



# Stirling Cryocooler

## Final Proposal Presentation

### DESIGN TEAM 1

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  - JOHN WILEY
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# Project Description

- Design and build a bench top device that demonstrates refrigeration processes using the Stirling cycle.
- Stirling Cryocooler: putting in power to remove heat.
- Model will be used as a working test device in Experimental Methods Laboratory.
- Allows students to further conceptualize processes such as isothermal compression and expansion. It also will serve as an example of a truly closed system (ME291 & 392).
- Sponsor/Client Dr. David Trevas.

# Cryocooler with subsystems labeled

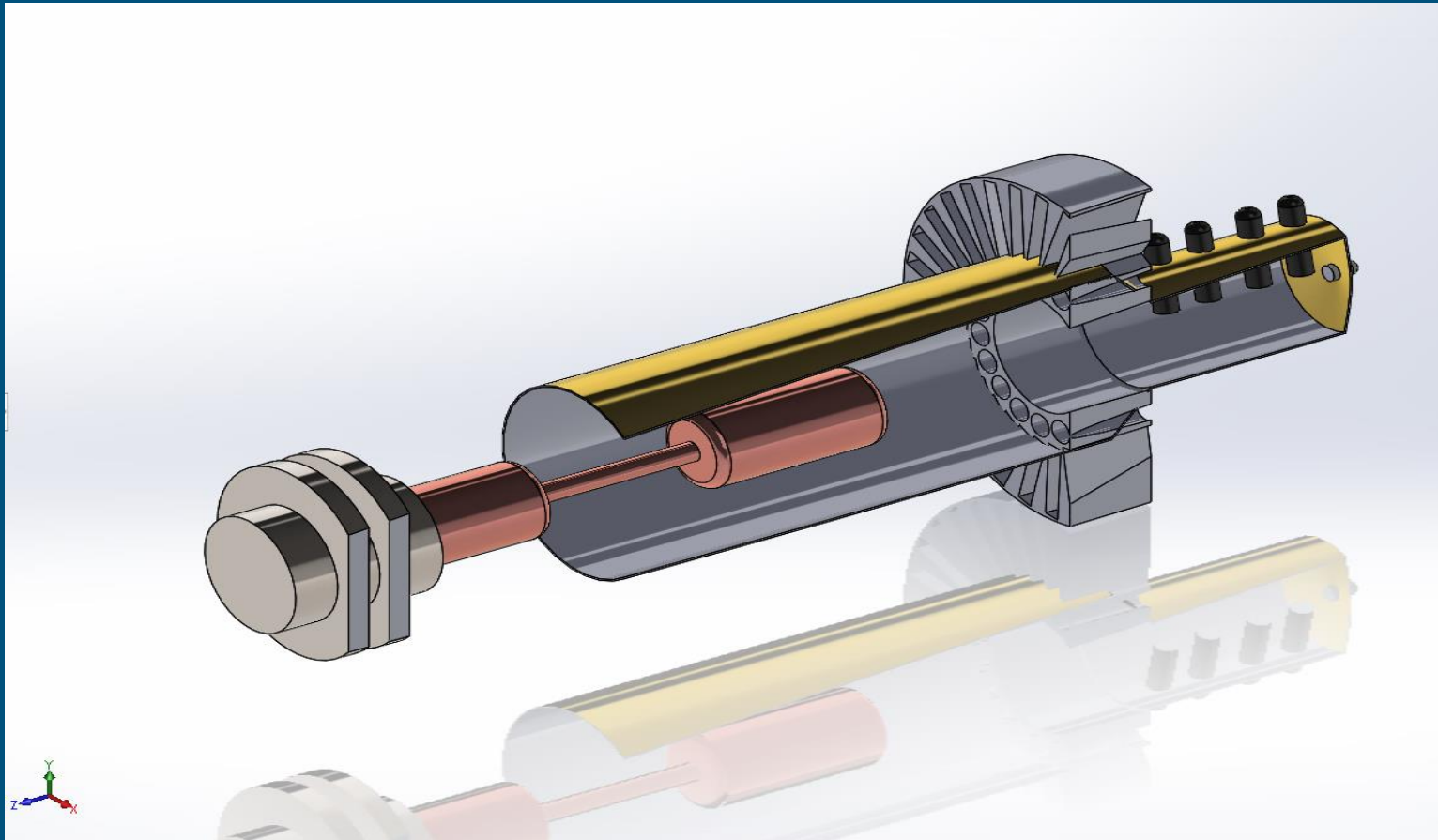
ITEM NO.	PART NAME	QTY.
1	Fin	1
2	MainCylinder	1
3	Piston	1
4	Displacer	1
5	Linear motor	1
6	Temperature/Pressure Ports	4

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UNLESS OTHERWISE SPECIFIED:		NAME	DATE	Date: 08/07/2018
DIMENSIONS ARE IN INCHES		DRAWN		TITLE: Team1_Stirling Cryocooler
TOLERANCES:		CHECKED		
FRACTIONAL: ±		ENG APPR.		
ANGULAR: MACH ± BEND ±		MFG APPR.		
TWO PLACE DECIMAL ±		G.A.		SIZE DWG. NO. REV
THREE PLACE DECIMAL ±		COMMENTS:		<b>A</b> Assembly
INTERPRET GEOMETRIC TOLERANCING PER:				SCALE: 1:5 WEIGHT: SHEET 1 OF 6
MATERIAL				
FINISH				
NEXT ASSY	USED ON			
APPLICATION				
DO NOT SCALE DRAWING				

Presenter: Ahmad Althomali  
 08/07/2018 Stirling Cooler #1

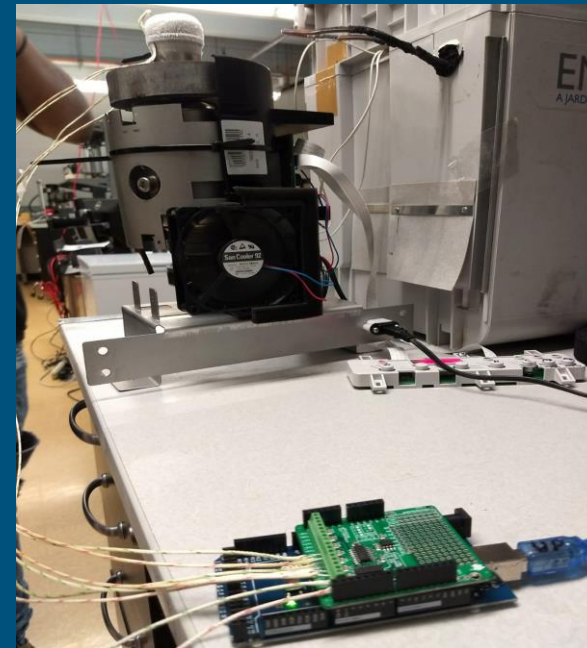
# Final Cad Drawing



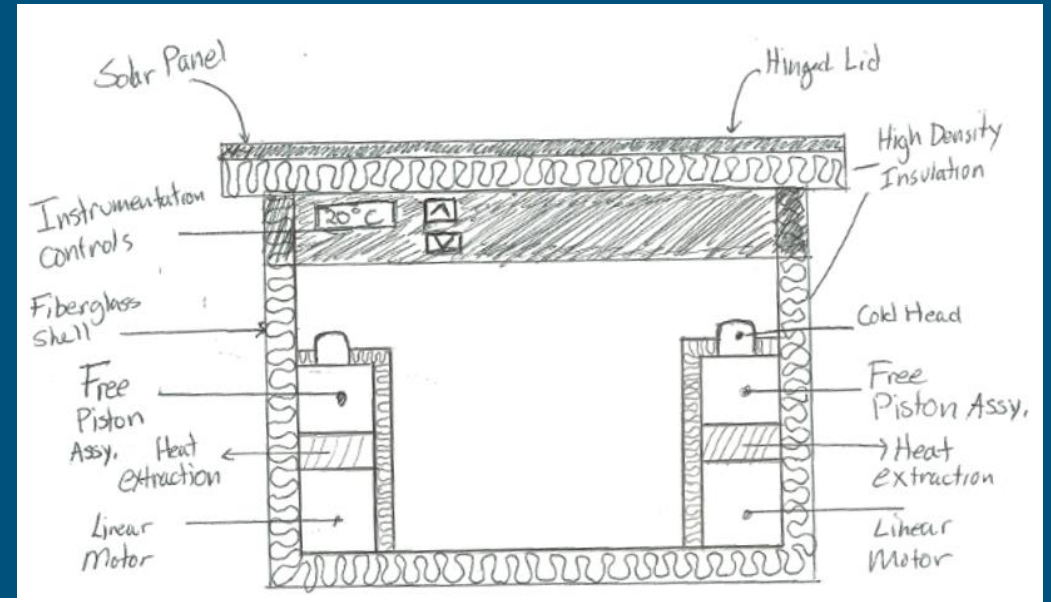
Presenter: John Wiley  
08/07/2018 Stirling Cooler #1

# Design Function

- RECIPROCATING MOTION FROM LINEAR MOTOR.
- STIRLING PROCESS PERFORMED: COLD TEMPERATURE REACHED DOWN TO  $-20^{\circ}\text{C}$ .
- HEAT REMOVED BY FIN ASSEMBLY: HOT TEMPERATURE REACHED UP TO  $42^{\circ}\text{C}$  AT THE CYLINDER TO  $32^{\circ}\text{C}$  AT THE OUTSIDE OF THE FIN ASSEMBLY.
- ENERGY REQUIRED WAS ONLY 40 WATT.



# Final Design Selected



Customer Requirement	Weight
Heat transfer from cooler	5
Fits in educational lab space	4
Externally powered	3
Educational	3
Safe	5
Lowest Cost Possible	5
Durable	3
Manufacturable	4

Presenter: Luis Gardetto  
08/07/2018 Stirling Cooler #1

# TENTATIVE SCHEDULE FOR NEXT TERM

- TASKS ASSIGNED EVENLY AMONG TEAM MEMBERS  
ACCORDING TO TEAM RESPONSIBILITIES
- - PROJECT IS ON SCHEDULE!
- FUTURE TASKS WILL INCLUDE FUTURE TESTING,  
FABRICATION, ASSEMBLY, AND FURTHER ANALYSES  
AFTER IMPLEMENTATION.

# BUDGET

FUNDING IS AVAILABLE THROUGH DEPARTMENT

STIRLING ENGINE MODEL FOR RESEARCH \$20

ENVIROCOOLER FOR REVERSE ENGINEERING \$275

ESTIMATED PART FABRICATION COST \$150-\$250 PER PART\*

ESTIMATED COST COULD REACH \$2000

\*PART QUOTES FROM [WWW.PROTOLABS.COM](http://WWW.PROTOLABS.COM)

Presenter: Faiez Alazmi  
8/07/2018 Stirling Cooler #1



# References

<https://www.ebay.com/itm/Envirocooler-ActiVault-25L4C-Cooler-A-Jarden-Life-Science-Brand-12V-DC-ONLY/113038906351?hash=item1a51a4d3ef:g:Xg4AAOSwXoRa1W4n>

[2] <HTTPS://AI2-S2-PUBLIC.S3.AMAZONAWS.COM/FIGURES/2017-08-08/1CD7458AEBE2F98AB918ED314C49E030A8E88E94/1-FIGURE1-1>

# Questions

