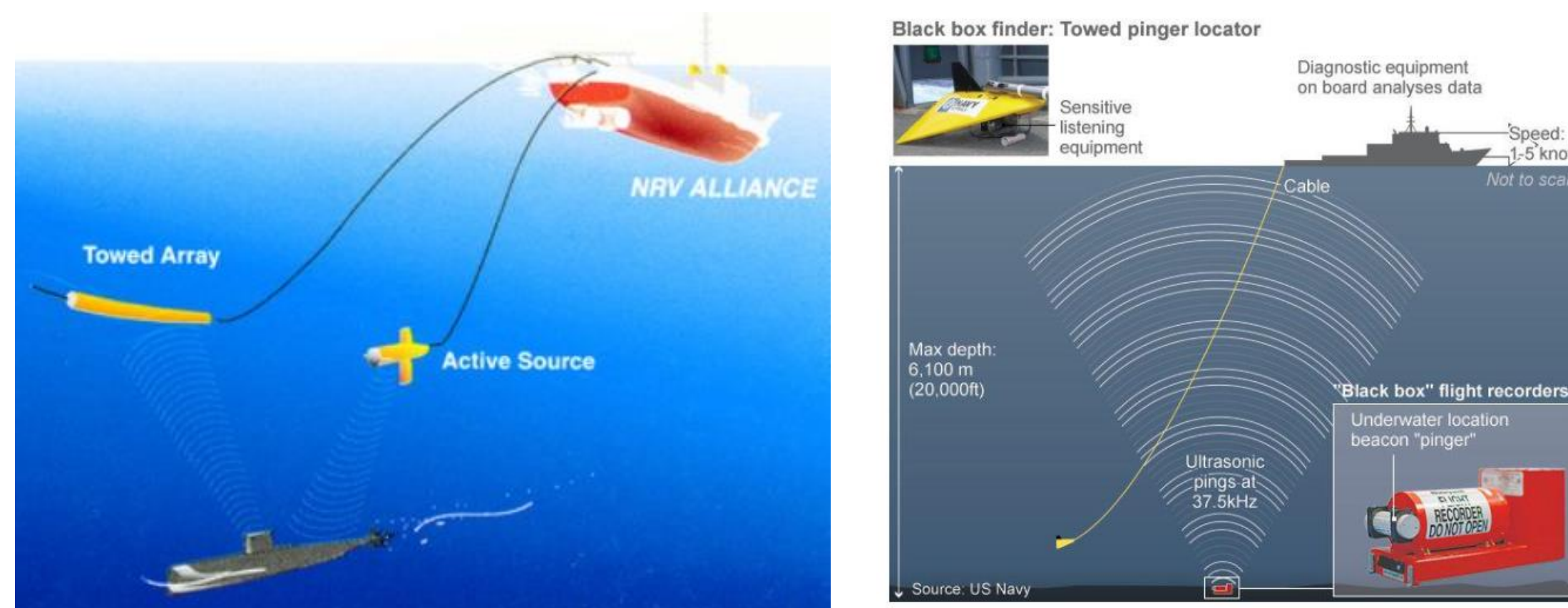


Towed Array Emergency Locator



Introduction

- Tasked with designing an Emergency Locator Beacon for Ultra Electronics
- Ultra Electronics Maritime Systems is a global industry leader, who's specialties include Sonar, Radar, Underwater Acoustics, and Power Systems
- Based out of Dartmouth, Nova Scotia with parent company in London
- Long arrays of Hydrophones are towed behind ship vessels as a means to locate objects underwater
- A hydrophone is a microphone designed for the listening/ Recording of sounds underwater
- These arrays can be severed.
- Currently there is no system in place to easily recover an array after it has become disconnected.
- Ultra Electronics tasked us with the project of designing a black box system that will detect when the array has been severed
- Once the box is triggered, after a delay it will begin sending out pings.
- Pings will be searched for by a recovery Vessel and Recovered



Design Process

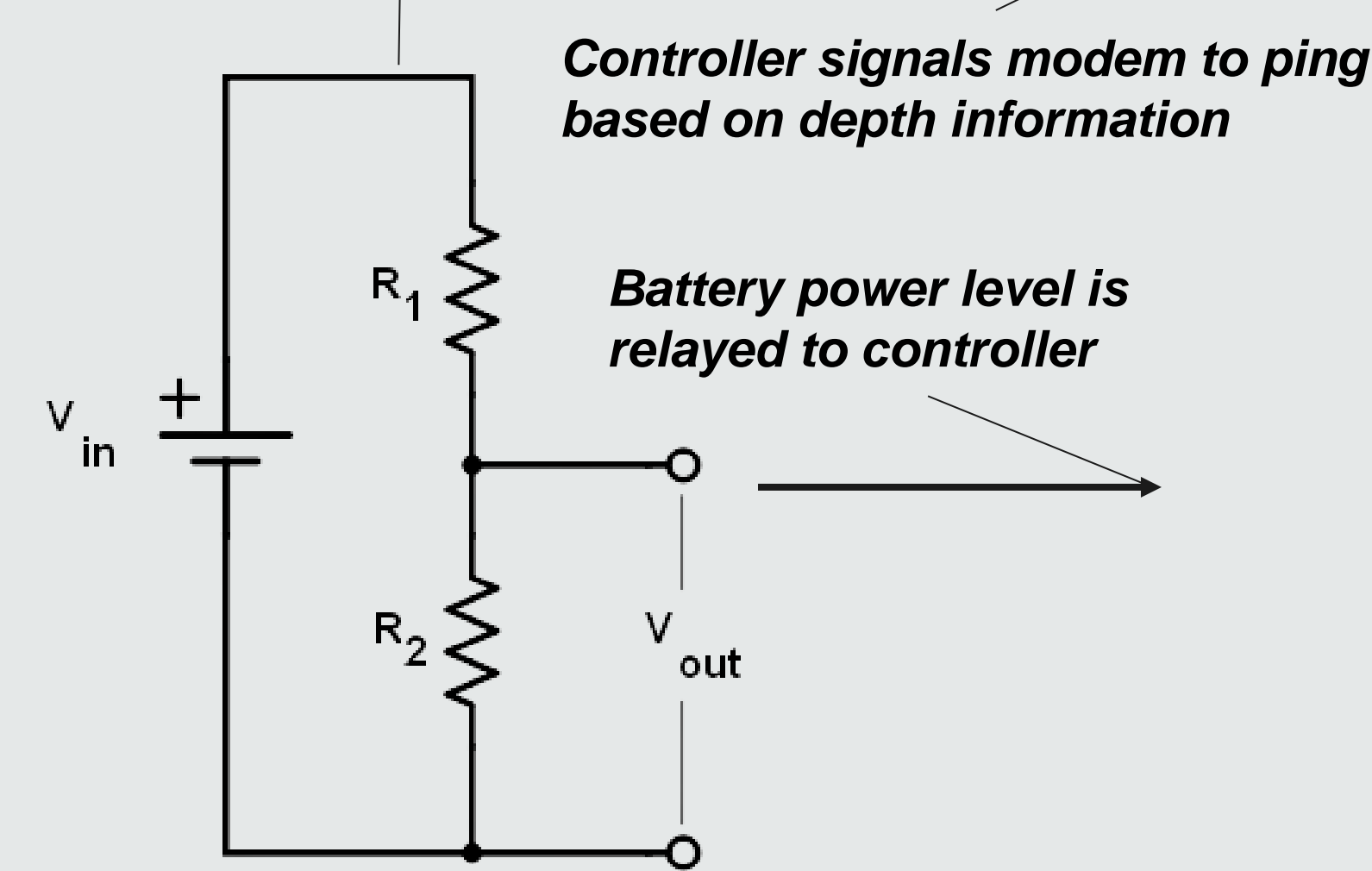
- Provide details of your design process. Talk about what you did and how you did it.
- Initially, an RPi3 was proposed, but we decided it was too power hungry, so swapped it for a less powerful device.
- AA battery proposed originally, but LiPo has better lifespan, is rechargeable, and has a flat discharge curve.
- Voltage divider chosen to be used to monitor battery as it was simplest. High resistances will be used to reduce current.
- Acoustic modem was chosen on basis of reliability and simple modulation scheme. Will be the main energy sink of the system when active.
- Depth sensor chosen on recommendation of internal supervisor.

Details of Design

In order to better organize and compartmentalize the system, it was broken down into 3 main subsystems:

- Battery and Power Monitoring
- Microcontroller, Sensor and Housing
- Acoustic Modem and Pinger

- Ideal way to monitor battery power is to use a method that measures Arduino rail voltage directly.
- However, this method requires more testing.
- A voltage divider is a reasonable alternative but it cannot be shut off.



Battery power is monitored

- The best battery option is a series of D-Cell LiSOCl2 batteries
- These batteries are small and have the required voltage to power other components when connected in series
- The proposed batteries are from EaglePicher
- Additionally, has a linear discharge for easier tracking of remaining power



- Simple piezoelectric pinger with Benthos modem is best option.
- This is based on power consumption, depth rating, as well as the modulation scheme.
- Depth rating of 2000m means it is applicable for most applications.
- MFSK is ideal modulation scheme as it is easier for underwater communication and it is preferred by the customer

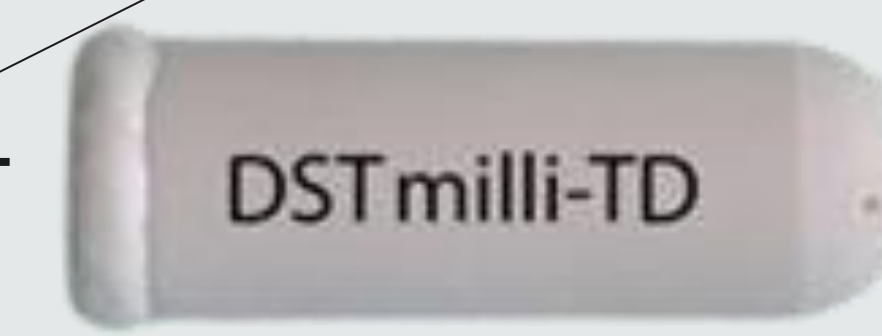


Depth of system sent to controller

- The best controller would be an Arduino Nano
- It has a small, manageable profile along with not being too power hungry.
- It contains enough connections for the peripherals that are required.
- The group has worked with Arduino Nanos before on previous projects, so this familiarity should help avoid some issues.
- The depth sensor chosen is the Star Oddi, based on Dr. Bousquet's recommendation and its ability to interface with a microcontroller.



Battery sends power to controller



Conclusion and Recommendations

- Our design will consist of the D-Cell LiSOCl2 batteries, arduino nano, Xeos Star Oddi depth sensor, a simple piezoelectric pinger with a Benthos Modem, and a battery monitoring system.
- Currently the team is doing research to ensure we have the best hardware components possible for each subsystem.
- Plan is to do the bulk of the coding over the summer and have a working prototype early in the fall term.
- Ultra Electronics has a test tank which will be used for us to perfect out design.
- Overall we feel very good about this project and are confident we can complete this system by the next December.
- Strong Communication throughout the coming months will be key.

References

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- USBL Multibeacons. (n.d.). Retrieved March 11, 2021, from <https://www.edgetech.com/product/usbl-multibeacons/>

• As this stage of our design in a proposed prototype, the images above are not exactly representative of the final parts that will be used. However, they do sufficiently describe the purpose of the part and the functioning of the system.