APPLICATION FORM

Sonic Avionics

1. Pitch your idea (Max 900 Characters)
Please provide a succinct overview of your idea, the problem you are solving, and the target demographic you are supporting with this idea.

Rocket launches are breathtaking when they succeed. Behind the scenes, complex avionics composed of dozens of electronic systems work seamlessly, adjusting thrust and orientation to stay on trajectory. At the heart of this technology are control and embedded systems engineers—critical not only in aerospace but also in robotics, biotechnology, and climate research. However, the industry faces a severe shortage of skilled talent; according to a IDC study, this shortage could result in over $5.5 trillion in losses by next year. Currently, students rarely have the opportunity to apply their theoretical skills to real-world, hands-on projects. Sonic Avionics addresses this gap by providing a modular, open-source, beginner-friendly avionics platform, enabling university students and amateur rocketeers to learn, collaborate, and innovate—cultivating the next generation of talented engineers.

2. What problem are you looking to solve?

We are trying to get a good idea of what problem you are solving. In other words, who is suffering from this problem (the more specific the better)? Why does this problem exist? What are the root causes of the problem?

Remember to think from the perspective of your customers/users, and why this problem matters to them.

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1. Opening: Candidates lack essential skills
2. Quote: Universities are "10 years behind"; even top grads need industry training
3. Hiring challenges: Companies overlook undergraduates; graduates still underskilled
4. Problem with current university teaching: Lack of hands-on, practical experience
5. Avionics as a solution: Holistic, multidisciplinary learning approach
6. Root issue: $8.5 trillion at risk from skills gap

According to an MIT study (https://wp.technologyreview.com/wp-content/uploads/2023/09/HCL-e_Brief-v8_FNLpdf.pdf), 64% of companies report that candidates lack the necessary skills or experience when recruiting for IT and tech roles.

"What's being taught in engineering schools is sometimes 10 years behind the current tech landscape," says Subbaraman Balasubramanyan, SVP of Strategic Initiatives at HCLTech. "We have to spend time getting new grads industry-ready, even if they come from strong college programs."

Companies want to hire, but they aren't seeing the skill set they need. Furthermore, tech companies rarely see undergrads as valuable resources; it's the exception. Per the MIT report, 69% of firms wait until students have graduated and gained industry experience or worked on exciting projects. Undergraduate students aren't being considered for jobs, and the graduates that are considered are still often underskilled.

Undergraduate programs often fall short in delivering the hands-on training essential for keeping pace with the fast-evolving technology sector, leaving students underprepared for industry demands and pushing them toward personal projects as an alternative—yet structuring self-learning to fill these gaps is a daunting, costly, and solitary endeavor. In multidisciplinary fields like robotics and aerospace engineering, where systems thinking is paramount, the challenge intensifies; designing a single component isn't enough—it must integrate seamlessly into a larger system, a skill no single course or lab can fully impart. It would be impossible to fit any more into an undergraduate engineering degree without adding a whole extra year. While academic institutions excel at teaching theoretical frameworks, they struggle to cultivate the intuition and creative problem-solving needed to break things, push performance boundaries, and master full system design. A perfect example is where a graduate from an electronics engineering course may perfectly understand how to use an Arduino kit, but when faced with trying to identify and explain the function of a capacitor or op-amp circuit they struggle. Bachelor graduates generally speaking are filled with anxiety when faced with a blank screen, and a task like designing a software module, a circuit, or an airfoil from scratch.

In complex fields like avionics—where advanced electronic systems constantly monitor and adjust critical rocket parameters such as speed, orientation, and stability—the skills gap is especially pronounced. According to the World Economic Forum, the automotive and aerospace sectors have the greatest importance for enhancement of technological literacy, AI, and leadership skills (https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf, p. 39). Just as tools like the Jetson Nano have transformed the learning experience in fields such as automation and computer vision, creating a similar accessible, intuitive development kit for avionics could bridge the industry-education divide. By offering hands-on experience through avionics—an exciting, challenging, and multidisciplinary domain—students could effectively apply classroom knowledge, enhance their intuition, and develop practical design skills. Much like Arduino revolutionized microelectronics by simplifying complexity into manageable projects, a modular avionics kit could be precisely what students need to excel, preparing them for advanced engineering roles and enabling them to confidently enter the workforce.

Why does it matter that companies find applicants underskilled? This skills gap poses a serious problem with significant consequences. The IDC forecasts that by 2026, over 90% of companies globally will experience the negative impacts of the IT talent shortage, resulting in approximately $5.5 trillion in financial losses due to delayed products, reduced competitiveness, and lost business opportunities. (https://www.idc.com/getdoc.jsp?containerId=prUS52128824). When companies can't find qualified talent, critical innovation slows, project timelines lengthen, and competitive advantages diminish. Without sufficiently skilled engineers capable of mastering integrated system designs, industries from aerospace to autonomous transportation risk missing opportunities for technological breakthroughs. Addressing this challenge by providing accessible, hands-on avionics education and training can meaningfully expand the talent pipeline, enabling companies to realize their full potential and drive sustained economic success.

3. How will you solve the problem? Describe your envisioned solution from the user/customer point of view.

We want to understand how you plan to solve the problem you have stated. How will it address the root causes identified earlier? What is unique or novel about your approach to solving the problem?

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Engaging Students through Practical Avionics: Bringing Theory to Life:

We aim to solve the aforementioned problems by utilizing the exciting application of avionics for model rockets. Avionics provides students with meaningful practice and tangible application behind the theory they learn in school, turning abstract concepts into practical skills they can see in action. This direct application motivates students by clearly demonstrating why foundational engineering principles matter, and creates excitement through model rocket launches.

Why Avionics? A More Streamlined and Accessible Alternative to Robotics:

While robotics is commonly used in education, it isn't suitable for every student due to its overwhelming complexity, multitude of options, and high costs. Avionics offers a simpler, more streamlined, accessible, and cost-effective alternative, making it an ideal entry point into the broader world of engineering, automation, and aerospace. Model rockets also deliver a more fun, exciting and engaging hands-on experience than traditional robotics. Just as Arduino made microelectronics accessible for learning and design, a similar avionics-focused platform could prepare students effectively for diverse engineering careers while providing an enjoyable, practical experience.

Building Confidence with Simplified, Beginner-Friendly Hardware Packages:

Our solution directly addresses common barriers to entry by providing simplified yet powerful hardware packages tailored specifically for common beginner rocket designs. Simplifying these package offerings streamlines the checkout process, reduces the bill of materials, accelerates build-to-ship times, and minimizes ongoing code maintenance. Beginners gain confidence quickly without becoming overwhelmed, enabling them to build momentum and enthusiasm for avionics.

Scalable Complexity: Avionics that Grow with Student Skills and Rocket Designs:
Sonic Avionics' modular approach ensures the system grows along with users' ambitions, allowing advanced practitioners to easily customize or expand their systems via add-ons available on our website—a scalability model similar to that used by successful 3D printer manufacturers such as Bambu Labs and Creality. The complexity of our avionics system naturally scales with the model rockets students choose, from affordable sub-$100 beginner kits to advanced projects worth thousands of dollars and involving teams of students. Our initial modules will log data, and eject parachutes. After beginners feel comfortable with them they'll be able to expand the system by adding downlink capabilities, GPS and cameras. Following that they'll be able to take on our most advanced kits such as a thrust vector control, fin actuation and air brakes.

Teaching Systems Thinking through Modular Integration:
A comprehensive systems-thinking approach is a requisite in avionics design, making it broadly transferable across various engineering disciplines. Our modular platform initially enables students to act as integrators, learning firsthand how different components interact within a larger system. Once comfortable with integration, students can delve deeper into specialized areas of the avionics stack—such as control systems, microelectronics, or optimization techniques—using advanced modules. This layered approach allows beginners to engage with sophisticated engineering challenges gradually.

Overcoming Perceptions of High Cost and Complexity:
Avionics today remains limited by perceptions that it is inaccessible and prohibitively expensive due to scarce open-source resources, inadequate documentation, and high customization barriers. Our avionics package will directly address these fundamental challenges. It will offer simplified yet powerful modules, thorough documentation, and a clear, step-by-step onboarding process comparable to Khan Academy. The platform is intentionally designed to be open and flexible, enabling engineers at all skill levels to rapidly prototype, innovate, and customize affordably, without the need for extensive expertise or expensive custom hardware.

Comprehensive Educational Guides and Open-Source Resources:
We will create extensive companion educational guides and clear documentation to help users quickly engage with the platform, ensuring they have all the resources necessary to succeed. Unlike existing open-source avionics systems, our solution will provide comprehensive educational content tailored specifically to various skill levels, promoting accessible learning and continuous innovation.

Avionics as a Gateway to Careers in Automation, Robotics, and Aerospace:
Ultimately, our approach will prepare students for careers in automation, robotics, and aerospace engineering. By combining modularity, scalable complexity, extensive educational resources, and open-source flexibility, our avionics platform will provide an accessible yet powerful introduction to professional engineering practices. It equips students not just with technical knowledge, but also the confidence and enthusiasm necessary to tackle advanced engineering challenges throughout their careers.

4. Explain the feasibility of the technology.

What are the technologies needed to deliver the solution? Is the proposed solution feasible? Are the technologies you want to implement accessible?

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The actual fabrication of PCBs will not be our greatest feasibility challenge. We plan to design and prototype printed circuit boards in-house using accessible resources, such as the Voltera One at the Design Fabrication Zone. This will accelerate development cycles, significantly reduce costs, and allow us to quickly identify bugs and incorporate user feedback.

The primary technological challenge will be developing a product that balances advanced capabilities with beginner-friendly usability. Creating avionics technology that is intuitive, engaging, and accessible enough for novices, while remaining sophisticated enough for experienced users, is complex. Designing a modular system that can serve both educational needs and professional applications requires iterative development and extensive testing with diverse user groups.

Fortunately, student organizations on campus, particularly MARS and MACH, have agreed to collaborate by allowing Sonic Avionics to test products with their teams. MARS, specifically, has hundreds of members ready to test prototypes and provide valuable, actionable feedback prior to the product launch. This will significantly aid our development process and improve our product-market fit.

Another key challenge is finding a profitable and effective business model. We'll need to carefully analyze pricing options for the PCBs, decide on the right size for our development team, identify optimal sales tactics, and determine how best to attract customers. To do this, we'll conduct market research and structured experiments to find the best mix of price, product features, and customer value.

Collaboration with teams from IBZ and FEAS, including groups such as TASC, Frontier, Met Rocketry, Met First Creates, and others, will enable thorough testing and iteration of our avionics systems, providing diverse perspectives and valuable external feedback. Additionally, we will reach out beyond our campus to students and design teams at other schools and universities.

For further details regarding prior attempts, technical precedents, and our confidence in the overall feasibility, please refer to our answers in Question 6. We believe the core technologies we plan to implement are entirely feasible and readily accessible. The challenge remains in creating a user-centric, intuitive solution that resonates strongly with both beginners and advanced users—similar to successful platforms such as Arduino, Raspberry Pi, and Jetson.

5. Why did you choose to solve this problem?
We want to understand your motivation for solving this problem - did you face this problem? Did you read about this problem?

I've always been captivated by avionics and rocketry because they bring together students from diverse engineering disciplines such as control systems, PCB design, electrical, computer, and aerospace, to collaborate on a shared, exciting goal: launching a rocket. It's a dynamic and rewarding way to apply theoretical knowledge in a hands-on environment. However, when I first explored avionics, I hit a roadblock: there were no open-source systems I could build upon. Existing solutions were either overly complex, poorly documented, or closed-source and expensive, leaving me no choice but to start from scratch, a frustrating process.

This challenge became a turning point during my time at Launch Canada, a week-long rocketry conference in northern Ontario. Watching various student teams in action, I saw each group had developed unique approaches and best practices. It struck me that combining these into a standardized, open framework that used the best practices from each team could transform the experience for everyone involved. This idea began to take shape as a way to address the hurdles I'd faced personally.

But my motivation grew beyond my own struggles. I realized these issues mirrored larger problems in engineering education across North America. Too often, students are taught theory first, without seeing its real-world applications, which makes their studies feel disconnected and uninspiring. Complex systems like avionics can seem daunting, leaving students unsure of how to contribute without industry experience or clear guidance. There's a lack of practical outlets and standardized tools for learners, forcing them to piece together knowledge from scattered resources, a tedious and discouraging task.

I knew students needed a better way: a structured, hands-on approach to engage with sophisticated systems like avionics. My own journey highlighted this gap, and I felt driven to fill it. That's why I chose to create Sonic Avionics. I envisioned a beginner-friendly, scalable, open-source avionics system that integrates best practices from university teams nationwide. With thorough documentation and a modular design, it would let students tackle complex projects in manageable steps, fostering collaboration and skill-building. My goal is to empower the next generation of engineers by bridging the divide between theory and practice, equipping them with the practical experience they need to thrive in the industry.

6. How is the problem solved today? List current alternatives (competition) to your proposed solution.

Give us an idea of how the problem is solved today, and why that is not good enough. Consider indirect and direct solutions/competition. Based on this, clarify what is innovative about your solution.

Today, the challenge of providing hands-on, industry-relevant avionics experience is met with various solutions, but none fully satisfy the needs of students. Existing options include open-source projects, educational resources, and commercial systems, yet each has significant drawbacks.

For instance, an open-source avionics package from Hackaday (https://hackaday.com/2017/08/21/open-source-modular-rocket-avionics-package/) offers modularity but lacks proper documentation and updates, and never progressed to selling kits. Ben Eater's 8-bit computer project (https://eater.net/6502) provides an engaging, kit-supported course, yet its focus on low-level assembly is outdated for modern industry needs. Projects like Openpilot (https://github.com/commaai/openpilot) and Tinygrad (https://github.com/tinygrad/tinygrad) are open-source and revenue-generating through hardware, but their lack of teaching materials creates a steep learning curve. Meanwhile, commercial avionics from AllRockets.ca (https://www.allrockets.ca/Altimeters) are closed-source, expensive, not designed for beginners or education, and high prices signal limited competition. TurtleBot (https://www.turtlebot.com/) created an excellent entry-level platform for learning robotics. However, it is essentially a Roomba with a Raspberry Pi strapped to it, and it lacks flexibility and significant expandability.
None of these solutions combine open-source access, excellent documentation, an industry relevant application and scalability for all skill levels.

Sonic Avionics distinguishes itself by providing a scalable platform designed for long-term learning, supported by comprehensive educational resources and open-source collaboration. Its modular approach makes rocketry accessible, engaging, and adaptable, allowing users to seamlessly progress from simple, beginner-friendly projects to advanced, complex systems. This empowers learners to experiment, innovate, and meaningfully contribute to avionics in ways unmatched by existing alternatives.

7. What do you plan to do next? What are you planning on working on in the coming 4 months?

Some things to consider are problem discovery and making sure that you have a good understanding of the demand for your solution/idea, or anything else that will help you work on your idea (i.e. sourcing feasible technologies, recruiting team members, seeking mentorship, connecting with community members, etc.).

Over the next four months, we plan to engage directly with members of the student rocketry community to better understand their specific needs and identify how an open-source avionics framework could benefit them most effectively. Our team intends to visit engineering students at institutions such as the University of Toronto, Waterloo, and Queen's to gather firsthand insights and clearly define their requirements.

Specifically, we aim to confirm whether avionics truly represents an ideal vehicle for students to learn engineering principles, or if alternative domains might serve better. We want to verify that an essentials-only avionics development kit can be realistically produced at an affordable cost, making it widely accessible to students. Additionally, we plan to confirm whether students can easily grasp core avionics concepts and if engagement with avionics truly motivates deeper exploration of their studies.

Furthermore, we intend to validate that a streamlined avionics development kit could meaningfully accelerate prototyping efforts for advanced roboticists, aerospace engineers, and computer engineers. To clearly measure demand, we will distribute surveys within student communities, asking if they would be interested in using such a framework, what potential barriers might prevent them from engaging with it, and what specific features would be most valuable to them.

Beyond demand validation, we will also focus on sourcing feasible technologies, exploring partnerships, recruiting additional team members who can fill knowledge gaps, and seeking mentorship from experienced avionics and robotics professionals. Connecting closely with community members throughout this process will ensure our project stays aligned with real-world needs and remains both practical and impactful.

8. What are the biggest challenges you face in pursuing your idea?

This is not a “gotcha” - we want to understand what you are lacking, and how the Innovation Boost Zone can be helpful.

Our biggest challenge currently is recruitment. Finding highly skilled students who can commit significant time and effort to the project has proven difficult. We are truly feeling the problem we seek to solve. To overcome this, we plan to engage like-minded individuals who are motivated to perform market research, collaborate with student teams, and clearly identify user needs.

Additionally, PCB printing remains expensive and technically challenging. Connecting with engineers already working in the field who can advise us on ways to drive down production costs will be essential to ensuring the affordability and scalability of our solution.

Furthermore, developing effective educational content tailored to avionics will require guidance from learning experts. We're pleased to hear that the IBZ already hosts successful education-focused startups we can learn from, particularly in sectors like Fintech (e.g., StockShock) and Science education (e.g., DSchool). Leveraging these resources will help us create engaging, impactful educational materials to complement our avionics framework.

9. How will your idea impact Canada?
The Norman Esch Awards backs projects that will have a positive impact on Canadian people, communities, society, and the economy. Describe how your solution will make an impact in Canada. Consider the jobs you will create and/or how your solution will improve the lives of Canadians.

Sonic Avionics will positively impact Canada by empowering a diverse range of students and enthusiasts to develop hands-on expertise in avionics, computing, PCB design, and rocketry. Our open-source, modular system simplifies advanced engineering concepts, making avionics accessible even to high school students and others who might not have previously considered this field. By capturing student interest earlier and sparking a passion for both the art of avionics and the underlying mathematics, we can foster a broader, more inclusive pipeline of future engineers.

This approach will directly benefit Canada's tech sector by expanding the talent pool and preparing students more effectively for university programs and industry roles. Students who engage early with Sonic Avionics will arrive at undergraduate programs better prepared, reducing the need for universities to spend significant resources on introductory programming or basic technical catch-up. This enables universities to elevate their curricula and focus on more advanced, innovative topics.

Ultimately, our solution will strengthen the Canadian economy by cultivating a generation of highly skilled, innovative, and job-ready engineers. By equipping Canadians with practical experience in emerging technologies and complex systems thinking, Sonic Avionics helps drive innovation, supports job creation, and enhances Canada's competitive advantage in the rapidly growing aerospace and automation industries.

10. Attachment (Optional)

Your attachment(s) can be any materials (i.e. document, video, etc) that can be used to rationalize your application answers (i.e. secondary research, technology, etc). You are free to include any type of materials that you feel would assist in your application.

Maximum 3 attachments can be included.

*Please note, your application is being reviewed anonymously - please do not include any personal information (i.e. your names or faces).