University of New Hampshire
College of Engineering and Physical Sciences

Mobile IV Manufacturing

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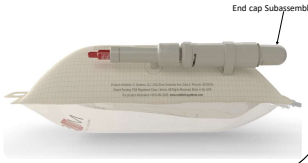
MIVS® Mobile I.V. Systems

1) What Is MIVS?

Mobile Intravenous Systems (MIVS) is a company based in Phoenix, Arizona which specializes in transforming the quality of health care through innovative I.V. medical devices that save time, reduce risk, and improve patient outcomes

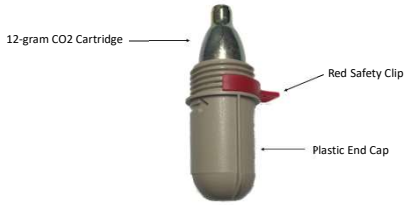
Problem

The current method of manufacturing the end cap subassembly is completed manually. MIVS is interested in a new manufacturing process that will provide a multiplier effect per unit time and will be scalable.

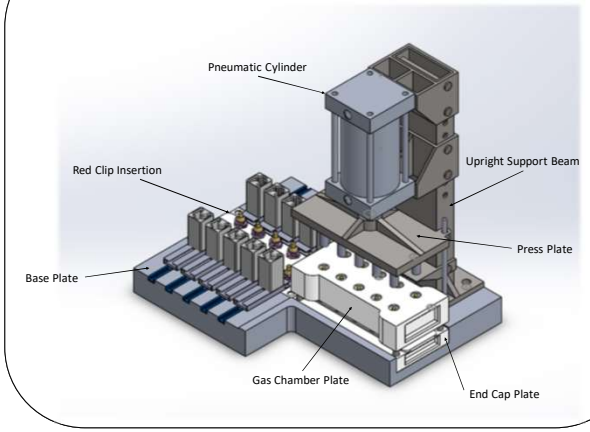


2) Project Overview

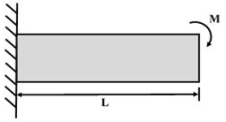
- The machine must be scalable to 10,000 gas cartridge installations per day per 1,000 pressure sleeve assemblies.
- The cost of the machine and replacement parts must be kept to a minimum.
- The machine must be composed of modular/interchangeable components to accommodate for different sized CO_2 cartridges and receiving chambers (cap).
- The machine must seat the CO_2 cartridge fully into the cap at a reproducible pressure.
- There may be some measurement uncertainties with the force required to fully seat a CO_2 cartridge into a cap.



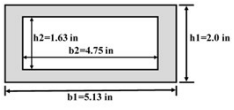
3) Design



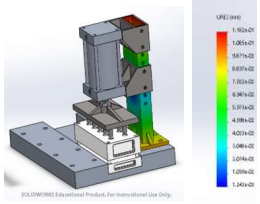
4) Analysis



Single Moment Calculation



Area Moment of Inertia to find Maximum Stress and Deflection



General Equations:

$$M\,[lb*in] = \frac{1}{2} * F_{tot}[lb] * D[in]$$

$$I_1[in^4] = \frac{b_1[in]*h_1^3[in^3]}{12}$$

$$I_2[in^4] = \frac{b_2[in]*h_2^3[in^3]}{12}$$

$$I_{tot}[in^4] = I_1[in^4] - I_2[in^4]$$

$$\sigma_{max2}\ [psi] = \frac{M[lb*in]*y_2\ [in]}{I_{tot}\ [in^4]}$$

$$\delta_{max2}\ [in] = \frac{M\,[lb*in]*L^2[in^2]}{2*E\ [psi]*I\ [in^4]}$$

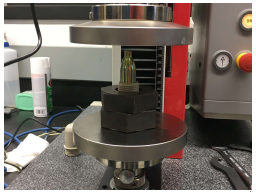
5) Results

Upright Support Beam Motion Analysis

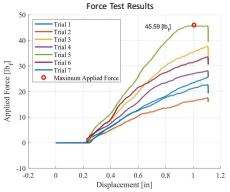
	Units	Solidworks	Hand Calculations	Percent Difference
Deflection	in.	4.65E-03	1.40E-03	57.97%
Stress	psi	1200	1513	23.00%

Stress Analysis of End Caps and Base Plate

	Units	Solidworks	Hand Calculations Plate	Hand Calculation End Caps	Percent Difference Plate	Percent Difference End Caps
Deflection	in.	9.25E-04	1.40E-03	5.80E-04	40.84%	132.13%
Stress	psi	1200	450	5803	90.90%	69.90%



Force Test For Pressing Cartridge



6) Future Work

- Finish machining all components
- Assemble and test initial design
- Determine the efficiency and practicality of design
- Consider and design improvements
- Implement and test improvements with the manufacturing team