for the dissemination of knowledge for the benefit of the public.
6. As a prize, team leads for each finalist team will also be invited to attend the Space Generation Congress 2023, the SGAC's annual meeting held in conjunction with the International Astronautical Congress.

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If you would like to receive more information about the updated 2023 SSP student competition, please contact us at: competition@spacecanada.org

The deadline for abstract submission of 2023 project team proposals is April 23, 2023.

Thank you and be safe.

ADDITIONAL COMPETITION INFORMATION is provided in ANNEX A, which follows.

CONTENT GUIDELINES for the 2023 International SSP Student Competition are provided in ANNEX B, which follows.

JUDGING CRITERIA for the 2023 International SSP Student Competition are provided in ANNEX C, which follows.

ANNEX A

ADDITIONAL 2023 SSP STUDENT COMPETITION INFORMATION

The following are additional details concerning the 2023 Competition.

1. This will be the first year of an annual competition open to further intensification of research and development for teams that wish to join the second track through to 2025.
2. The purpose of the competition is to engender new, meaningful and credible student research projects in the broad field of *Space Solar Power*, and to support the presentation of the best of the various projects in an international forum including explicit recognition of the best research with a formal prize. Each team will then be able to learn from the experience and the community contact during each annual event to improve on and develop their ideas and research in each succeeding year.
3. The International Space Solar Power Student Competition Prize for 2023 will have four parts: (a) reimbursed travel³ and registration support for selected semi-finalist teams to attend the annual ISDC (see below); (b) a formal certificate of recognition for selected semi-finalist teams (as a team, and for each team member, including the faculty advisor); (c) reimbursed travel and registration support for up to three selected finalist teams to attend the annual IAC SSP Symposium (see below); (d) a formal certificate for the selected winning team(s).

³ Funding support provided by Competition will be provided in the form of reimbursement of expenses incurred by a selected and previously-approved team at each stage of the competition; it may be used for (1) airfare, (2) ground transportation, (3) lodging, and (4) meeting registration fees, up to a determined maximum based upon participation levels as well as location of participants. Funds may not be used for reimbursement of food or related expenses.

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4. The competition is open to participation by faculty-coached, student-implemented project team, including a faculty advisor, not fewer than two undergraduate students and potentially one or more graduate students from any accredited international college or university. A given project team may involve more than a single university in an integrated team; however, each team from any participating college or university must include not less than two undergraduate students and one faculty advisor. All students must be aged 35 years or under at the time of the IAC 2023.
5. The competition will involve three stages: (1) registration and proposal / abstract submission by proposing teams; (2) following selection of semi-finalists by Competition Judges, preliminary presentation of interim results at the annual NSS International Space Development Conference being held during May 25-28, 2023 in Dallas-Frisco, Texas, USA (see <https://isdc2023.nss.org>) and (3) following selection of finalist teams, presentation (with a formal technical paper) of up to three best projects at the IAF Power Committee Solar Power Satellite (SPS) Session at the annual International Astronautical Congress (IAC), to be held in October 2-6, 2023 in Baku, Azerbaijan (<https://iac2023.org>).
6. Semi-finalists in the annual competition will be chosen by an independent review process based on submitted abstracts and draft presentation materials; these will be provided with a fixed level of financial support for their attendance and presentation of interim results at the annual ISDC SSP Track. (A team participating in the ISDC must send to the Conference not less than one member of the student team and one faculty advisor; however otherwise the decision as to who should participate and how the funds should be distributed among team members to meet travel and registration costs will be flexible.) If a team cannot attend the ISDC due to travel restrictions, provisions will be made for an online presentation, for example via zoom.
7. Finalists in the annual competition will be chosen by an independent review process based on the presentations made at the annual ISDC SSP Track, and updated draft research presentation results. In the event that no project teams are adjudged to have achieved a sufficiently high level of technical accomplishment in a given year, no award will be made during that year.
8. The chosen winner(s) will be provided with a fixed level of financial support for their attendance and presentation of interim results at the annual IAC SPS Symposium. A formal paper is required, and must be submitted to the IAC according to the rules of the conference. Participation in the IAC must comprise not less than one student team member and one faculty advisor; however otherwise the decision as to who should participate and how the funds should be distributed among team members to meet travel and registration costs will be flexible. If a team cannot attend the ISDC due to travel restrictions, provisions will be made for an online presentation, for example via zoom.
9. In order to be eligible, members of each competing team (as described elsewhere) must generally be available and able to attend and present at the ISDC (semi-finalist)

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and the IAC (finalist). However, If a team cannot attend the ISDC due to travel restrictions, provisions will be made for an online presentation, for example via zoom.

10. Teams accepted are allowed to apply to the second track, which is a four year developmental pathway to taking the Teams concept idea forward through development to a point where it could potentially become a startup Space Solar Power business. The Teams that wish to participate will be evaluated by an Accelerator which is being set up for this purpose and will receive further and more in depth advice and assistance toward this longer term goal.

11. The first deadline for participation in the 2023 competition is development and submission of an abstract for a proposed student research project by not later than April 23, 2023.

We look forward to participation by students and faculty from accredited colleges and universities globally in this year's competition. If you would like to indicate interest in participating and to obtain additional information, please contact us at the email address provided.

ANNEX B

COMPETITION CONTENT DETAILS

The competition will encompass multiple disciplines, but will be focused this year around a particular Solar Power Satellite concept considered as a stage one for the achievement of this technology. During 2023, the focus will be on modular microwave wireless power transmission (WPT) and Solar Power Satellite (SPS) concepts applicable to upper atmosphere/LEO, demonstrator ground to device or between device ground testing and proof of concept.

Acceptable disciplines/fields for research projects include:

- architecture level system design activities, cost-benefit studies, environmental footprint studies, etc.;
- end-to-end energy concepts & technology (including wireless power transmission (WPT), solar power generation and distribution, etc.);
- structural systems, in-orbit assembly, controls and dynamics technology, and modeling of these considerations;
- flight and/or space transportation technology and engineering for the SPS (including Earth-to-orbit or in-space transportation and/or propulsion);
- ground systems and integration

In addition, acceptable cross-cutting topics of general interest include:

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- the potential value of SPS in reaching goals to mitigate climate change issues; and,
- near-term demonstration of relevant SPS concepts and technology;
- mid-term demonstrations of relevant SPS concepts and technology (for example in low Earth orbit);
- space resources utilization for SPS;
- space policy, legal and regulatory considerations across all of the above (including international cooperation, spectrum management, space debris, etc.); and,
- financing concepts for SPS systems and development.

If you have any question about the acceptability of your prospective topics, feel free to contact us at: competition@spacecanada.org

ANNEX C

COMPETITION JUDGING CRITERIA

Judging criteria points

1. Is the abstract written clearly and organized well?
2. Is the topic of scientific or methodological importance, with a clear link to SSP?
3. Is the work original and inventive, with no evidence of plagiarism?
4. Is the project-idea aligned to this year's competition focus?
5. Is there a background/problem statement and is the scope/hypothesis well defined?
6. Is the study design capable of meeting the aim, with a clear methodological approach?
7. Are the potential findings likely to be scientifically sound and statistically significant?
8. Is there a coherent conclusion or summary, including next steps or recommendations?

Quality of submission

Up to ten project-ideas will be considered for selection as semi-finalist of the competition based on abstract quality, following which the Judges will select the finalists in this year's competition. To determine abstract quality, a score out of ten has been awarded to each submission by the competition judging panel, according to the criteria points listed above. Please be aware that the judging panel's decision is final and there will be no opportunity for appeal.

In terms of your project-idea, each member of the judging panel has provided a score for the listed criteria points. You can find the results of this process below, along with the overall

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average score assigned to your project-idea in the bottom right cell. Your score was then compared against the entire applicant pool to determine whether it was amongst the top six submissions and, hence, advancing to the semi-final stage. This decision can be found in the next section followed by reviewer feedback.

Reviewer	Judging Criteria								
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Maximum
1	-	-	-	-	-	-	-	-	80
2	-	-	-	-	-	-	-	-	80
3	-	-	-	-	-	-	-	-	80
4	-	-	-	-	-	-	-	-	80
5	-	-	-	-	-	-	-	-	80
Maximum	10	10	10	10	10	10	10	10	80