

**Welcome to the  
2022 Ethics in Engineering Case Competition!**

**Week of  
Feb 21**  
Preliminary Rounds

**Monday  
Feb 28**  
Tournament

**Tuesday  
Mar 1**  
Semi-Finals & Finals



*Figure 1: Lockheed Martin Next Gen Overhead Persistent Infrared (OPIR) GEO*

**This Case Competition Guide contains information that will help you prepare for the competition, including the Case, Agenda, and Judging Criteria for all rounds.**

Please contact [David Gebler](#) with any questions.

**WE LOOK FORWARD TO SEEING YOU FEBRUARY 28!**

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## Welcome

Welcome to the 5<sup>th</sup> Annual Ethics in Engineering Case Competition!

Lockheed Martin is proud to host this competition to help prepare future engineers to their entry into the workforce by introducing business ethics challenges they may someday face.

In 2020 the Case Competition was one of the last events held at Lockheed Martin before the pandemic. We had hoped to be back in person in 2022, but our twenty-five colleges and universities will be competing remotely this year. We hope to return to an in-person format next year.

We have a full schedule of speakers as well as opportunities for students to ask questions of Lockheed Martin engineers and recruiters. We hope our student participants will take full advantage of the experience.

This Competition Guide includes the Case and details about the competition and the event, including the agenda, format of the competition, instructions, scoring rubrics, and tips for success.

For more information on previous years' cases, visit the [Academic Outreach Page](#).

We look forward to seeing you February 28<sup>th</sup>.

## Agenda

(times are US EST) Please see the [Competition event site](#) for the most updated schedule.

<b>Day 1 (Mon Feb 28)</b>	
10:00am-10:30am	<ul style="list-style-type: none"><li>• Welcome to the Case Competition! Jim Byrne, VP of Ethics and Business Conduct, and David Gebler, Senior Manager, Ethics Engagement</li></ul>
10:30am-11:00am	<ul style="list-style-type: none"><li>• Icebreaker</li><li>• Judges &amp; Moderator Briefing</li><li>• Breakout Room Set Up</li></ul>
11:00am-11:45am	<ul style="list-style-type: none"><li>• <b>ROUND 1</b></li></ul>
11:45am-12:30pm	<ul style="list-style-type: none"><li>• <b>ROUND 2</b></li></ul>
12:30pm-1:00pm	<ul style="list-style-type: none"><li>• Break</li></ul>
1:00pm-2:00pm	<ul style="list-style-type: none"><li>• Lockheed Martin/Engineering/Recruiting Q&amp;A Panel</li></ul>
2:00pm-2:30pm	<ul style="list-style-type: none"><li>• Round 3 bracket announced</li><li>• Recruiter Q&amp;A Continued</li></ul>
2:30pm-3:30pm	<ul style="list-style-type: none"><li>• <b>ROUND 3</b></li></ul>
3:30pm-4:30pm	<ul style="list-style-type: none"><li>• <b>ROUND 4</b></li></ul>
4:30pm-5:30pm	<ul style="list-style-type: none"><li>• Bracket for <b>ROUND 5</b> announced</li><li>• Networking Session</li></ul>

2022 Lockheed Martin Ethics in Engineering Case Competition

<b>Day 2 (Tues Mar 1 )</b>	
10:00am-10:15am	<ul style="list-style-type: none"> <li>• Welcome Back!</li> </ul>
10:15am -1:30 pm	<ul style="list-style-type: none"> <li>• Sessions for non-competing teams</li> </ul>
10:15am-10:45am	<ul style="list-style-type: none"> <li>• Team Review</li> <li>• Networking Breakout Room</li> </ul>
10:45am-11:45am	<ul style="list-style-type: none"> <li>• <b>ROUND 5</b></li> </ul>
11:45am-12:45pm	<ul style="list-style-type: none"> <li>• <b>ROUND 6</b></li> </ul>
12:45pm-1:30pm	<ul style="list-style-type: none"> <li>• Break</li> <li>• All teams re-join main room</li> <li>• Finalists announced – prep for final rounds</li> </ul>
1:30pm-2:30pm	<ul style="list-style-type: none"> <li>• Keynote Speaker – Mark Pasquale, Vice President and General Manager for Lockheed Martin Space</li> </ul>
2:30pm-2:45pm	<ul style="list-style-type: none"> <li>• Recruiter Q&amp;A Continued</li> </ul>
2:45pm-3:00pm	<ul style="list-style-type: none"> <li>• Break</li> </ul>
3:00pm-3:50pm	<ul style="list-style-type: none"> <li>• <b>ROUND 7</b></li> <li>• <b>Final Rounds:</b> open to all non-participating teams</li> </ul>
3:50pm-4:00pm	<ul style="list-style-type: none"> <li>• Break</li> </ul>
4:00pm-4:50pm	<ul style="list-style-type: none"> <li>• <b>ROUND 8</b></li> <li>• Open to the public starting now</li> </ul>
4:50pm-5:00pm	<ul style="list-style-type: none"> <li>• Break</li> </ul>
5:00pm-5:50pm	<ul style="list-style-type: none"> <li>• <b>ROUND 9</b></li> <li>• Open to the public</li> </ul>
5:50pm-6:00pm	<ul style="list-style-type: none"> <li>• Break</li> </ul>
6:00pm-7:00pm	<ul style="list-style-type: none"> <li>• <b>FINAL ROUND - ROUND 10</b></li> <li>• Open to the public</li> </ul>
7:00pm-7:30pm	<ul style="list-style-type: none"> <li>• Discussion with Lockheed Martin Engineers and Ethics Reps about the case</li> </ul>
7:30pm-8:00pm	<ul style="list-style-type: none"> <li>• Awards Ceremony hosted by Jim Byrne</li> <li>• Presentation of the competition winners, and a celebration of all the teams' hard work.</li> <li>• Program Wrap Up</li> </ul>

## 2022 Ethics in Engineering Case

### **Background**

#### ***Poseidon Orbital***

Led by Dr. Brody Tempesta, Poseidon Orbital is a remote sensing company specializing in monitoring and forecasting severe and dynamic weather conditions through its multiple satellites. Poseidon recently launched the first of its Atlantis-class satellites which incorporates innovative use of AI algorithms and cutting-edge satellite positioning technologies. The Atlantis series generates more accurate early predictions of weather patterns, which has proven to save lives when extreme weather is approaching. With the continuing trend of more severe storms, hurricanes and other weather patterns, Poseidon has entered into a major contract with the National Oceanic and Atmospheric Administration (NOAA) to become a leading provider of specialized weathering monitoring. Success in this NOAA contract will open the doors for more Atlantis-class customers.

#### ***Locus Aerospace***

Locus Aerospace started as a small engineering firm performing modeling and analysis for government space programs. With its strong track record, Locus has become a leading subsystem component supplier and engineering services company with over \$250M in annual sales. With space technology advancing at an incredible rate, founder Dr. Hunter Nimbus positioned Locus to be on the forefront of new capabilities for space payloads and communication technologies, for both government and commercial customers.

Since releasing its proprietary laser communication capability, Locus is poised to become a leader in CubeSat communication satellites. Locus' CubeSats will provide the most precise and secure communication network in the world. If successful deployment of the constellation is achieved, Locus could experience monumental growth by providing satellite-based communications at a fraction of the current cost to govern Air Traffic Control (ATC) communication, primary military operations communication, and even a globally accessible civilian communication network. In order to fit in a very small form factor, Locus is using cold gas thrusters instead of traditional rocket thrusters to control the attitude of the CubeSats. The use of cold gas thrusters reduces the design complexity which permits its cost-savings size and weight.

Preliminary analysis indicates that a minimum of 145 3U CubeSats must be deployed and operational at all times to maintain line-of-site during orbit. This analysis revealed though, that if less than 145 CubeSats were operational, there could be up to a 10-minute outage in communications coverage.

With venture investment in place, Locus began its first full deployment. In Phase 1 of the mission, five CubeSats were launched, successfully reaching their desired orbits, and proving functionality of the laser communication system. Two weeks ago, Locus initiated Phase 2, with the goal of

establishing the integrated global reach of the network by launching 150 additional satellites to achieve the constellation needed to create the desired coverage with an orbit of 90 minutes.

### **Monday**

With the initial operating capability (IOC) performing to plan and ATC and military operations in full use of this system, Dr. Nimbus received news late on Monday night from the US Space Force that an identified close approach of an object might impact up to 15 CubeSats over the course of several hours. The closest approach would be on Friday night and that some action was needed to mitigate the potential space collision.

The approaching object turns out to be Poseidon's new Atlantis-class weather satellite in a low earth orbit (LEO). Upon receiving the news, Dr. Nimbus immediately called Poseidon and both companies agreed to immediately look into the issue and reconvene for a detailed briefing early on Tuesday.

Locus put two teams into action. One team determined that a loss of these 15 CubeSats would prevent the constellation from reaching the full global reach of the constellation needed to achieve the required coverage, and therefore, the operational availability required for their customers. The other team ran the ephemeris data for the CubeSat constellation and requested specific details on the 15 CubeSats in question. The ephemeris data showed that those CubeSats were holding to their intended locations and had not drifted. Dr. Locus was hopeful that Poseidon's data would validate that their satellite was the one in question.

Poseidon also ran ephemeris data that did in fact show that it was their weather satellite that had drifted slightly from its intended orbit, resulting in the reported close approach. Even though the Poseidon satellite was in the reported potential collision envelope, Dr. Tempestas was not concerned as the projections still showed enough margin to not raise the risk level to one requiring action.

That Monday Poseidon had been instructed by NOAA to track a developing powerful storm confluence. Dr. Tempestas believed that performing a collision avoidance (COLA) maneuver would jeopardize the data collection event. This was one of the largest storms ever recorded by a weather satellite that was poised to hit the Gulf Coast on Saturday and a gap in coverage could prove detrimental to the emergency response and evacuation of people in the danger zone.

Just to keep options open, Luna Blazar, who leads Poseidon's engineering and space operations organization, asked John Allen, one of her engineers, to evaluate whether the thrusters on this satellite could potentially move it out of the collision window. John reminded Luna of three key issues: 1) limited fuel,<sup>1</sup> 2) that the repositioning would halt any data collections occurring during the time of the maneuver, and 3) once repositioned, the satellite would require re-calibration.

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<sup>1</sup> Poseidon Orbital's weather satellites do have thrusters to help control the attitude and positioning of their satellites, but as with all thrusters there is a limited fuel supply, and faster attitude changes use more fuel.

However, after his analysis, John felt that the repositioning could be completed before the storms reached a critical stage.

## **Tuesday**

For the meeting with Dr. Tempesta and the Poseidon team, Dr. Nimbus brought with him Dr. Cherice Malleus, a recent PhD with recognized expertise in orbital mechanics and space phenomena.

Dr. Malleus reported the ephemeris data of the 15 Locus' CubeSats to the group and recommended that Poseidon perform a COLA maneuver to reposition their weather satellite back into its intended orbit.

Dr. Tempesta acknowledged Dr. Malleus' findings but assured both teams that the risk of collision was below any threshold for action as the CubeSats were so small and the collision envelope was conservative. Dr. Tempesta reminded the assembled group that close approach notifications are very common. This position was alarming to not only Dr. Nimbus and his team, but also surprised several individuals from Poseidon's chief engineering organization.

Dr. Nimbus quickly chimed in to restate the urgency of the matter and then candidly shared that it was Poseidon that needed to take action since it was their satellite that was not in the intended orbit. Dr. Tempesta quickly countered and said that if Locus was so concerned, they should perform COLA maneuvers to get out of the hazard area. The meeting ended with many members of both companies concerned, upset, and frustrated, and no clear direction was agreed to. Locus and Poseidon agreed to reconvene early on Wednesday once additional analyses could be performed.

Following the meeting, Luna Blazar approached Dr. Tempesta and asked him why he was unwilling to perform the COLA maneuver since it was their own satellite that was out of its intended orbit. Dr. Tempesta, who was by that time frustrated and tired, snapped at Luna stating that she should know that there was enough margin, and that he was not willing to risk not fulfilling Poseidon's obligations to NOAA during this weather event, especially with the lives of so many on the line.

Luna, surprised by Dr. Tempesta's aggressive tone, nodded with acceptance, and walked away to avoid any additional reprimands from Dr. Tempesta. She had her team run some probabilistic scenarios of the event to assess the potential margin. Luna was generally a conservative engineer, and heavily supported her recommendations based on data rather than her gut. Once the analyses were complete, they yielded differing results due to the orbital velocity and inertia deviations from the Earth's gravitational pull. The data was not conclusive that staying the course would be safe.

Upon direction from Dr. Nimbus at Locus, Dr. Cherice Malleus conducted similar probabilistic analyses. Dr. Malleus' results yielded similar data – it was inconclusive on whether no action was safe or not. Being the problem solver that she is, however, Dr. Malleus ran an analysis with the 15 Locus CubeSats performing COLA maneuvers. Much to her surprise, the thrusters did not provide

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sufficient directional change to reposition the CubeSats out of the area of concern in time, even though original analyses stated they should have been able to perform a series of maneuvers within the allotted time interval.

She quickly shared her results with Dr. Nimbus.

### **Today**

Both Locus and Poseidon are members of the International Satellite Collision Avoidance Agency (ISCAA) which provides emergency arbitration services in situations such as these. Leaders from both companies contacted ISCAA to arrange for today's urgent meeting. Your team will be assigned to represent either Locus Aerospace or Poseidon Orbital at this crucial meeting to develop a plan of action before the Friday close approach.

## Notes on the Case

This Case will be used for all rounds of the competition. However, as in real life, last minute facts and issues may come to light which could impact your analysis. Be prepared for a few twists during the competition!

The situation described in the case is hypothetical and intentionally ambiguous, so there is no single correct solution. Teams may leverage whatever resources they wish (professors, colleagues, internet, scientific journals, etc.) to prepare their recommendations, with one exception: teams are not permitted to contact current Lockheed Martin employees for guidance.

Teams can assume that the [core values](#) and [code of conduct of](#) Locus Aerospace and Poseidon Orbital are similar to those of Lockheed Martin.

Any questions about the case can be directed to [David Gebler](#), who will determine with the Case Competition Planning Committee (“Committee”) whether and how to respond to the question. *If* a response is provided, it will be posted to the [FAQs tab of the event website](#), and all participants will be notified via email that new information about the case is available.

## Competition Guidelines

### Qualifications

A team is comprised of two undergraduate students, along with a faculty advisor. Each of the registered schools may register guests from their school (i.e., additional faculty advisor, graduate student, additional students, etc.), but only the two registered student competitors may present throughout the competition. As the case will address an engineering issue, we recommend that at least one of the students be studying engineering.

Students who have interned at Lockheed Martin may participate but students who have participated in a previous Lockheed Martin case competition may not.

Students of all nationalities are welcome.

### Dress Code

Even though it’s virtual, the dress code for this event is business casual (or military attire for cadets).

## Roles and Responsibilities

### Student Competitors

Students are ambassadors of the institutions they represent and are expected to treat everyone with respect and comply with the letter and the spirit of all [competition guidelines](#).

For the preliminary round, competitors will demonstrate their understanding of the overall case.

For tournament rounds, competitors will be randomly assigned the role of Locus Aerospace or Poseidon Orbital.

### Faculty Advisors

- Faculty advisors should support and encourage the students as they prepare for the competition.
- Faculty advisors may suggest resources for students to use in their research, provide feedback on the students' ideas, proofread their presentation deck or talking points, and/or listen to the students practice their presentations.
- Faculty advisors may help students think through their ideas to determine whether they are reasonable and defensible but should not provide students with what they believe to be "the correct answers" or put together the presentation for them.
- During the competition, the role of the faculty advisor will be to provide moral support and encouragement, as well as feedback that will help the students learn from their experience. Faculty advisors may attend only their school's presentations, and no others.

### Judges

Judges are required to disclose any potential conflicts of interest with the schools they are judging. Every effort will be made to avoid assigning judges to teams with which they could be reasonably believed to have a personal or professional relationship. Judges will evaluate teams' performances using the [Judging Criteria](#) defined in this document.

### Moderators

The Lockheed Martin moderator in each room will be responsible for timing each presentation and saying "stop" when time has elapsed, for ensuring that judges complete their scoring forms correctly, for escorting teams in and out of the virtual room, and for relaying any issues or questions to the conference organizers. Moderators will not judge the competition and will serve as a facilitator/host.

### Zoom Support

Zoom support will be present in each room or virtual room to help organize with breakout rooms, when necessary.

## Competition Format



Preliminary rounds will be held during the week of February 21, 2022, via Zoom. A school's score from the preliminary round will determine their seeding for the tournament.

We understand schedules and time zones will vary throughout the competitors so you will receive a schedule of your timeslot for the preliminary round later in advance of the competition. For preliminaries, teams must log in 15 minutes before their time slots. Because preliminary rounds will determine seeding, teams will receive their schedules for Day 1 and 2 the night before or on the day of the Tournament.

The semi-finals and the finals which will also be in the tournament format will be held on Day 2. We will have an opportunity for students to ask Lockheed Martin engineers and recruiters any questions they may have. Then we will finish off the competition by presenting a Lockheed Martin-based suggestion to the case and will announce the winner.

The final rounds will be open to the public.

### Preliminary Rounds

In the preliminary round, each team will have 15 minutes to identify and address the ethical, engineering, and business issues of the case before a panel of two judges.

Teams may use up to five (5) slides or visual screens in their presentation.

Teams will share their presentation via Zoom. During the team's time slot, a team member or faculty advisor may drive the slides by clicking on the green "Share Screen" button.

There will be a 10-minute Q&A period after the presentation, during which judges may ask teams to explain, clarify or defend specific aspects of their arguments or overall presentation.

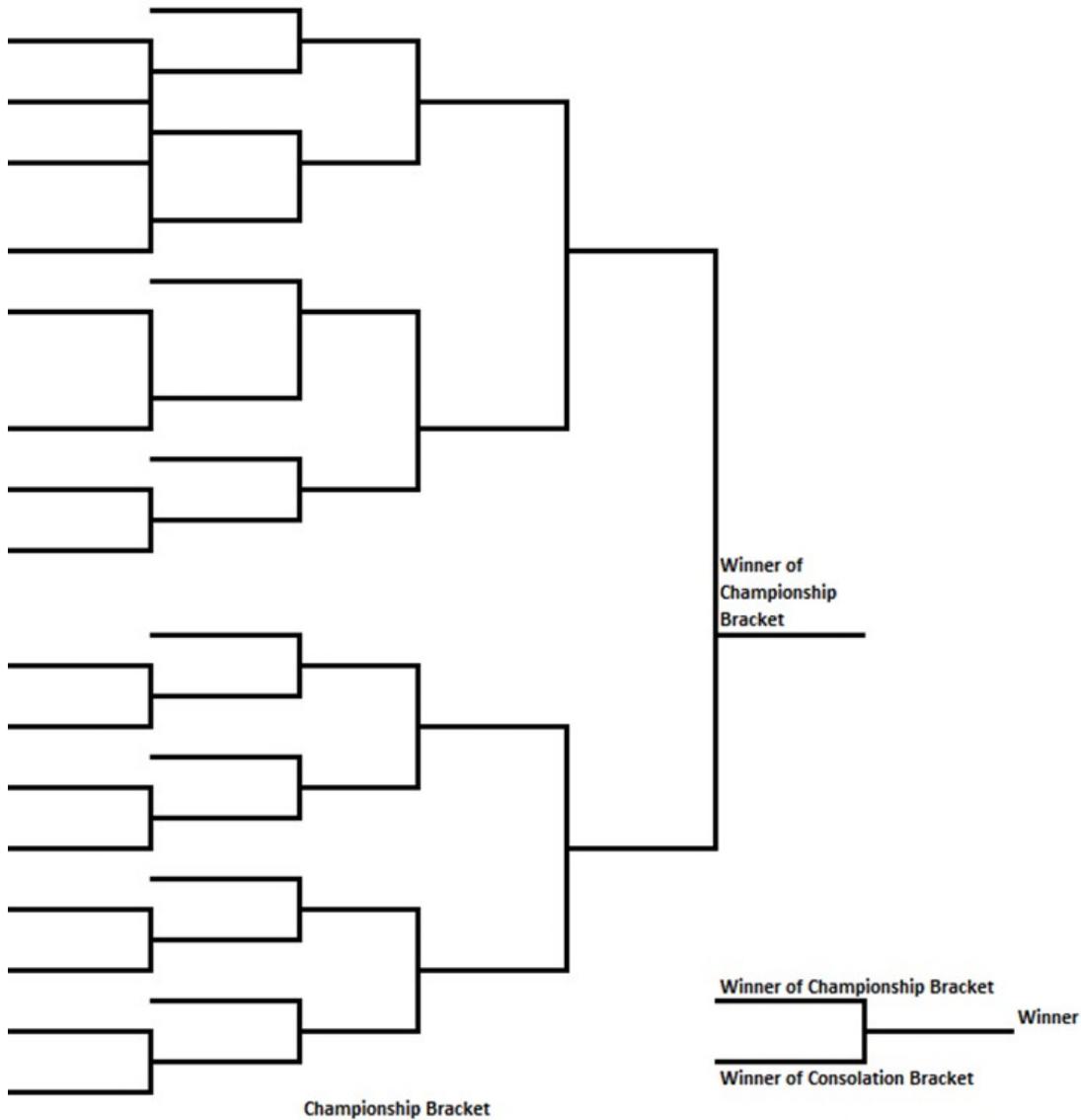
## Tournament Rounds

### Double Elimination

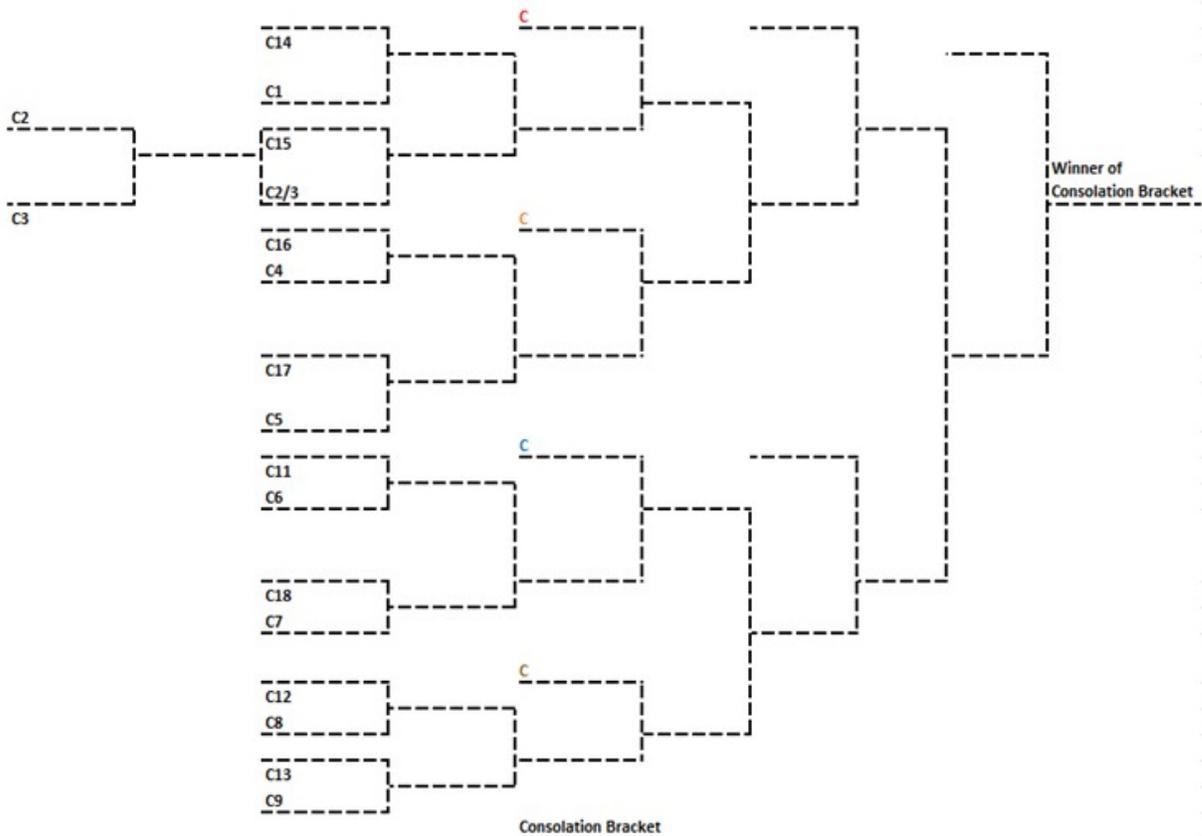
The tournament rounds begin on Day 1. The tournament this year is in a double elimination<sup>2</sup> format so each school will compete at least twice. Each match will be a head-to-head competition between two teams.

The top bracket represents teams that have not lost any rounds. The dotted lined bracket on the next page gives teams that have lost once a second chance for redemption.

### Double Elimination Bracket



<sup>2</sup> A double-elimination tournament is a type of elimination tournament competition in which a participant ceases to be eligible to win the tournament's championship upon having lost two games or matches. It stands in contrast to a single-elimination tournament, in which only one defeat results in elimination.



### Tournament Seeding

The team's score from the Preliminary Round will determine the team's seed for Round 1 of the Tournament.

On Day 1, teams will be provided with breakout room assignments for Round 1. The assignments will be seeded based on the scores from the Preliminary Round.

Neither individual team scores nor their ranking will be revealed. The teams will only be told their room assignment.

The tournament brackets will be continuously updated and available for viewing throughout the competition.

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### Tournament Rounds and Finals

The format for the tournament rounds is the formal meeting with Locus Aerospace, Poseidon Orbital and ISCAA as outlined in the case.

For the tournament rounds, competitors will be randomly assigned the role of Locus Aerospace and Poseidon Orbital at the beginning of the round.

There will be no slides for the tournament rounds.

Each round is 30 minutes:

- Each team will have 5 minutes to present their assigned company's recommendations to the judges who will be playing the role of member of ISCAA
- The teams will engage in a 15-minute discussion with one another to work towards a resolution. The judges in their role as ISCAA members may join in the discussion to ask questions.
- There will be a 5-minute Q&A period after the presentation, during which judges (as judges) may ask teams to explain, clarify or defend specific aspects of their arguments or overall presentation.

Judges will use the Judging Criteria to choose a winner to proceed to the next round.

The winning team will view the tournament board to see the time for the next round.

## Judging Criteria and Scoring

In each round, each judge will assign a score from 1 (worst) to 5 (best) for each of the criteria below. General guidelines for the scores are as follows:

1 point	Did not achieve any of the objectives; totally incoherent and/or unprofessional
2 points	Achieved, or partially achieved, some of the objectives but missed key elements
3 points	Achieved most of the objectives but left room for improvement
4 points	Achieved all of the objectives with no apparent shortcomings
5 points	Significantly exceeded expectations; went above and beyond defined objectives

### Preliminary Round (total of 35 points possible)

Seven criteria

Conceptual Foundation

1. Did the team demonstrate an understanding of the ethical aspects of the case?
2. Did the team consider the competing interests of multiple internal and external stakeholder groups?

Content

3. Did the team identify and clearly explain the engineering, ethical and business dilemmas of the case?

Communication

4. Did the team present their ideas in a coherent, engaging, and professional fashion?
5. Did the team make adequate use of the allotted time without exceeding the time limit?
6. Did the students present as a cohesive team?
7. Did the team respond clearly and thoughtfully to the judges' questions?

The combined score from the two judges will be totaled and use to determine the school's seeding.

## Tournament Rounds (Total of 60 points possible)

### Twelve criteria

#### Conceptual Foundation

1. Did the team demonstrate an understanding of the technical/engineering aspects of the case?
2. Did the team demonstrate an understanding of the business/financial aspects of the case?
3. Did the team demonstrate an understanding of the ethical aspects of the case?
4. Did the team consider the competing interests of multiple internal and external stakeholder groups?

#### Content

5. Did the team identify and clearly explain the engineering, ethical and business dilemmas of the case?
6. Did the team present recommendations that were logical/defendable (i.e., adequately supported by facts, figures, and rationale)?
7. Did the team come to an effective solution?
8. Did the team respond clearly and thoughtfully to the judges' questions?

#### Communication

9. Did the team present their ideas in a coherent, engaging, and professional fashion?
10. Did the students present as a cohesive team?
11. Did the team respect their opponent?
12. Did the team make adequate use of the allotted time without exceeding the time limit?

Each of the three judges will total their scores for both teams. The moderator will tally the combined scores for the two teams and determine the winner. In the event of a tie, the three judges will vote for the winner with the school that receives two or three votes moving on to the next round.

If the result of the match for the losing team is their first lost, the team will continue the competition in the "One Loss" bracket. For teams which have lost twice, they will be eliminated from the tournament.

**Note:** The competition organizers reserve the right to adjust or clarify the judging criteria. We don't expect many changes, but if you see something that is confusing or incorrect, please let us know so we can discuss a modification. All participants will be notified of any changes ASAP.

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### Prizes

The winners will be announced at the Program End Tuesday afternoon.

Each student competitor on teams in the final rounds will receive an Amazon gift card:

- 1<sup>st</sup> Place: \$1,000<sup>3</sup>
- 2<sup>nd</sup> Place: \$750
- Semi-Finalists (4 teams): \$250

Winners who are U.S. citizens or resident aliens will be required to complete a [W-9 Form](#) so that Lockheed Martin can send them IRS Form 1099-MISC in January 2021. Winners who are foreign nationals will be required to complete a [W-8BEN Form](#).

### Contact Information

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<sup>3</sup> If in the final round the team with one loss beats the undefeated team, there is a tie, and two 1<sup>st</sup> Place prizes will be awarded

Participating Schools

