



Remote Euthanasia System

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Overview of Presentation

Problem Statement

Background

Preliminary Design Specifications

Designs and Design Matrix

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References and Acknowledgments



Problem Statement

- Our client is testing the Navy's standard operation to rescue sailors in a disabled submarine at the bottom of the ocean.
- This hyperbaric chamber will be putting the sheep through a variety of pressures that can be fatal.
- Our goal is to create a device that is able to remotely euthanize the sheep when they are inside of the hyperbaric chamber prior to a rapid drop-out decompression.

Background Material

- Hyperbaric chambers are often utilized to help fight infection or minimize injury. They are usually used at around 1.5 atm, 15-18 m of water [1].
- Too much exposure in a hyperbaric chamber may result in [2]:
 - Lung collapse caused by air pressure changes (barotrauma)
 - Seizures as a result of too much oxygen (oxygen toxicity)
- It takes around 172 hours to rescue all of the sailors from a disabled submarine.

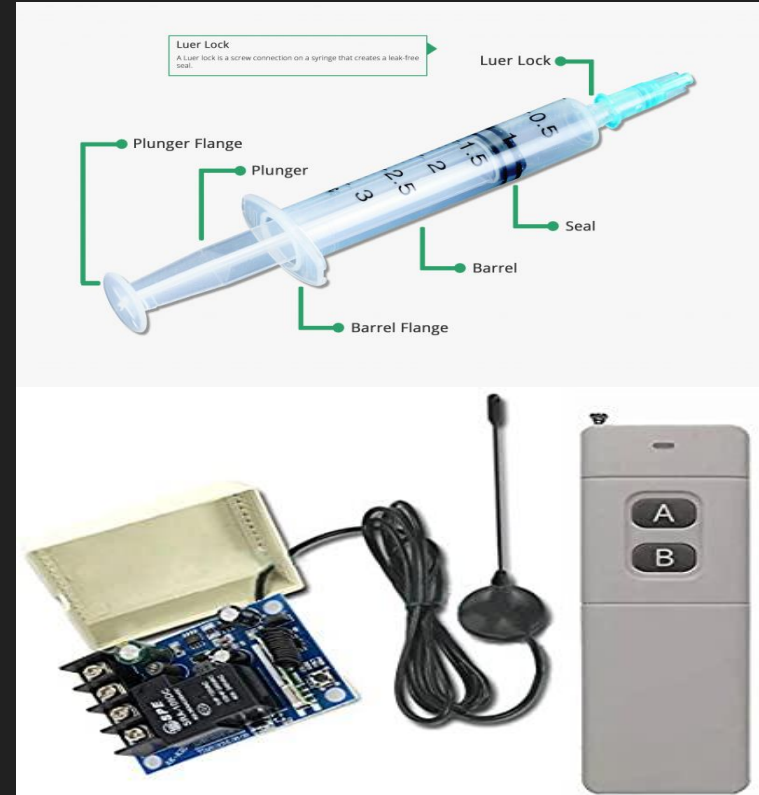


<https://www.sportdiver.com/how-does-hyperbaric-chamber-work>

Summary product design specification - PDS

Key client requirements:

- Operate and withstand pressure changes induced by the hyperbaric chamber
- Must be remote controlled
- Efficiently force the euthansia solution from syringe



-<https://syringepumppro.com/parts-of-the-syringe/>

-<https://www.amazon.com/Lejin-200m-1000M-Wireless-Controller-Transmitter/dp/B078HQWJPG>

Competing Designs

Infusion Pumps (Baxter Sigma Spectrum) [3]

Advantages:

- Designed for consistent injection of fluid
- Designed to last for decades
- More robust than syringe pumps
- Adjustable rate of flow

Disadvantages:

- Only rated for up to 1.4 ATM
- Expensive

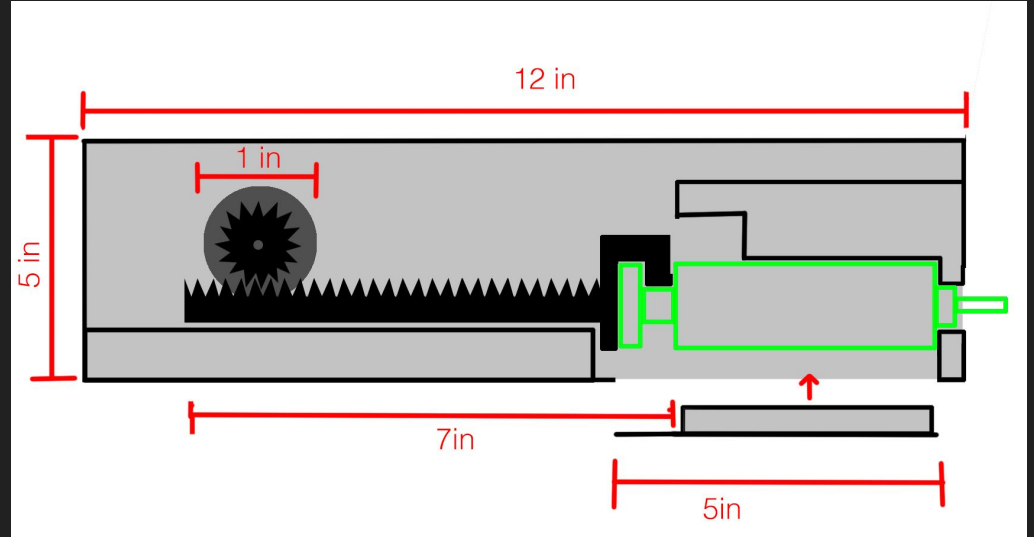


<https://www.biomedixmedical.com/product/baxter-sigma-spectrum-infusion-pump/>

Rack and Pinion

Capabilities:

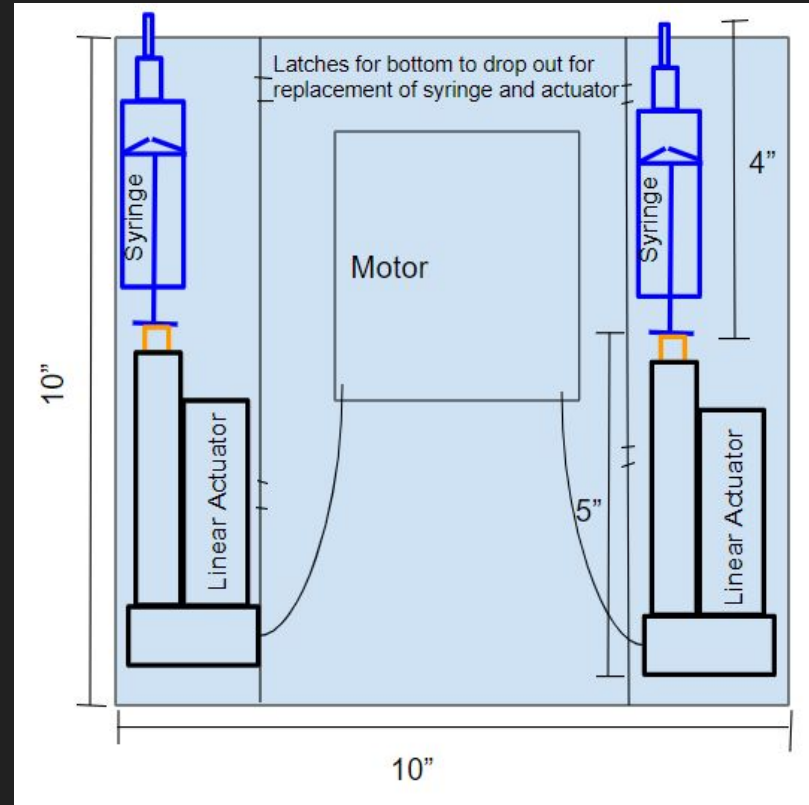
- Only 2 moving components
- Can move quickly and has a low power draw
- Syringe is easily loaded and removed (like a shotgun shell)



Linear Actuator

Capabilities:

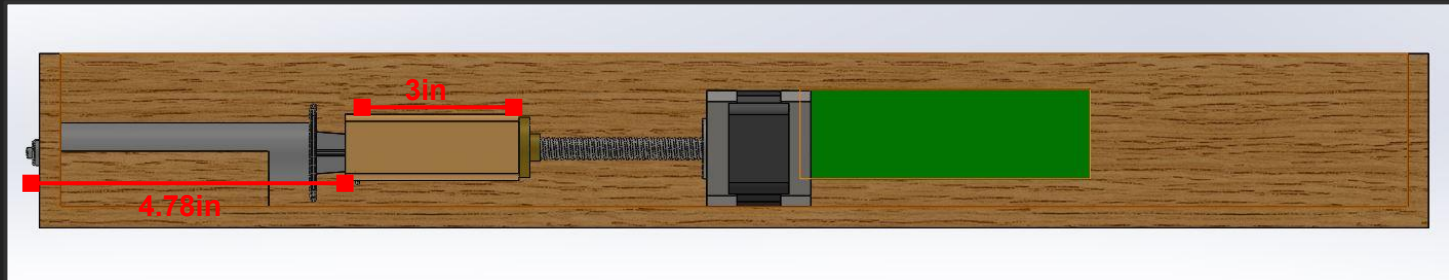
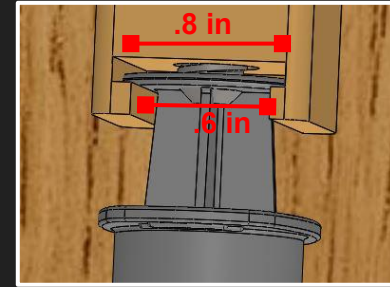
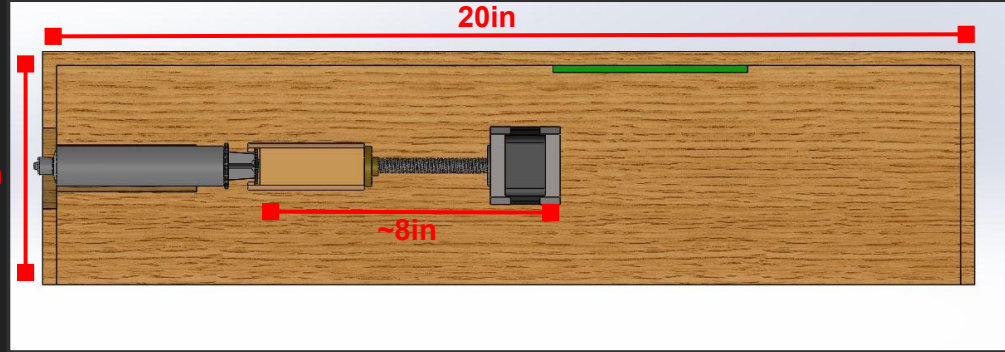
1. Easily Loaded
2. Consistent & Powerful
3. Many Choices of Linear Actuator



Lead Screw Plunge

Capabilities:

1. Easily Loaded
2. Threaded Holding Cap
3. Leadscrew & Stepper Motor
 - a. Force feeds the leadscrew forward into syringe
 - b. Very customizable (Speed & Force)



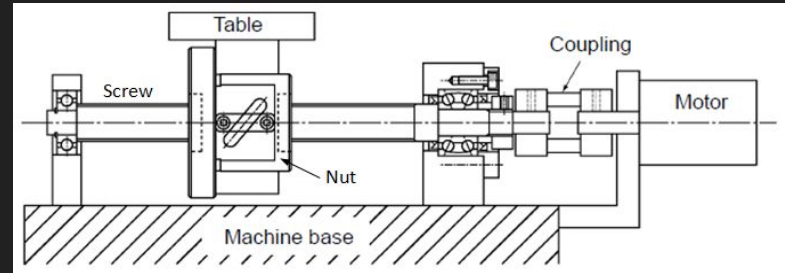
Design matrix

Designs	Rack and Pinion		Linear Actuator		Lead Screw Plunge	
Reliability (30)	3	18	4	24	5	30
Efficiency (25)	5	25	3	15	4	20
Robustness (20)	4	16	3	12	5	20
Feasibility (15)	4	12	5	15	3	9
Ease of Use (10)	4	8	4	8	5	10
Cost (5)	5	5	1	1	3	3
Total (100)	84		75		92	

Future work

In the coming weeks:

- Lead Screw Plunge Design
- What's next for us?
 - Future design thoughts



<https://www.anaheimautomation.com/manuals/forms/images/ball-screw-assembly.png>



<https://penntoday.upenn.edu/2015-04-16/features/hyperbaric-therapy-treats-patients-pure-oxygen>

Acknowledgements

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References

- [1] R. M. Leach, P. J. Rees, and P. Wilmshurst, "Hyperbaric oxygen therapy," *BMJ (Clinical research ed.)*, 24-Oct-1998. [Online]. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1114115/>. [Accessed: 01-Oct-2020].
- [2] MayoClinic.org. 2020. Hyperbaric Oxygen Therapy - Mayo Clinic. [online] Available at: [https://www.mayoclinic.org/tests-procedures/hyperbaric-oxygen-therapy/about/pac-20394380#:~:text=Potential%20risks%20include%3A,by%20air%20pressure%20changes%20\(barotrauma\)>](https://www.mayoclinic.org/tests-procedures/hyperbaric-oxygen-therapy/about/pac-20394380#:~:text=Potential%20risks%20include%3A,by%20air%20pressure%20changes%20(barotrauma)>) [Accessed 10 September 2020].
- [3] Sigma international, *Sigma Spectrum Operators Manual*. Sigma International, Medina, NY, 2008.