ETHICS AND BUSINESS CONDUCT
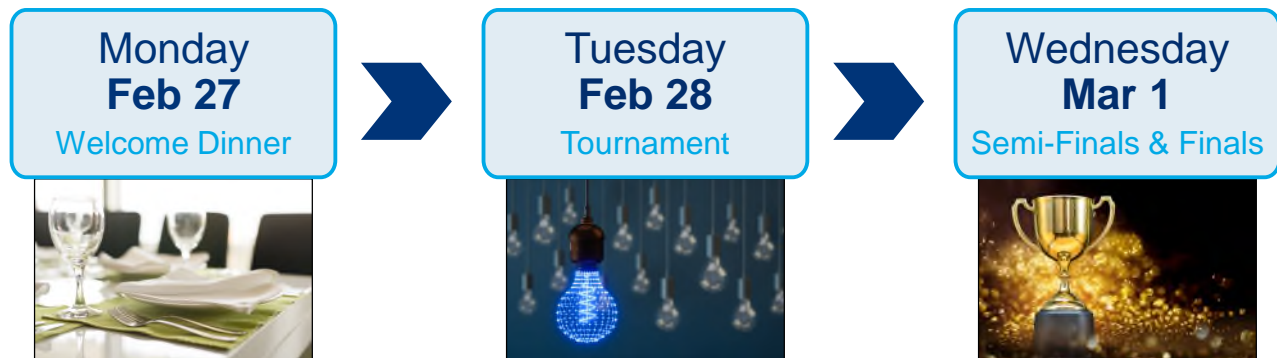EXCELLENCE THROUGH INTEGRITY

Welcome to the

2023
Lockheed Martin Ethics in Engineering Competition

Case and Competition Guide

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

| Monday **Feb 27** Welcome Dinner | → | Tuesday **Feb 28** Tournament | → | Wednesday **Mar 1** Semi-Finals & Finals |

ethics — Ethics in Engineering Competition

Questions? contact David Gebler or Erin Lederman

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Fortified Science and Trainers, Inc (FaST)

Fortified Science and Trainers, Inc (FaST) is a successful provider of training systems for both the defense and commercial markets. FaST has a proven history of developing innovative training solutions at a market leading cost. Dr. Summer Farmer, CEO of FaST, takes great pride in her company's innovative and entrepreneurial culture which continues to push the boundaries on technologies to deliver the greatest solutions to their customers. Most recently, FaST developed and delivered a virtual reality (VR) training system for an international customer's Group 1 unmanned aerial vehicle (UAV). However, Farmer understands FaST cannot rest on its laurels. Success today doesn't guarantee success tomorrow.

Calico Security

Led by Clinton Santiago, Calico Security is a defense contractor that, over the past few years, has narrowed its focus to specialize in cyber security solutions. As internationally known thought leaders, Santiago and his Calico team are on the forefront of shaping industry standards and educating customers on the constantly changing cyber vulnerability environment. Recently Calico has attracted significant venture capital to finance expansion into new software and hardware capabilities.

Joint Program Office (JPO)

With global tensions on the rise, the government created a JPO across multiple branches of the armed services to help define, develop, and deliver a UAV training system to aid in the rapid deployment of Silver Claw Group 4 UAVs in fielded operations. To help leverage existing investments and reduce system costs, the JPO sought a partner with specific proven and fielded subsystems.

Sharona

Through a competitive bidding process, the JPO awarded a contract to FaST to provide a secure VR training simulator for Silver Claw UAVs. The training system, code-named "Sharona", will be deployed on US and ally forward operating bases (FOBs) to support the real-time training of soldiers operating the fielded UAVs. The JPO chose FaST for the Sharona program because of its prior success in developing a real-time simulation of the UAVs' advanced autonomous manned-unmanned teaming (MUM-T) of the aircraft so pilots can practice missions using the advanced artificial intelligence / machine learning (AI/ML) teaming algorithms, a capability the JPO has been eager to field on their platforms. Each Sharona system must be able to receive continuous software and firmware updates, including updates to AI/ML algorithms, data, metrics, and diagnostics. The system also must be able to push AI/ML performance data, as well as other metrics, diagnostics, and updated inventory information to the host location.

Because of where Sharona will be deployed, the system must not only be able to protect data, it also must have controls to prevent adversaries from reverse engineering the

advanced AI/ML autonomous teaming algorithm if it was to fall into enemy hands. Although Sharona is a training system, physical or cyber compromise of the flight representative software could give an enemy a strategic advantage in predicting how autonomous systems would perform in a battlespace, putting confidential missions in jeopardy.

To speed deployment, the contract requires FaST to utilize an existing suite of components consisting of a central processing unit (CPU) and operating system (OS) developed by the Air Force. This system has a track record of over 10 years of proven success on other UAV platforms. As the Air Force continues to maintain this specialized CPU, the JPO is committed to using this proven technology on the new platform. According to the project specifications, FaST will use the government furnished equipment (GFE), CPU and OS, to develop the cyber solution in accordance with the cyber requirements flown down in the contract. Using the GFE will also help ensure the AI/ML algorithms are compatible with the JPO's existing fielded systems.

FaST has architected and delivered many training systems in the past, but Sharona would be its most complex system to date. To meet the JPO's aggressive timeline, FaST decided to base its solution on its proven and delivered Group 1 UAV VR simulator. Additionally, as FaST is still in development of its cyber security capabilities for network connected systems, FaST selected Calico Security as a subcontractor to support that aspect of development. FaST informed the JPO of its selection of Calico for Sharona.

In the course of its work, Calico's cyber security lead, Bruce Stark, identified some potential vulnerabilities with the CPU and the OS, especially in its capacity for encryption. This vulnerability could expose the system to cyber-attacks in the bi-directional access, presenting a risk to both the end user as well as the host site. Stark briefed Santiago and the Calico engineering leadership on the issue. Santiago asked Stark to put together a detailed analysis for FaST which outlined the vulnerability issues of using the GFE, along with a recommended path forward. Santiago was concerned that while Calico could support FaST in meeting the stated technical requirements of the contract, it would not be able to deliver what Calico believes the JPO needs to meet its mission objectives.

First Meeting

In Calico's first meeting with Farmer and the FaST engineering team after identifying these issues, Stark spoke about Calico's state of the art analytical tools and provided a high-level explanation of the issues, along with a recommendation to present to the JPO. Calico was very concerned about the long-term cyber security posture of Sharona. Santiago told the FaST team that because the JPO was requiring use of the GFE, the cyber security capabilities seem to be an add-on rather than integral to the design and implementation. This approach would likely lead to several exploitable vulnerabilities being uncovered over time.

When Farmer asked Santiago for specific examples, Santiago said they found indicators of a lack of secure coding practices, as well as some design decisions that could lead to compromise. He mentioned Calico's cyber intelligence work and familiarity with advanced persistent threats (APTs), but as this information was

classified, he could not go into detail about specific vulnerabilities and attacker techniques. Calico's recommendation was to use its own CPU and cyber solution instead of the JPO GFE.

Farmer was quick to point out, based on the tests so far, the basic cyber requirements of the contract were being met so there was no need to offer up Calico's own CPU. Doing so would increase project cost, time, and risk. Santiago agreed the basic requirements were being met, but in Calico's expert opinion, the requirements were insufficient to provide the level of cyber security they believed the customer was trying to achieve.

When the Calico team left, Farmer pulled her risk and opportunity management team together to review Calico's concerns. Farmer was clearly upset. She felt Calico was expanding the risk parameters as a way to increase its scope of the Sharona program and push FaST out of the way. After an awkward silence in the room, Harry Wu, FaST's chief engineer, said the safety and security issues Calico presented could be valid for this system. Farmer cut him off before he could finish, "Harry, show me a system that is 100 percent secure," she yelled. After a long and uncomfortable discussion, the engineering team came to an agreement that the level of security risk under the contract was within acceptable parameters because the system's security controls partially mitigated some of the potential vulnerabilities.

Second Meeting

FaST and Calico reconvened the following week after FaST completed their review of Calico's concerns. Farmer told Calico that FaST's position was to proceed with the development as stated in the subcontract. She requested Calico formally document the risk, so it could be captured.

Bewildered with the recommendation, Santiago said although FaST would be meeting all the literal requirements of the contract, it could not satisfy the intent of all the requirements flown down. Santiago said firmly to FaST, "the risks to security are unacceptably high."

Looking at Santiago, Farmer said, "Understood. The customer knows what they have and what they will be getting. Their primary objective is a fast-performing system that can simulate autonomous teaming, using their CPU. We know no system can be completely free of cyber vulnerabilities, but we have a proven track record of providing innovative solutions that push the realm of possible, and we're not budging from this philosophy. We don't get to work in the lab with unlimited time and money. We need to finish the product and deploy it to help our warfighters." She said unless Calico could show a greater risk to security, Calico should proceed with the development of the work outlined in their subcontract.

Santiago and Stark spoke on their way back to their office. Both were surprised by FaST's position. Santiago felt that while no cyber solution is perfect, who is Farmer to declare what is considered good enough? He thought FaST's position was counter to how Calico executed their programs. If there was a perceived shortfall in the system, Calico always sought to resolve it, regardless of cost and schedule. Stark felt the vulnerabilities could potentially expose Sharona to a cyber breach which could result in

adversaries hacking into either end of the bidirectional system, an unacceptable risk considering the national security aspects of the platform. Stark was concerned about the risk of classified, competitive, or sensitive information being leaked, as well as enabling an enemy to reverse engineer the platform and AI/ML algorithm. Santiago was worried Calico may be supporting a poor prime contractor which could impact its reputation as a cyber expert in the defense industry going forward.

When Santiago asked for ideas, Stark replied, "We're meeting the basic requirements, but the contract won't deliver what the JPO needs. If we have this formally documented, isn't it on FaST and the customer if something happens?" Santiago responded, "That doesn't matter. The CPU was never meant for this type of application. The customer should know that. I'm sure they must expect FaST to identify and solve these kinds of issues. I'm not comfortable with this."

For Santiago, it would be Calico's responsibility to eliminate all cyber vulnerabilities to the greatest degree possible. He was not comfortable with simply documenting the concern as it would provide a false sense of security, and it was counter to Calico's core beliefs. Being an emerging expert in the cyber domain space, Santiago knew Calico had a solution that could effectively mitigate the risk, and he wasn't going to be shut out of letting the customer know.

The Program Management Review (PMR)

Shortly after the series of meetings with Calico, FaST met with the JPO for a previously scheduled PMR. Farmer captured the risk identified by Calico on the program's risk register and, at a high level, presented it as an acceptable risk based on the urgency of the program. The customer acknowledged the program should continue to proceed as planned. The senior JPO official on the project shared, "I need this system fielded as soon as possible. This capability is critically important, and I'm personally assigned to deliver this capability to the warfighter. Sharona is needed to make the high priority Silver Claw mission successful. Get it done and get it done fast." Farmer nodded with acknowledgement and reconfirmed FaST would not fail to meet the terms of the contract.

The Audit

Soon after the PMR, the government performed an audit of the Sharona project as part of the normal certification for defense contractors. Jenna Thompson, who recently joined this audit team, was assigned to lead her first audit. During the program management section of the review, Thompson began to question the risk register's quantitative probabilities and impacts, specifically the cyber solution for Sharona. Thompson, who did have some experience in cyber solutions, felt something wasn't right in the risk register. As this was her first audit as lead, Thompson wanted to be sure her report did not have any gaps surrounding the cyber risk. During the audit out brief, Thompson told Farmer she had requested both FaST and Calico meet with the JPO to review the cyber risk in greater detail.

The JPO scheduled an in-person meeting with FaST and Calico leadership for next week.

Today

Farmer and Santiago agreed to meet today with their teams to prepare for their meeting with the JPO. In the Competition your team will be assigned to represent either FaST or Calico at this critical meeting to develop a recommendation to present to the JPO.

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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 the core values and code of conduct of Fortified Science and Trainers, Inc (FaST) and Calico Security are similar to those of Lockheed Martin.

If you have questions about the case, please check the FAQs tab of the event website,

Competition Guidelines

Student Competitors
Only the two registered students may compete in the Competition. Additional registered students are considered additional Faculty Advisors and may be present in their school's matches.

Faculty Advisors
The role of the faculty advisor is to provide moral support and encouragement, as well as feedback to help the students learn from their experience. Faculty advisors may attend only their school's matches, and no others. Faculty advisors may attend the semifinal and final rounds of other schools if their team has been eliminated from the competition.

Competition Format

In each round of the Competition two teams will meet in matches to develop their recommendations to the JPO. There will be multiple matches running simultaneously during each round.

Preliminary Round
Every school will compete in a preliminary round match on Tuesday morning (February 28). The match assignments for this round will be randomly selected. In this round the judges will provide a numerical score to each team which will be used to create the seeding for the competition rounds.

Based on the seeding from the preliminary round, each school will compete in one of four divisions, with the division winners meeting in the semi-final and then final round.

Competition Rounds
Beginning in the afternoon of Tuesday February 28, the teams will compete in a single-round elimination tournament.

During the competition round the judges will determine a winner of each match and that team will proceed to the next round.

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

Format of the Match
The format for each match is the meeting with FaST and Calico as outlined at the end of the case:

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The matches will be held in conference rooms throughout the CLE. Only the two student teams and their advisors, three judges, and a moderator will be present in each room.

The semi-finals and final rounds will be open to all attendees no longer competing.

At the beginning of each match, competitors will be randomly assigned (via digital coin flip) the role of either FaST or Calico.

Each match lasts 30 minutes:

- Each team has 5 minutes to present their assigned company's recommendations to the other team and to the judges.
- The two teams then engage in a 15-minute discussion to work toward a common approach to present to the JPO.
- After the discussion there is a 5-minute Q&A period during which judges may ask teams to explain, clarify or defend specific aspects of their arguments or overall presentation.

Judging Criteria and Scoring

The winner of each match will be determined by a three judge panel based on the criteria below.

Each judge will score the teams on a 1-5 scale on each of the four criteria listed below. The criteria will be weighted based on the round, so the 15 is maximum score for any one team.

Round	Analysis	Solution	Persuasiveness	Presentation
Preliminary and Rounds 1 & 2	30%	20%	25%	25%
Rounds 3, 4, 5	25%	30%	30%	15%
Semi-Finals and Final	10%	40%	45%	5%

Criteria

1) Analysis

How well did the team demonstrate an understanding of the ethics / business / engineering aspects of the case?

How logical and plausible was the team's analysis?

1	2	3	4	5
The team misunderstood the basic issues in the case	The team struggled to articulate how the ethics/business/ engineering aspects impacted the customer	The team understood the strengths and weaknesses of the ethics/business and engineering issues	The team integrated relevant external facts and data to support their analysis	The team demonstrated an in depth analysis and understanding of the ethics/business and engineering issues of all stakeholders

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2) Solution

How well did the team's solution meet the needs of all of the stakeholders?

1	2	3	4	5
The solution was not plausible, feasible or backed up with data	The solution was one-sided and did not take into consideration the issues of the other company	The team's solution took the other team's issues into consideration	The team's understanding of all aspects of the case guided their ability to find a mutually satisfactory solution	The team presented creative ways to see the issues and how to develop a win/win solution

3) Persuasiveness

How well did the team present its position?

1	2	3	4	5
The team acceded to the solution of the other team	The team was not able to effectively engage the other team in dialogue	The team was able to acknowledge the other team's concerns	The team was able to have the other team see the soundness of their position.	The team was able to engage the other team in uncovering a win/win solution

4) Presentation

How well did the team respectfully, and effectively, engage in the discussion?

1	2	3	4	5
One team, or team member, dominated the conversation	The team did not seem to be listening to or acknowledging the other team's statements or ideas	The team engaged in more of a debate than a discussion to find a mutually acceptable solution	The team was respectful towards the other team, and was able to reflect back on what was said in a manner that demonstrated intent to move towards a solution	The team took time to ensure that the other team as well as the judges understood where they were heading in their argument

Prizes

The winners will be announced at the conclusion of the Competition on Wednesday afternoon.

Each member of a winning team will receive an Amazon gift card:

- 1st Place: $600
- 2nd Place: $500
- Quarter-Finalists (6 teams): $250

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