Meeting 10/20/16 w/ Stevenson, Kloepper
-Postdoc Felix (Yanqing Fu) and Professor Laura Kloepper from SMC
-Project funded by the Navy
-Trying to see how bats communicate with each other so that Drones can work the same way.
-We bought a motherfucking falcon that's going through training right now.
-Sonar. How are they not colliding? How do they know where the walls are, etc.
-2 Pieces of Equipment: Falcon Pack/Bat Pack. Falcon hunts
-Falcon Pack: Strap camera and ultrasound recorders to see how the bats are doing. Higher priority
-Bat Pack: Accelerometer-attached.
-Current camera records AVI file w/ audio (only for speech, not sonar) into micro-SD card.
-Bats sonar: 30 kHz - 60 kHz. They send a sweep of High frequency --> lower frequency per pulse (1ms-5ms)
-We want our microphone to be sampling ~200 kHz
-Audio and video is unsynchronized, so we'd want to synchronize them. How? Clapping in front of camera is crude, but Stevenson is looking into boards
-Simplest Goal: Use the high-frequency microphone with adjustable gain feeding into a PIC32 to do Analog2Digital conversion, then dump the data into a microSD card
-Reach Goal: Using stero sound (two microphones). Video is reach goal as well.
-Requirement: Total weight has to be ~25g.

Meeting 10/27/16 w/ Stevenson
-All female bats.
-How to avoid mutual interference of signals (echolocation)
-Belle, female hawk in New Mexico.
-Specific camera has already been chosen for the hawk, will be head-mounted.
-BUT we might need to find another one since ours is super sketchy.
-Figrue out how to interface a microSD card with the PIC32 board that we're using in Senior Design.
Analog Electronics:
-10 kHz < frequency < 100 kHz
-We have a tunable amplifier (adjustable gain)
-SPI definitely works with the microSD, but they might have 4-bit interfaces as well. Try to figure out the latter, but the SPI might be fine.
-Only sensors should be on head, and everything else (hardware) should be on the hawk backpack.
-Battery should be sized to last an hour (current draw? power needed?)

Meeting 11/7/16- Only Bill, Roz
-We need to store data into the flash memory chip used in Senior Design.
-We need to sample at 200 kHz, but the signals go up only to 100 kHz.
-Supply voltage has to be at least 1.5 V, less than 3.6 V
-Output voltage ranges from 0 to 5Vs, depending on input.
-Microphone outputs an analog voltage proportional to frequency of input signal(?)

Meeting 12/8/16- w/ Stevenson
-Plug in I/O pin, flip it back and forth, to connect to logic analyzer. Then use microphone to read the waveform.
-Bottleneck is the flash memory, not the microcontroller. DMA will be useful when the processor is what's slowing us down.
-SD Card will be faster than the flash memory we're using right now. Probably. (80Mb/s??)
-Focus on writing 512-byte blocks.
-Use log scale for graphs
-Microphone provides nice waveforms as seen on the oscilloscope.

Meeting 1/20/17- w/ Schafer
-6-7 weeks, we'll have a blocked system test, where we prove that each subsystem works.

-Afterwards, we have to demo the integration between all the subsystems.
-Board design should be done w/ a specific manufacturer, making Quantity 3 Boards. 1.5 week turnaround time.
-The sooner we have a board, the better.
-We should be using a SPI interface to dump data into the SD card.
-We might need to create a filesystem onboard the SD card, instead of using raw data (but just using raw data will be the easiest).

Meeting 1/20/17- w/ Stevenson
-Can receive and write high freq sound signals to memory as of now.
-Might have to do board design fast, since we'll have to do multiple iterations.
-Automatic gain control. Should just be small.
-2 inches of back space of the falcon.
-Weight restrictions on head vs. back
-Figure out all analog components: voltage regulation, gain control, bandpass filters
-Significantly less than 15 minutes of data and power. Assume a half hour of power.
-Rugged electronics to resist dust, feces, pee, etc.
-Version 1 of the board should be made in Eagle soon.

Meeting 1/23/17- w/ Bill, Roz, Albert
-Microphone outputs AC signal that looks exactly like input sound.
-How do we buy stuff? Through order sheet?

Meeting 1/25/17- w/ Schafer
-List of subsystems: Receive data, record data
-Went through the plan of how to complete separate subsystems
-Need to develop circuitry for the microphone
-Sparkfun: AGC/AJC(?) chip w/ microphone. Possible order request.
-Would connect this system to our microphone.
-Need to talk to Kloepper about specific port and power comnig out of their battery pack.
-What current draw are we limited to?
-Important: Just know the voltage. Might have to step it down, use a DC-to-DC convert, etc.
-Possible solution: Have a 2-pin power connector parallel to the battery port to provide more than one way to power the board.
-Also need to implement a system that will provide power to an auxillary device (camera)
-Also need a solder paste screen
-Next meeting: Updates on purchase requests, supplementary circuits for microphone, beginning of Eagle Design, and update on SD card code design.
-Also update guys in the Heart Senior Design Team when we figure out the SD card.

Meeting 1/30/17 w/ Stevenson, Kloepper
-We can keep the AGC off if we want to maintain constant gain. (0dB to 80dB, or 20dB to 100dB)
-Might not need AGC at all.
-Before, we were getting a ton of clipping, so we should err on the side of quiet.
-Need to filter out wind noise. Simple HPF? Usually use a 10kHz HPF for Kloepper's experiments. Bat communication frequencies go down to 15kHz. Should be 10kHz to 100 kHz.
-Will probably use FAT files on microSD card, record data into .txt or .csv
-OR we can write a raw .wav file.
-10-bit ADC. Want as many bits as possible.
-We'll go with a PIC16 or PIC24
-Might go with a small watch/coin battery, but use Li-ion battery pack for now.
-LED synchronization should be trivial.
-Don't forget to put LED port on the PCB.

-Add power LED, recording LED, synchronization LED.
-Add button that would start recording on the board. Add connectors to PIC.
-Amplifier should be right next to microphones, NOT the board, in order to prevent noise.
-Back panel should contain battery, microSD, and PIC.
-Battery pack should be disconnectable, as it will be charged off-board
-Might end up w/ 40g on back. 2x1.5" ish, 10g ish on the head, including camera.

Meeting 2/8/17 w/ Schafer
-We'll stick with the PIC32
-We can do serial debugging, if we add wires on board.
-Use mini-USB instead of micro-USB to power the board.
-A DC-to-DC converter is more efficient than a regulator 90% of the time, so we'll use that.
-Currently: microSD creates text file, and has string loaded into it.
-Get details about camera voltage, and see if we'll steal voltage from it.
-MM series vs. MX series?

Meeting 2/13/17 w/ Stevenson, Kloepper
-Eagle PCB design is all done, should be ordered today.
-Another LED should go on the head for audio/video synchronization.
-MicroSD card SPI is sending signals, but we don't have anything being written into the SD.
-We might want to use 4-bit parallel mode with the SD Card if the SPI isn't fast enough. 4-bit parallel mode is 4x faster than SPI mode.
-If we can't write quickly enough to the SD card w/ SPI, we'll actually have to make hardware changes to the board.
-We should be able to switch between SPI and 4-bit parallel... I think.
-We want to be able to record the amount of gain when we record.
-Might want to look into better mics, since ours maxes out at ~120dB.
-We need to borrow a hawk from the zoo.

Meeting 2/15/17 w/ Schafer
-PCB Design: Still going back and forth w/ Schafer on design.
-Need to show Vdd and GND indicator on the actual PCB.
-SD Card usage is close, we're getting some error messages, but we're still working all of them. We're receiving SPI signals to the SD card at the correct clock rate, which is good.
-We'll stray away form the spring-loaded SD Card mount. Schafer currently working on a MOLEX connector. Need to wait for him to get physical hardware.
-We'll need large vias (>1mm) in the board in case we want to get a soldering iron through it to fix some components.
-We switched over to the PIC32MX-series from a PIC24.

Meeting 2/27/17 w/ Stevenson, Kloepper
-Received falcon, backpack straps, high frequency chirp generator, microphone
-MicroSD card now works at ~500 kilobytes/sec, which is well over what we need
-We also have three copies of the PCB, and we'll learn how to put on the solder-paste screen today, and then have a prototype.
-Also received a Salae logic analyzer.
-Look at how we have our logic analyzer configured to see if we're also analyzing an analog sample, since it would slow down our digital reading.

Meeting 3/1/17 w/ Schafer
-Make sure to see there are no shorts between +3.3V and GND before powering, and the same thing with +5V on the other side
-We have a MX270U, that utilizes #defines. We need to remap the pins, since none of the pins come mapped

beforehand.
-We will keep the FAT formatting on the SD card.
-Sampling should be interrupt-driven.

Meeting 3/8/17 w/ Schafer, Stevenson, Kloepper (Design Review)
-We capture 4k of data into RAM, and put it into the microSD.
-32kHz sine wave on the input of the amplifier, separate from the audio input (bad).
-Try changing the frequency of the system clock, to see if it comes from the oscillator. Remove the coupling capacitor, see how that works out.
-It could be coming from the microphone itself. Try looking for different MEMs microphones?
-Kloepper's microphone also had 64kHz noise.
-Add LED that blinks regularly and sends a sync pattern into the audio file.
-Add a unity gain op amp coming out of the microphone/amplifier. Infinite impedance?
-Last resort, we can use a notch filter and just filter out the 32kHz tone.
-9 inches between the two units
-What would we need two copies of for two microphones?

Meeting 3/22/17 w/ Schafer
-May have to adjust distance between components to reduce piezoelectric effect.
-Pay attention to the CLASS of capacitors to reduce noise.
-Figure out how the float points of the data are actually being stored w/ the PIC.
-Data collection still needs to be faster. Possibly use DMA?
-Maybe store data as ints using microvolts, so the numbers scale from 0-330000, and scale it down post-data collection.

Meeting 3/27/17 w/ Stevenson
-We're now successfully writing the data as ints directly to the SD card instead of floats
-We might want to scale it to 0:1 instead of 0:3.3V, according to Stevenson.
-We're writing 4k blocks fast enough to keep up with the sampling rate.
-We want to finish writing the 4k block before the next block is ready to be read.
-We're waiting for the new, stable capacitor to be shipped here, and that should reduce the noise that we were getting before.
-LED should be flashed once every 30 seconds, and will probably be placed right on top of the camera. That will need another 2 wires coming up from the board to the LED.
-We also need to implement a start/stop recording button on the board itself.
-Weight is probably more important than the size of the board.

Meeting 3/29/17 w/ Schafer
-We're getting periodic noise...
-Roz will start making a prototype of the two boards, if the class 1 capacitor fixes our problems.
-In the ISR, we should select the SRS instead of using auto
-We probably shouldn't have to use DMA, since our software goes fast enough.
-We might have to use surface mount buttons, since screw-ons are too heavy. Get it from Schafer's library
-Adding two other LEDs for testing.
-We should write the text on the board in the T-names layer. Can even do it in copper.
-Smash?
-FTDI --> USB

Meeting 4/5/17 w/ Schafer
-Still need to get the MOLEX SD Card connector 5739 or something. Need to get it from Schafer's library
-Possibility of writing to two files for two microphones?
-Ask Stevenson whether tradeoffs of using two microphones will be worth it or not.
-TPS6 is a DC-to-DC voltage converter designed for the USB range used by most students in Senior Design.

-The concern is we don't know what kind of voltage we're getting from the camera.
-Right now we're just powering the board with USB, using a regulator.
-32kHz noise was gone when the board was tested in Fitzpatrick. Suspected to be from capacitance of the oscilloscope. Class 1 capacitors are still on there.
-Try using the 270 board to run the PLL at its maximum clock speed.

Meeting 4/10/17 w/ Stevenson, Kloepper, Felix
-2nd board is about to be sent out (Roz). Should have completed/populated board in 1.5~2 weeks.
-No issues with timing.
-SPI runs at 20 MHz. Sample rate = 200 kilosamples/s
-Maybe make new timestamped files every 30 seconds. Figure out how long it takes to make new files and write to them between 30 second periods. We'll have to close each file after 30 seconds. There's a limit on the number of files we can have open at one time.
-4k of samples ~= 0.1 ms(?)
-Need a start/stop button that opens/closes a file each time that you press it.
-Get weight and size dimensions of the two boards to Kloepper ASAP.
-Felix will be building a case for the boards and the camera. Camera will take up most of the space.
-Microphone is omnidirectional, so we have to decide if we want to put it on the head or the back.
-Case design: 3D-printed, thin case? Can also use milk cartons/cardboard.
-We'll just stick with one microphone for now..

Meeting 4/12/17 w/ Schafer, no Roz
-We might not have enough time to close, create, and write to a new file every 30 seconds. We'll just add a new line every 30 seconds to save time.
-Or we can add a "nonsense high" data point that can't be measured normally as our marker.
-We can declare our ints as "unsigned shorts" instead to double our sampling speed.
-Taking a shorter buffer and writing it into a larger variable, the variable will be casted to accommodate for the smaller size.
-We should truncate the 10-bit data into 16-bit chunks instead of 32-bits.
-How precise does the 30 second data stamps have to be? The crystal oscillator we're using should be enough
-We have to add information to our website.
-We would probably want a crystal resonator more than a ceramic one, but we would need to have the capacitors necessary to use it.
-Double check the parts that we'll need to have for the second iteration of the board.

Meeting 4/19/17 w/ Schafer
-Figure out the website (FTP)
-Can use CyberDuck or FireFTP to connect to the network.
-Keep in mind that people will actually be using our product, so maybe create a user manual.
-Schedule a pre-demo before the actual demo some time this week. Will have to invite Kloepper, Stevenson.
-Think about how we're actually going to show that it works.
-Mount it on the toy falcon itself.
-Need to order batteries to power the board.