Spring 2026 ECE 445 Team Contract

Instructions: The content of this document should be specific to your goals and needs. Ideas for the content of each section are provided as suggestions.

Project No. and Name	Project Number 34, LabEscape Ultrasonic Directional Speaker
Member Name, netID	Sam Royer, sroyer2
Member Name, netID	Arthur Zaro, azaro3
Member Name, netID	Piotr Nowobilski, piotrn2

ECE 445 is a project-based course. The course includes both team and individual grades. Project teammates generally all get the same grade for team assignments based on the expectation that all team members do their fair share of the work involved. The purpose of this contract is to lay out the tasks needed for the successful completion of the project and distribute them in a fair and efficient way to the team members. It will also discuss how the teammates will work together during the project and address any issues that come up. A contract that promotes good teamwork that leads to a successful project should:

- Acknowledge that each team member has commitments and responsibilities outside of ECE 445
- Encourage open communication about challenges that team members are facing, both in and out of ECE 445
- Give team members the benefit of the doubt and the opportunity to explain themselves when something goes wrong and resist jumping to judgement

Project Description:

Our project is to create two separate directional speakers, one with a reference wave, and the other with an amplitude modulated audio wave, so that upon their intersection, the waves interfere with each other, and the original audio sound is heard. We still do not know if this is physically possible, so we will first attempt a singular directional speaker using pulse width modulation for driving the signal with amplitude modulation driving the signal. This project was pitched by Professor Kwiat for the purpose of the LabEscape escape room, and we are in regular contact with him. The ultimate purpose of the directional speaker(s) is so that a clue in the escape room is only audible in a certain spot.

Project Goals: *If the team is successful in its purpose, what hardware and software achievements will attest to this?*

To confirm success in our project, we shall accomplish the following:

- *The transducer audio should only be heard at the intersection of the two waves, assuming that this solution is possible. If we discover that it is not possible, a singular directional speaker will be audible within a narrow cone of no more than 80 degrees. This audio should be able to play without heating issues related to the driver circuit.*
- *The ESP32 will accurately reconstruct our previously recorded audio through a 16-bit DAC. This process will be repeatable over many repetitions with high accuracy.*
- *The ESP32 will accurately be able to construct a carrier wave for modulation and a reference wave for output using a programmable waveform generator chip. This wave should be easily referenced by the oscilloscope to consistently have the correct periodicity.*
- *The audio amplifier will be able to run continuously throughout the escape room experience from the time it is activated to the time it is no longer needed without heating issues. The audio amplifier will also clearly show amplification of the signal/audio.*
- *The bandpass filters will successfully filter out any noise/ harmonics that come from the input signal.*
- *The connection between the driver board and transducer array board will be as lossless as possible, with oscilloscope readings from each side showing minimal losses.*

Expectations (ground rules) for each member: *Try to list six or more minimum expectations. Consider aspects such as preparation, participation, feedback, responsiveness, etc. Try to explicitly list anything that could potentially turn into a problem. Find ways to encourage everyone to communicate (this may also fall under "tasks").*

Each member will:

- *Communicate any scheduling conflicts or busy weeks to group members such that all members of the group are aware of conflicts ahead of time.*
- *Communicate progress at least once a week to confirm consistent and noticeable progress on the project.*
- *Ask for help or ask questions when progress is not being made, so that consistent and noticeable progress is possible.*
- *Attend all group meetings unless an exception can be made due to clearly communicated scheduling conflicts.*
- *Complete assigned tasks before corresponding deadlines to the best of his ability, where the deadline is either a course submission deadline or a deadline agreed to by all group members.*
- *Clearly agree to specific tasks delegated to him and carry them out to the best of his ability.*

Roles: *Do you see this team performing well because everyone works together and contributes equally? Are there certain aspects of the project that some teammates excel at? Can tasks be spread among individuals to optimize progress toward the final product?*

Our team plans to perform well by splitting tasks equally and clearly working together to make our individual work compatible and combined. Tasks have been assigned to each member to optimize progress towards the final product and have each teammate work on what they can excel at as shown below:

- *Sam will mainly be responsible for the ESP32 to DAC audio sound reconstruction and ESP32 to AD9833 sine wave programming.*
- *Piotr will mainly be responsible for the bandpass filters and audio amplifiers.*
- *Arthur will mainly be responsible for the amplitude modulation circuit and impedance matching for the transducer arrays.*
- *Piotr and Arthur will jointly be responsible for the ESP32 sine wave input to transducer array testing using pulse wave modulation.*

Project Meeting Time(s): *The team will meet at the scheduled team meeting with TA each week. Can you also preset an ideal time for team meetings in the lab (your team may need to sign up for lab bench access)? Is your team interested in meeting to work on other aspects of the course together such as project research?*

We will hold groups calls twice a week at times that work for us depending on the week to discuss progress and put individual components of the project together. On Thursdays from 10:30-10:50 AM, we meet with our TA, unless course staff communicates with us that there is no TA meeting in a particular week. We also will meet with Professor Kwiat biweekly to discuss the project, with specific meeting times scheduled during each previous meeting depending on availability. We will not preset an ideal time for team meetings in the lab room; rather, we will sign up for lab bench access as needed depending on availability. We are interested in meeting to work on aspects of the course together when it is necessary to do so, such as when combining different parts of our project, either in the lab room or the ECEB lobby.

Agenda: *Who will set the agenda? Beyond the weekly meetings with the TA, what will the team do to ensure that it stays on track during the semester? When a decision needs to be made, will it be approved by consensus or majority vote? Will a team member be appointed to keep records?*

The agenda will entail regularly discussing individual progress during group meetings and the necessary next steps for each member. The agenda is formed collectively. No single team member will be appointed to keep records. Rather, each member will keep their own journal as record keeping and share relevant information on the group discord channel. When a decision needs to be made, it will be approved by the consensus. However, in the event of the inability to

form a consensus regarding the agenda, the process described below for dispute resolution will be followed.

Process and penalties for dealing with team issues: *What happens when ground rules are broken? Who intervenes? What happens if the situation escalates? Always remember not to jump to judgement. Give group members the benefit of the doubt and the opportunity to explain themselves when something first goes wrong. TAs and instructors are available to help resolve issues.*

When there is a dispute of any nature, each side of the dispute will be allowed to voice their point of view. Both sides of the dispute will first attempt to mutually resolve their disagreement. If a mutual solution and consensus cannot be reached after 24 hours and at least one member agrees that this is a significant issue, then the group will contact the TA and ask him to mediate the dispute via an in-person meeting; if the TA still cannot get the parties to resolve the agreement, then the TA will make a decision that we must follow. In the case that the TA is unable or unwilling to help resolve issues, then his role will be replaced by a course instructor. Additionally, any decision made by the TA can be overruled by a course instructor.

In the case that there is a dispute, but it is related to technical details, i.e. disagreements in how the project should be implemented, then there is no penalty involved whatsoever.

In the case that there is a dispute, and it is related to a certain team member being suspected of significantly breaking ground rules in this document including, but not limited to, putting substantially less work into the project than other members, or persistently not attending meetings, then the team member must be given notice of this allegation via Illinois email. If a team member is not given notices of this allegation via Illinois email, then there is no penalty involved whatsoever. If the dispute is resolved between the parties of the dispute, then there is no penalty involved whatsoever. If the dispute is persistent and then the team member is given at least two notices of this allegation via email and there is no resolution, then the TA will make a final decision, which will be bounding. If the TA deems that the team member significantly broke ground rules in a persistent way after meeting with the group in-person, then this significant infraction shall be penalized by being documented via Illinois email by the TA and must be denoted with the sentence "A significant infraction has been committed by [student's name]." The TA may also opt for different final decisions, such as giving the student a "first warning", deeming that no infraction has been committed, or opting for no penalty if the infraction is deemed to be minor.

All team members agree to work proactively to the best of their efforts to avoid situations of significant infractions or disputes by following ground rules and giving each other feedback. Team members agree to only escalate a dispute by bringing it up to the TA after an honest attempt at consensus and giving each other the benefit of the doubt.

End-of-term agreement on using final peer assessment for grade adjustment: *Do you believe that this contract should hold your team accountable to its contents or that it may hold little value? There will be two formal peer assessments this semester. The first is used only to provide honest, constructive feedback to each team member. The second peer assessment affects a teammate's grade.   Without accountability, many promises go by the wayside.*

This contract's contents shall be used to hold our team accountable. The contract holds a lot of value and sets standards of how each member should contribute to the final goal. The team will try to proactively give feedback to one another regarding roles and keeping the contents of the team contract upheld. If a certain team member is found to commit a "significant infraction," as explained above in the "Process and penalties for dealing with team issues" section in this team contract, then in either the first or second formal peer assessment, the team members can cite an email by the TA or a course instructor which contains the sentence "A significant infraction has been committed by [student's name]," provided that this sentence has not been overruled by any course instructor. If this precise citation is made in one of the peer assessments, then course instructors can adjust grades, i.e. give certain team members different grades for team assignments. If this citation is not made in one of the peer assessments, then course instructors are advised not to adjust grades. However, the ultimate discretion for assigning grades is given to the course instructors, and we fully respect any decisions made by course instructors.

Signatures: Iterate on this document until everyone is comfortable with its contents and signs (it is okay to type your printed name as your digital signature).

I affirm that I participated in generating this team charter and that I will abide by its contents to the best of my ability. Furthermore, I understand that failure to meet the expectations expressed here can lead to the stated consequences.

netID: sroyer2   (digital) Signature: Samuel Royer   Date: 02/24/2026

netID: azaro3   (digital) Signature: Arthur Zaro   Date: 02/24/2026

netID: piotrn2   (digital) Signature: Piotr Nowobilski   Date: 02/24/2026