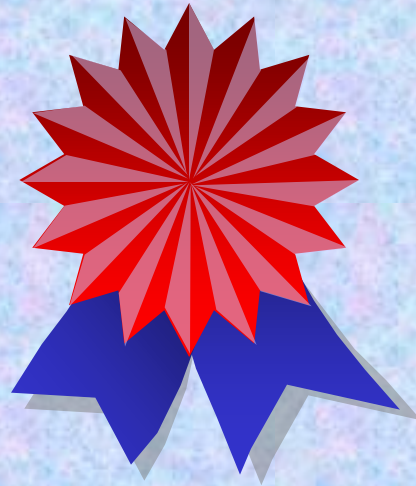Texas State University- San Marcos
Ingram School of Engineering

2008 Best Product Development Contest Award

2008 Best Team: Green Mold
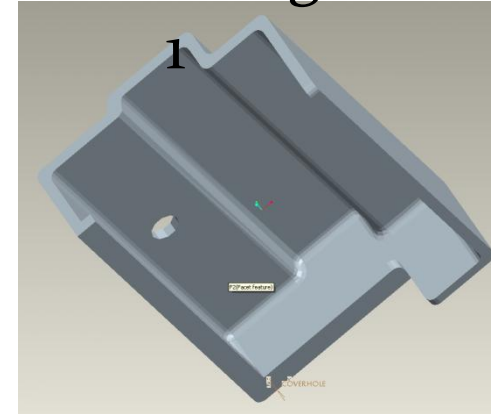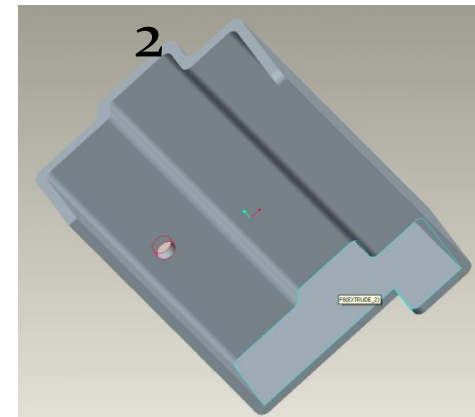## Battery cap mold design

Samer Morad
Nicolos Deland

Xtreme Power

Concept selection matrix

Design 1

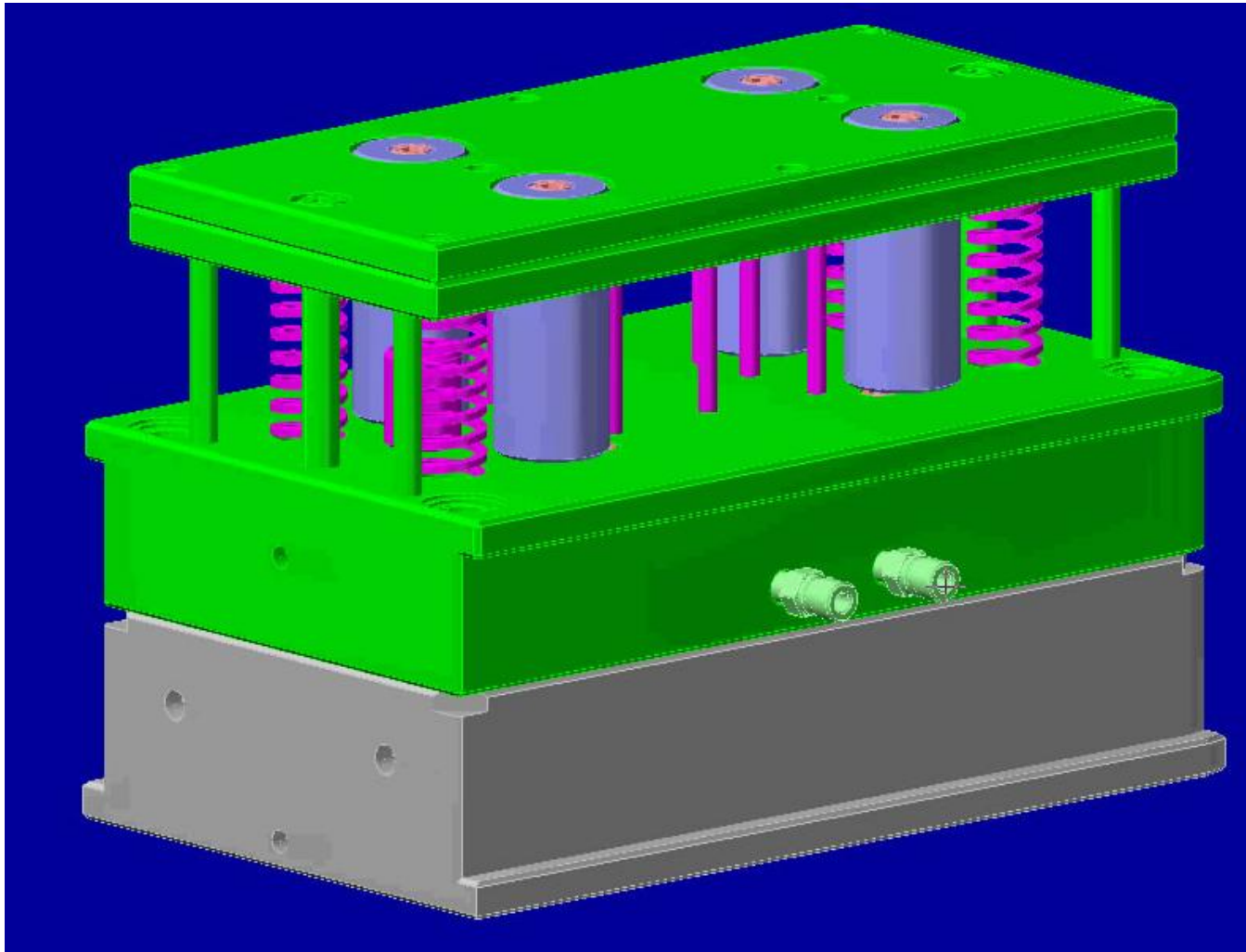|		Concepts							
		Design 1		Design 2		Design 3		Design 4	
Selection Criteria	Weight	Rating	Weighted Score	R	WS	R	WS	R	WS
Ease of assembly	30%	3	.9	3	.9	3	.9	5	1.5
Durability	20%	4	.8	4	.8	4	.8	4	.8
Ease of Manufacturing	15%	1	.15	5	.75	3	.45	3	.45
Impact absorption	15%	3	.45	2	.3	3	.45	3	.45
Stability	20%	4	.8	1	.2	4	.8	4	.8
	Total score	3.1		2.95		3.4		4.0	
	Rank	3		4		2		1	
	Cnt?	NO		NO		NO		YES	

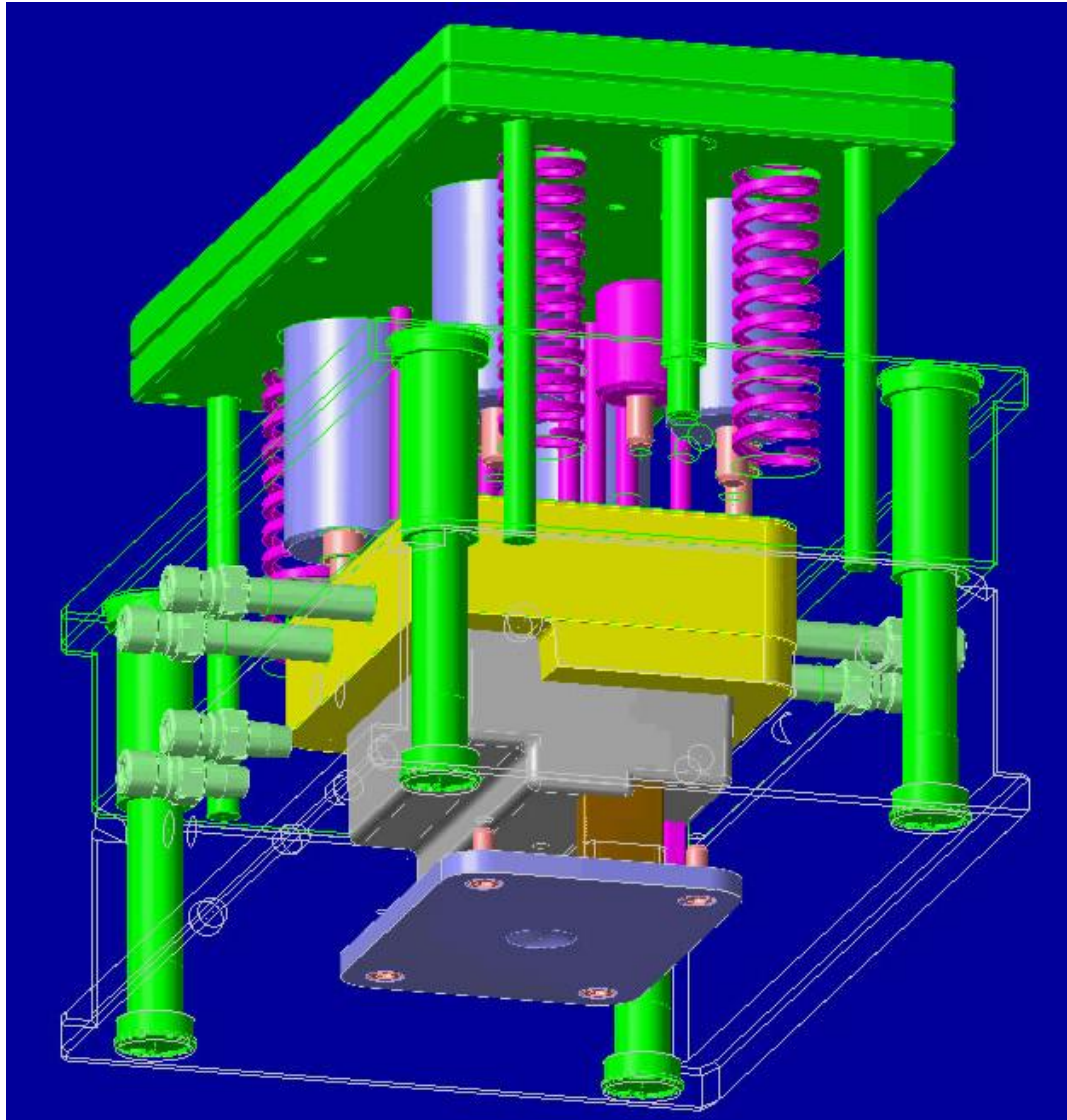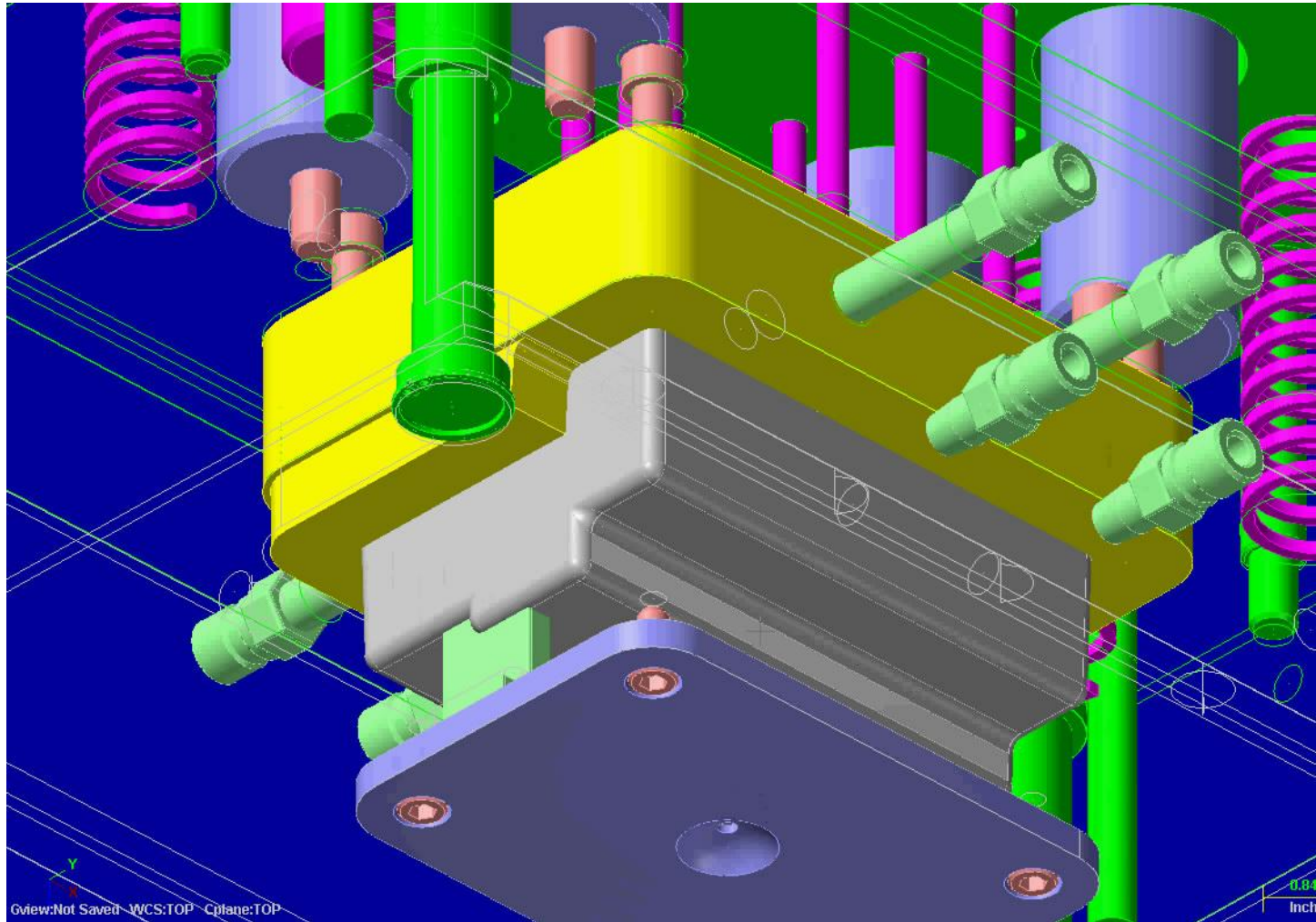Design 2

Design 4

Design 3

S
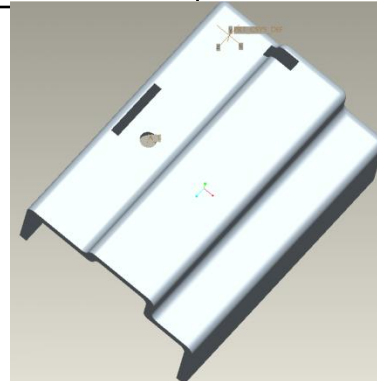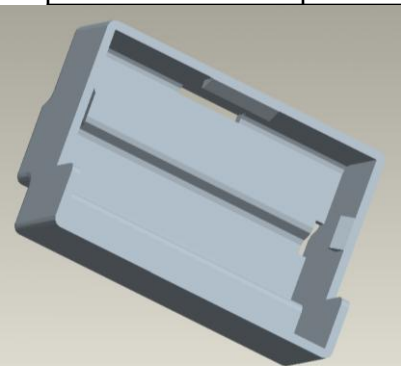
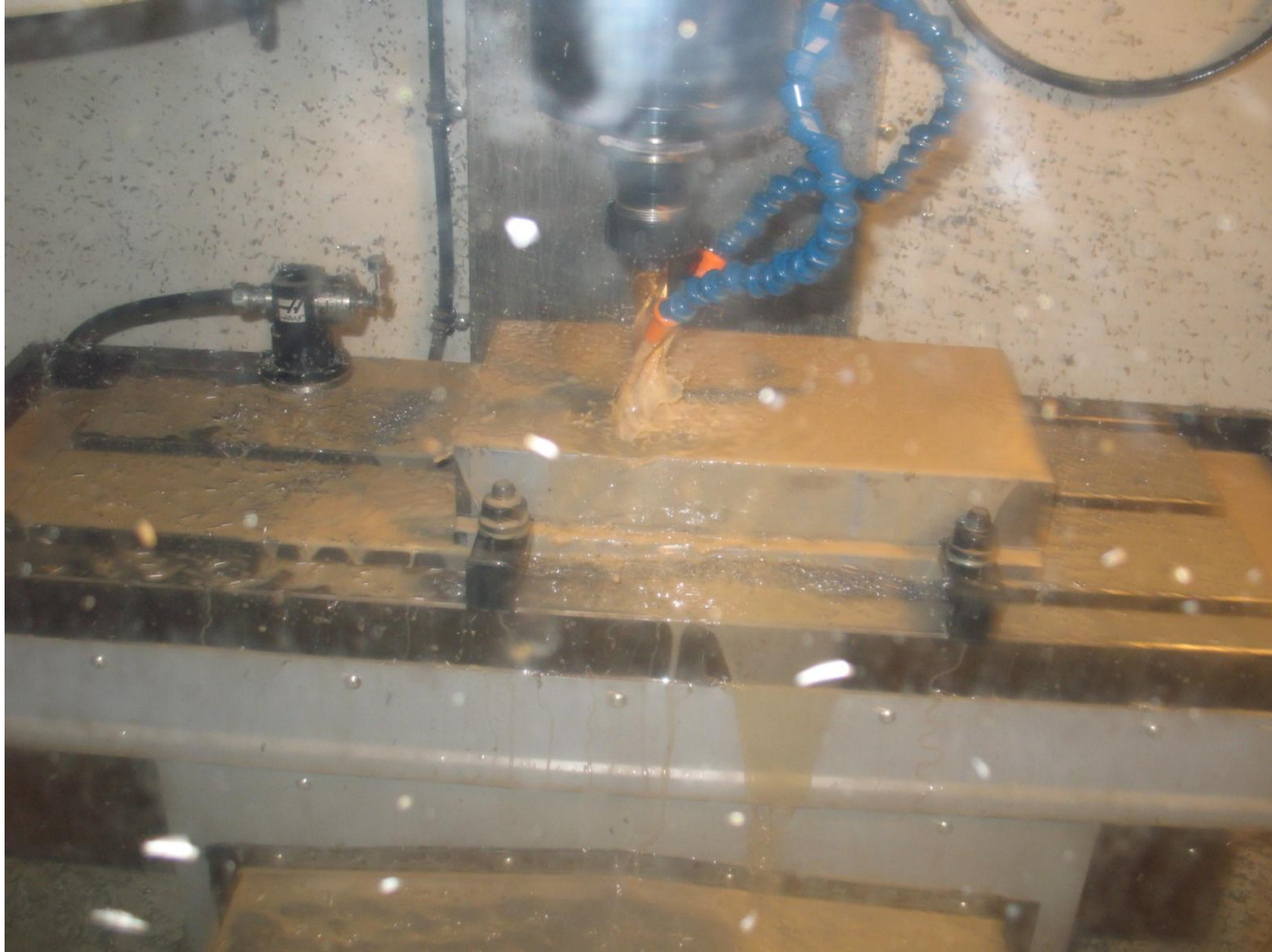# Final mold design components

Final mold design components

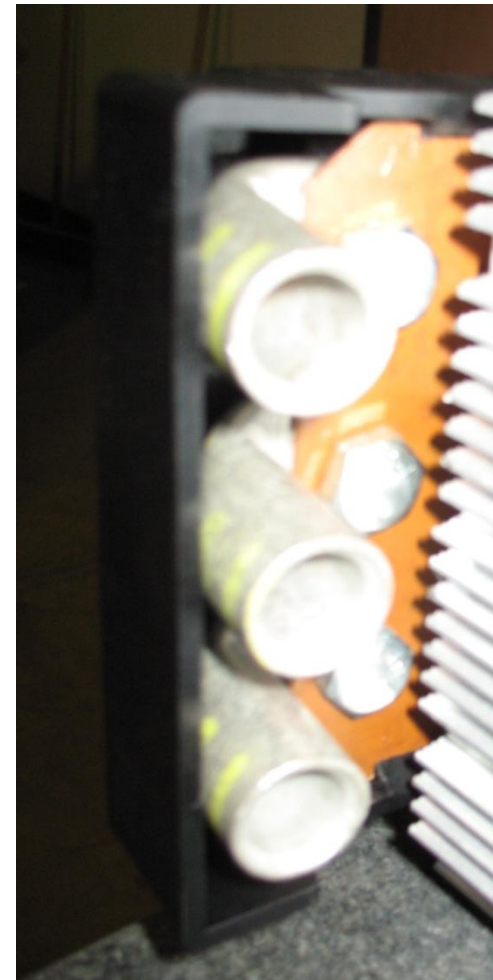# Final mold design components

Mold components manufacturing

Final fabricated part

Final fabricated part

Modular Battery Racks

Shawn Youngblood

Robert Singleton

Erwin Yuwono

Concept scoring

Selection Criteria	Weight	Design 7		Design 9		Design 10	
		Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Expandable	11.40%	5	0.57	4	0.46	5	0.57
Space for batteries	14.30%	5	0.72	5	0.72	5	0.72
Battery Temp. < 120*	14.30%	5	0.72	5	0.72	5	0.72
Stackabiltiy	14.30%	4	0.57	4	0.57	4	0.57
Ease of Assembly	11.40%	3	0.34	5	0.57	3	0.34
Ease of Manufacturing	11.40%	4	0.46	4	0.46	3	0.34
Meets Insulation Req.	5.70%	2	0.11	2	0.11	2	0.11
Looks Good	2.90%	1	0.03	3	0.09	3	0.09
Impact Resistant	2.90%	4	0.12	4	0.12	3	0.09
Affordable	11.40%	5	0.57	4	0.46	4	0.46
Total	Score		4.20		4.26		4.00
	Rank		2		1		3
	Continue?		No		Yes		No

Design 7
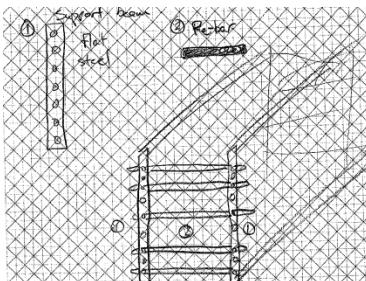
Design 9
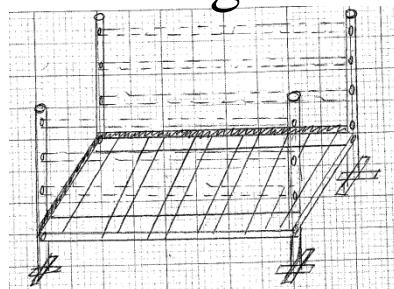
Design 10
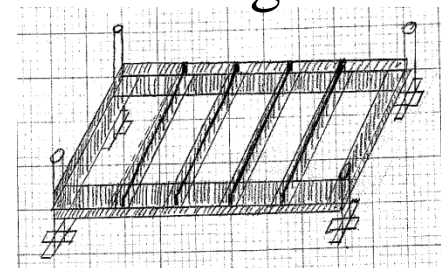
FEM stress studies (crossbar safety factor)
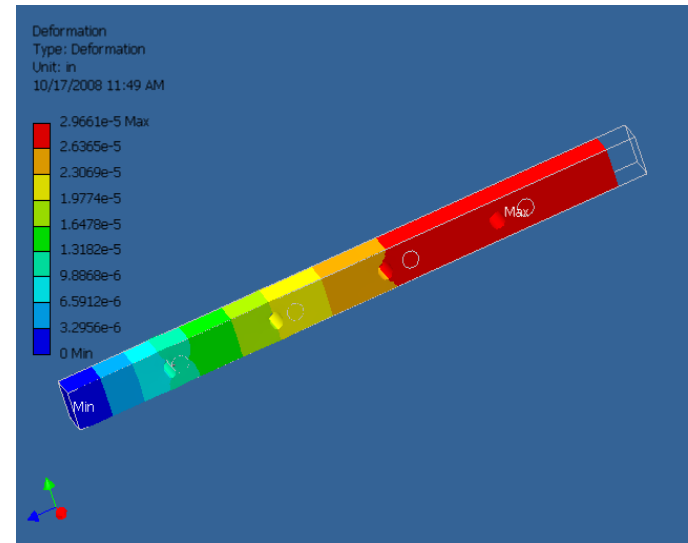
Final CAD assembly

Rack manufacturing and assembly

Final product

Lift a Chair

Pavel Kinev
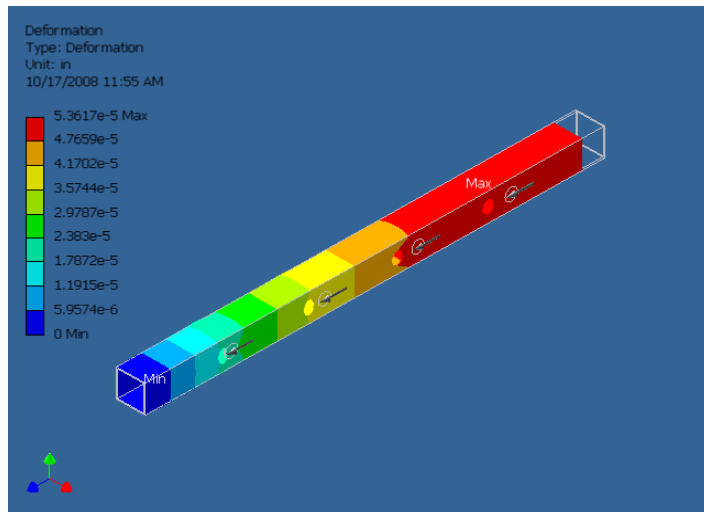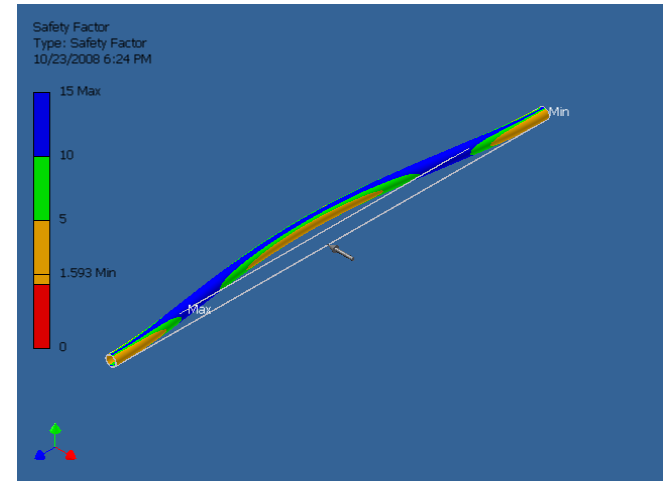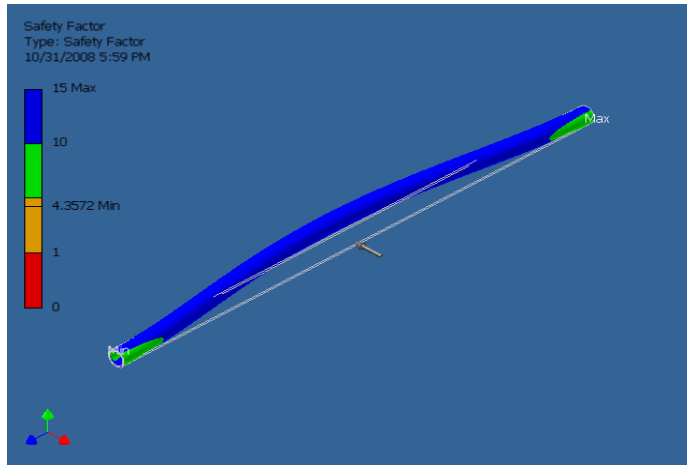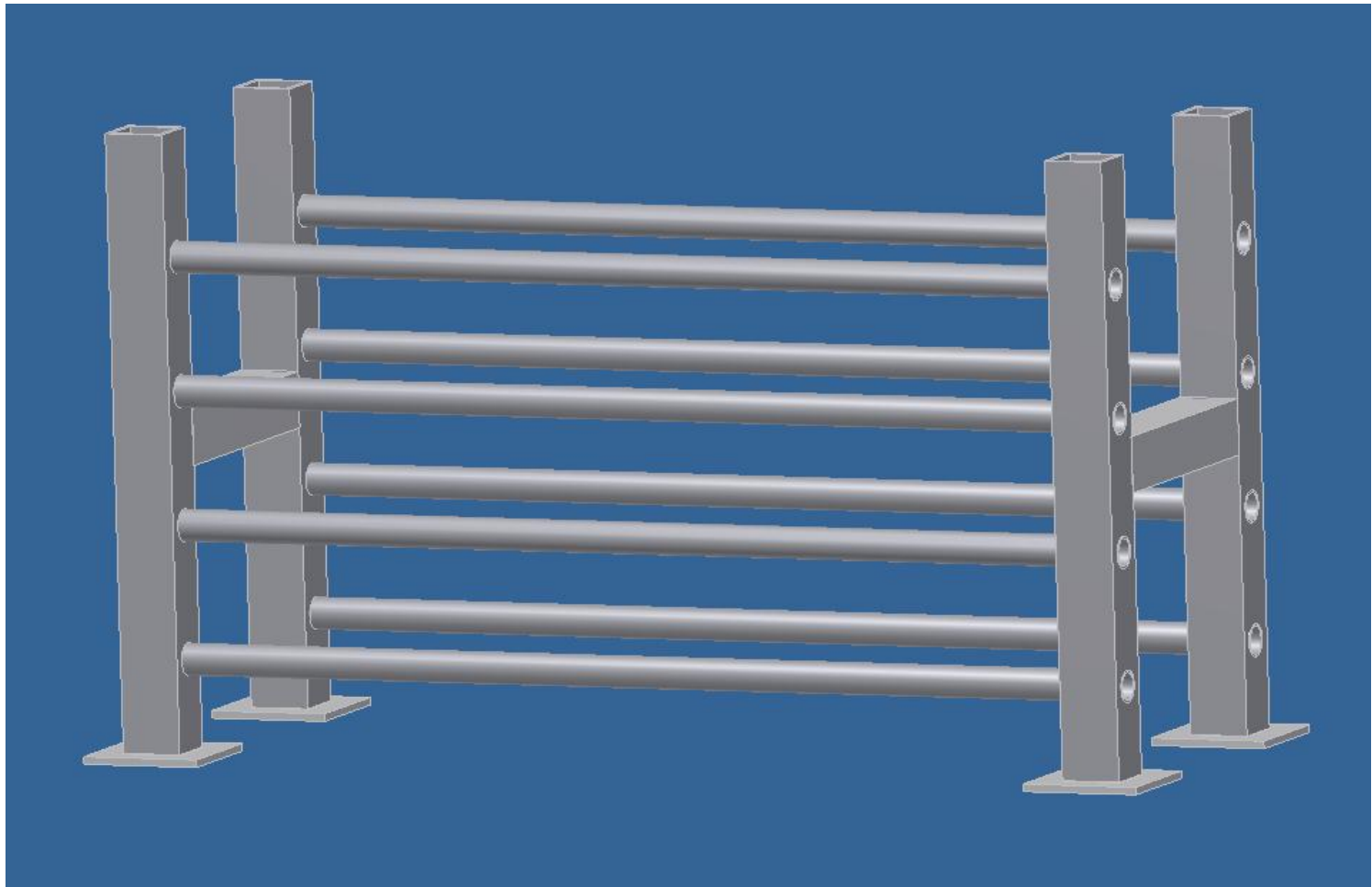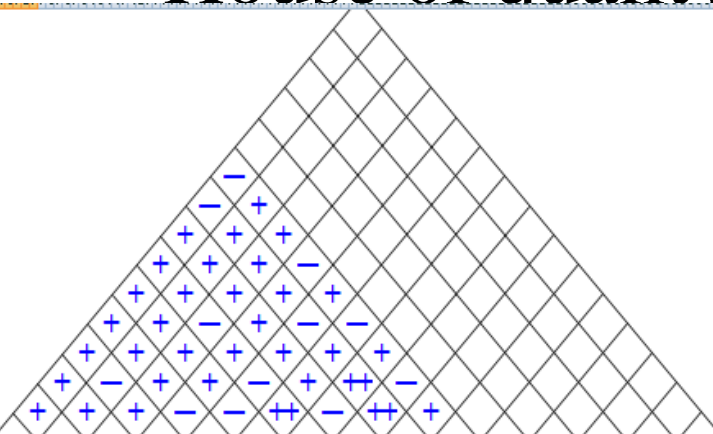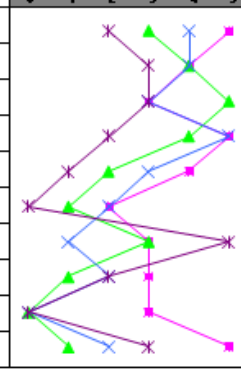
Kyle Marksbury

Josh Frizzel

House of quality

Title: Wheelchair carrier

Author: Kyle Marksbury, Josh Frizzell, Paul Kinev

Date: 10/21/2008

Notes:

Legend

Θ	Strong Relationship	9
Ο	Moderate Relationship	3
▲	Weak Relationship	1
╫	Strong Positive Correlation	
+	Positive Correlation	
—	Negative Correlation	
▼	Strong Negative Correlation	
▼	Objective Is To Minimize	
▲	Objective Is To Maximize	
X	Objective Is To Hit Target	

Competitive Analysis (0-Worst, 5-Best)

- Our Company
- Competitor 1
- Competitor 2
- Competitor 3
- Competitor 4
- Competitor 5

Column #	1	2	3	4	5	6	7	8	9	10
Direction of Improvement: Minimize (▼), Maximize (▲), or Target (x)	X	▲	▲	▲	▼	▼	▲	▼	X	▲

Quality Characteristics (a.k.a. "Functional Requirements" or "Hows")

Row #	Max Relationship Value in Row	Relative Weight	Weight / Importance	Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	Platform area	ramp length/slope	connection points	Shock dampining	Loading time	Material size	Bending Strength	Manufacturing cost	Material Type	Material coating	Our Company	Competitor 1	Competitor 2	Competitor 3	Competitor 4	Competitor 5
1	9	13.5	5.0	Can Hold 500+ lbs	▲	Ο	Θ	Ο	Θ	Θ	Θ	Ο	Θ	▲	5	3	4	2		
2	9	8.1	3.0	Allow proper ground clearance	▲	Θ	▲	Ο	Θ	Ο	▲	▲	▲	▲	4	4	4	3		
3	9	8.1	3.0	Uses class 3 trailer hitch	▲	▲	Θ	▲	▲	Θ	▲	Ο	▲	▲	3	5	3	3		
4	9	13.5	5.0	Chair is secure	Ο		Ο	Ο	Ο	Ο	Ο	Θ	Ο	▲	5	4	5	2		
5	9	13.5	5.0	Ease of loading/unloading	Θ	Θ	▲	▲	Θ	▲	▲	Ο	▲	▲	4	2	3	1		
6	9	5.4	2.0	Allow acess to rear cargo area	Θ	Ο	▲	▲	Ο	Ο	▲	Ο	▲	▲	2	1	2	0		
7	9	8.1	3.0	weather resistant	▲	▲	▲	▲	▲	▲	▲	Θ	Θ	Θ	3	3	1	5		
8	9	8.1	3.0	Can handle a variety of chair sizes	Θ	Ο	Ο	Ο	Θ	Θ	Ο	Θ	▲	▲	3	1	2	2		
9	9	8.1	3.0	Reduces vibration	Ο	▲	Ο	Θ	▲	▲	Ο	Θ	Ο	▲	3	0	0	0		
10	9	13.5	5.0	Long lasting	▲	Ο	Ο	Ο	▲	Ο	Θ	Ο	Θ	Θ	5	1	2	3		

| Target or Limit Value	2000 sq in	>20 degrees/60 in	>10	10 kN·m	>2 min	2 in x 2 in	8000 in·lb	>$275	mild steel	Good
Difficulty (0-Easy to Accomplish, 10-Extremely Difficult)	0	7	5	10	7	4	3	3	3	2
Max Relationship Value in Column	9	9	9	9	9	9	9	9	9	9
Weight / Importance	359.5	354.1	359.5	278.4	483.8	418.9	456.8	429.7	424.3	273.0
Relative Weight	9.4	9.2	9.4	7.3	12.6	10.9	11.9	11.2	11.1	7.1

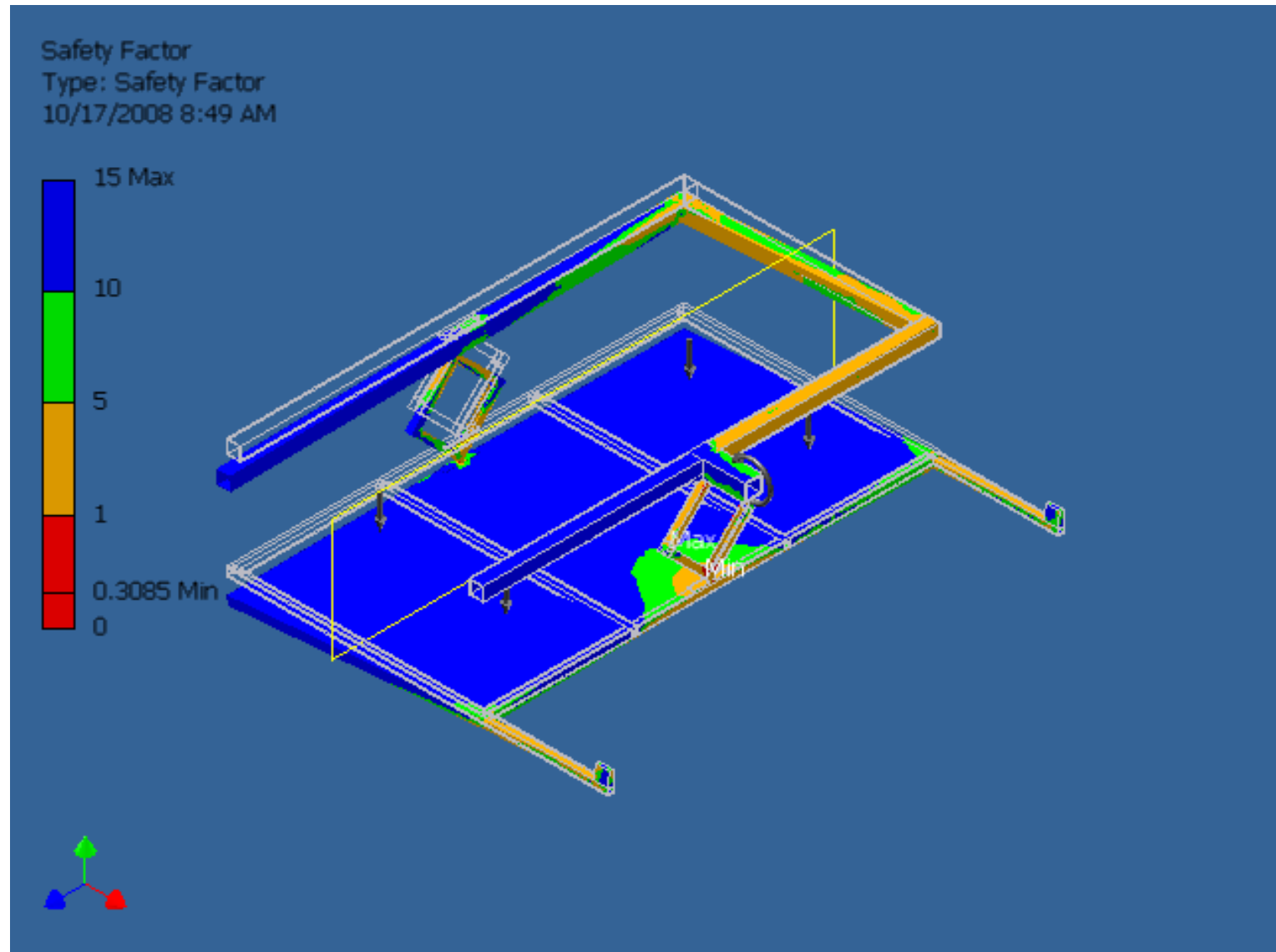# Concept generation
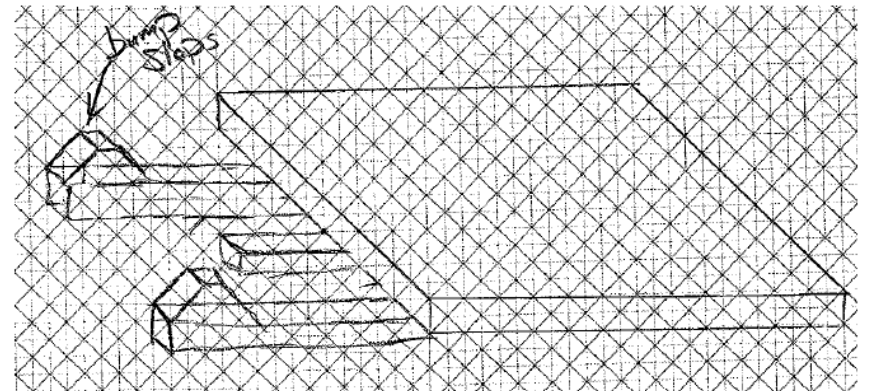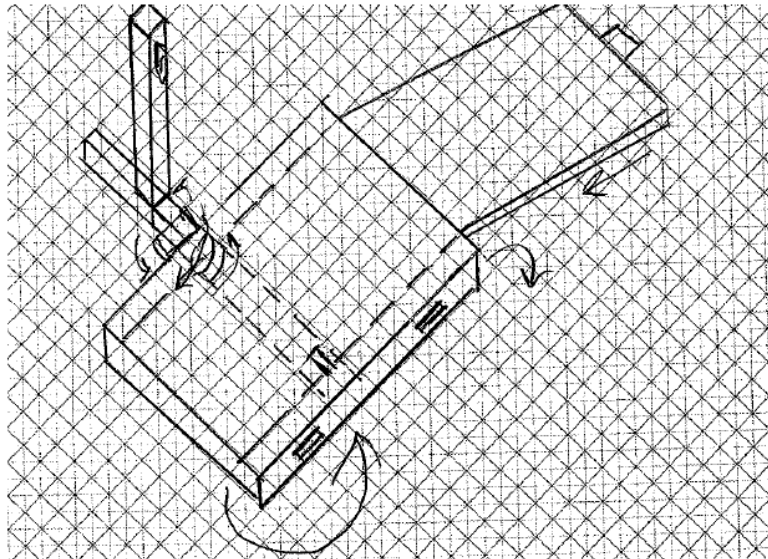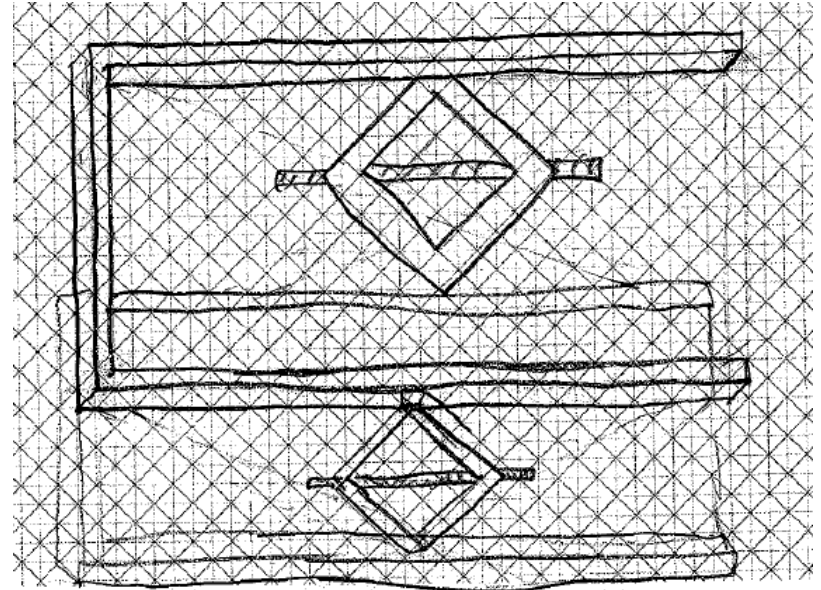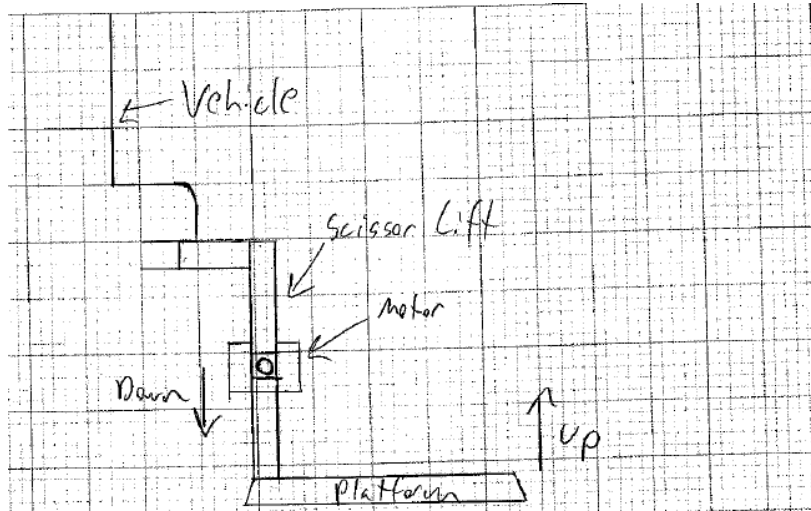
Final CAD design
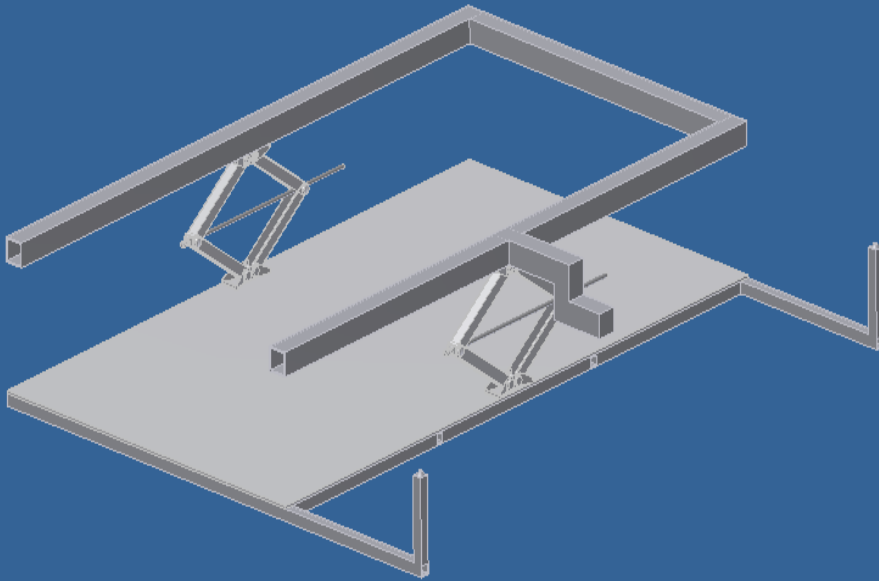
- Utilizes two modified car jacks
- Has two bump stops for added stability
- Can hold over 500 lbs
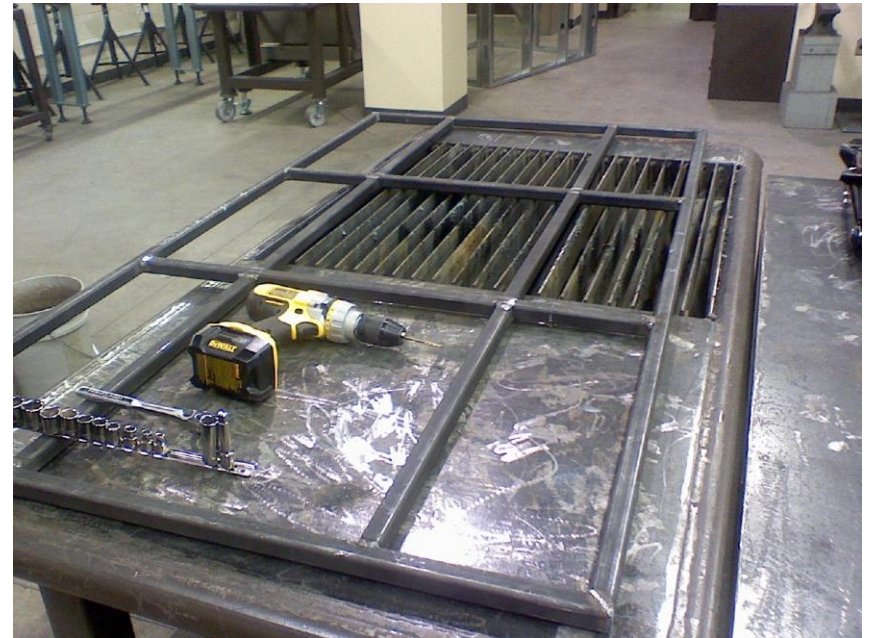- Strong U frame for added strength and to reduce bending

Assembly exploded drawing
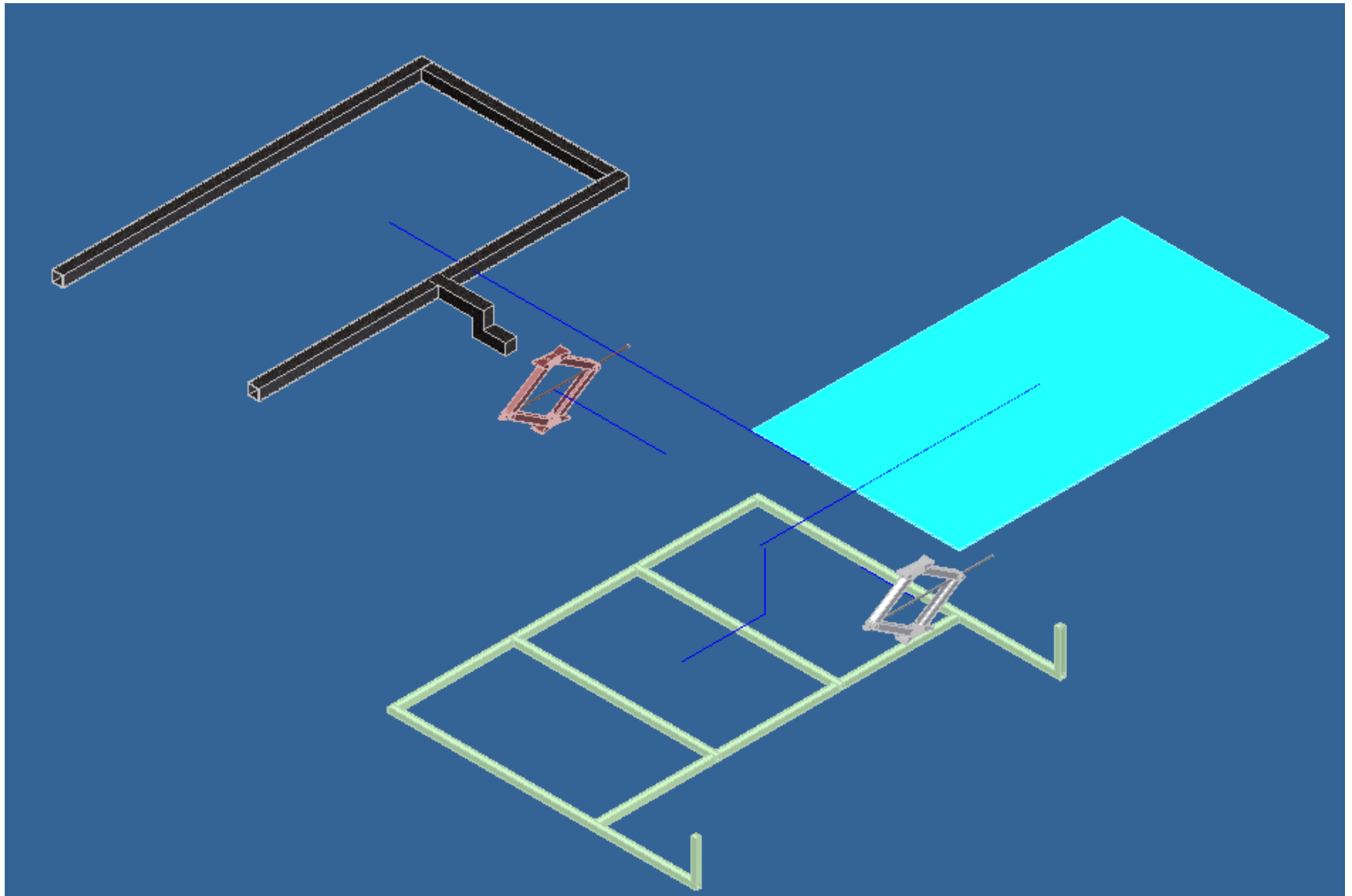
Safety factor by FEM

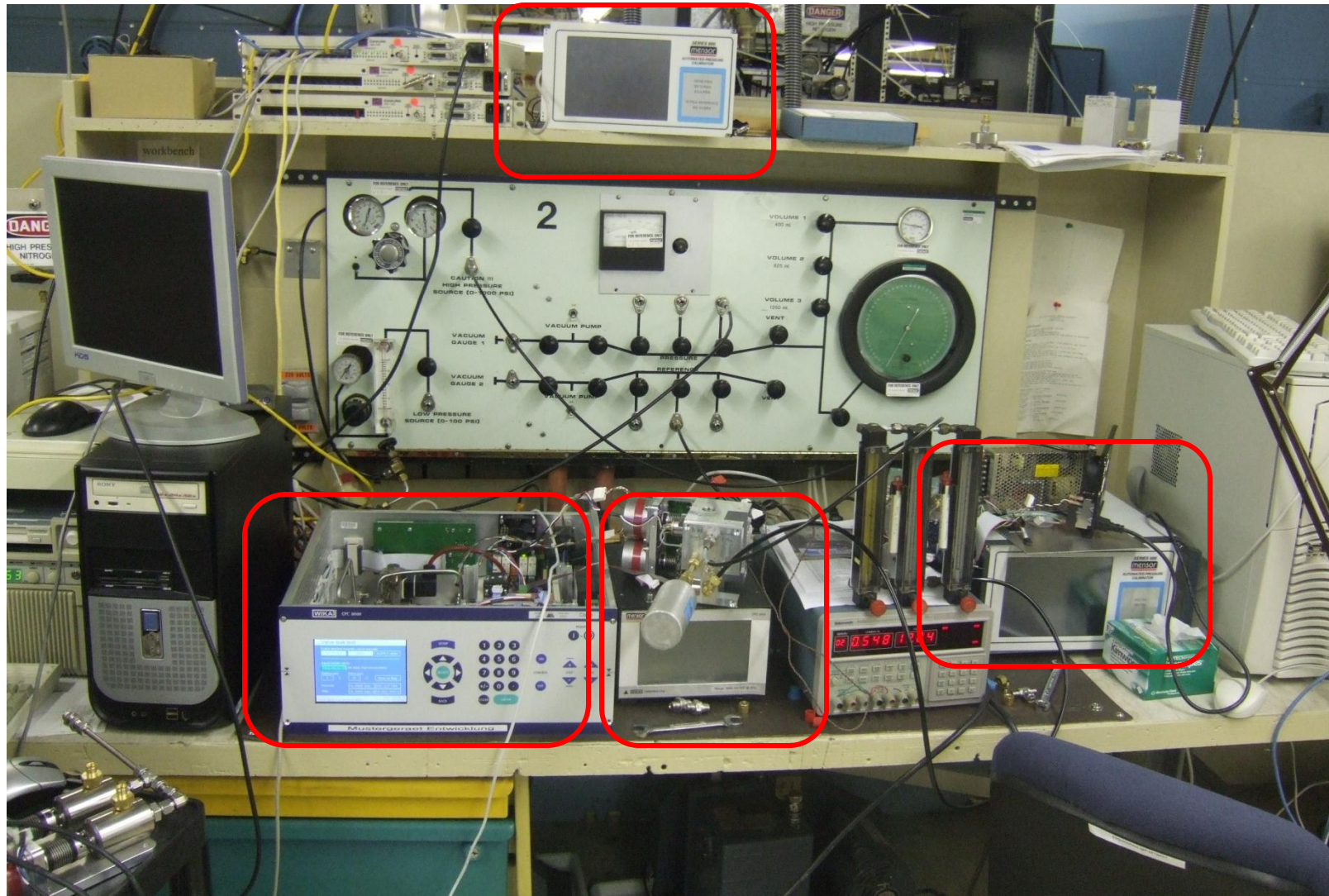# Assembly pictures

Final assembly

Final test

Pressure test bench design

Bill Reverman
Dmitri Kabakov
Stephen Jones

Current work station: testing process

Survey results: Bench

|	Must have	Good to have	Do not need	Final Product
Adjustable heights			X	☑
Antistatic surface	X			☑
Room for 2 people	X			☑
Keyboard/mouse on the table			X	☑
Keyboard/mouse under the table	X			☑
110 V Power Outlets	X			☑
220 V Power Outlets	X			☑
Grounded	X			☑
Lighting ware	X			☑
Drawers Under the table			X	☑
Overhead rack/shelves	X			☑
Wheels			X	☑

Concept sketches

- Long Panel
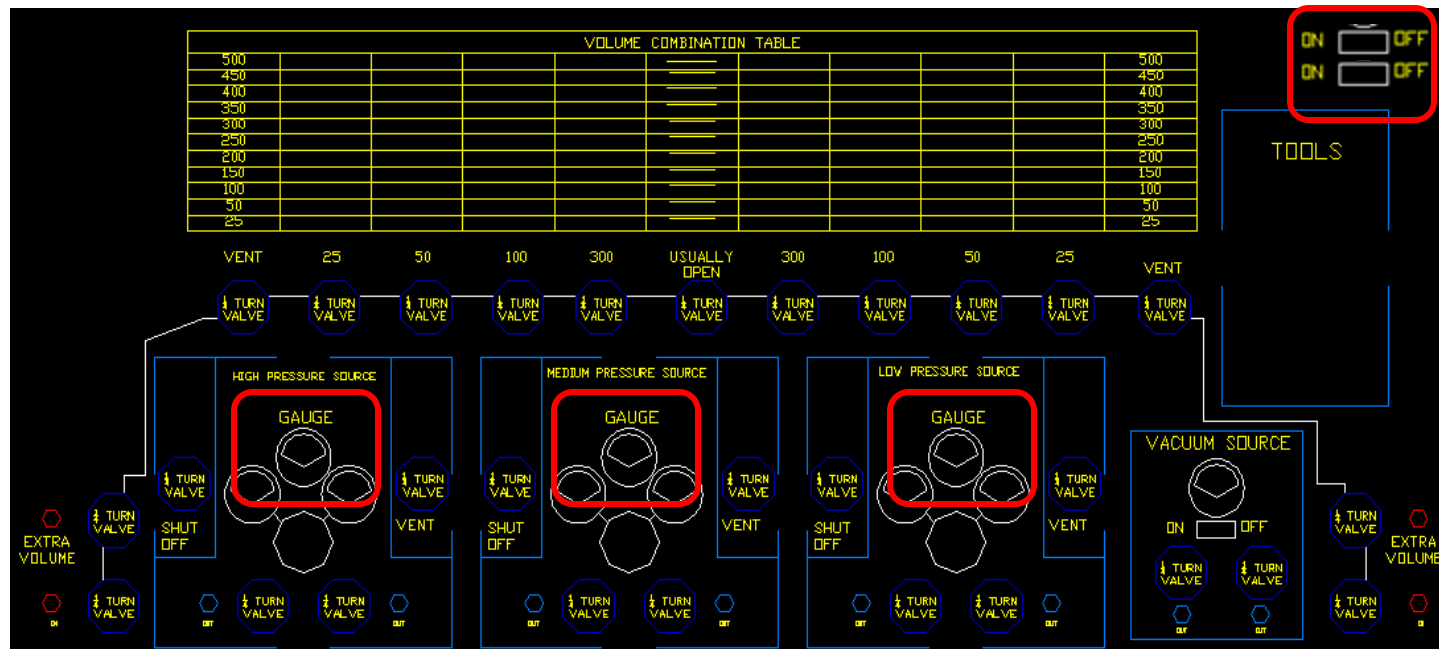 - Functional Blocks
- Bench Accessories
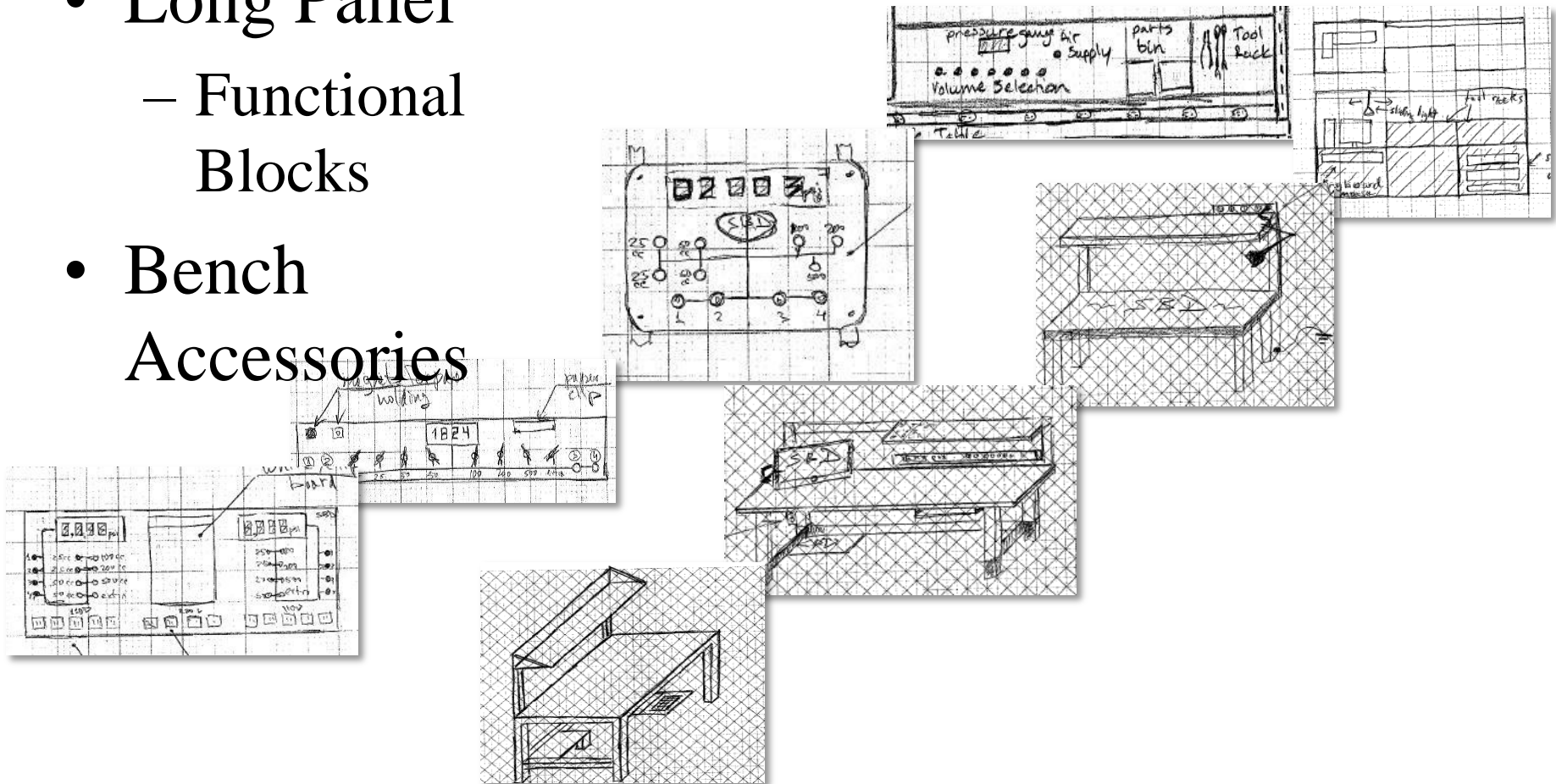
Panel: first design

- New ideas
  - Split volume system into 2 subsystems
  - Volume combination Chart
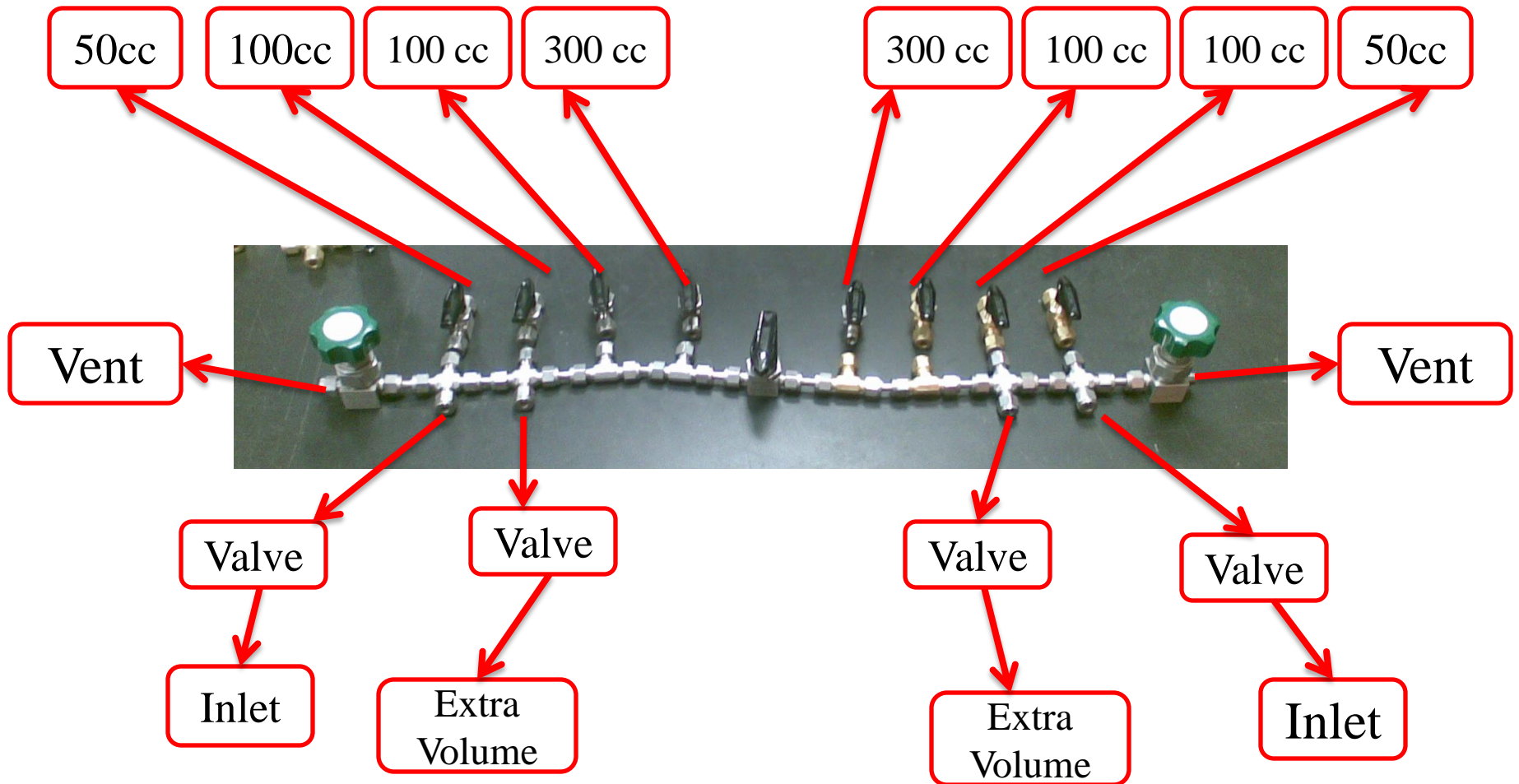 - Retractable pressure hoses
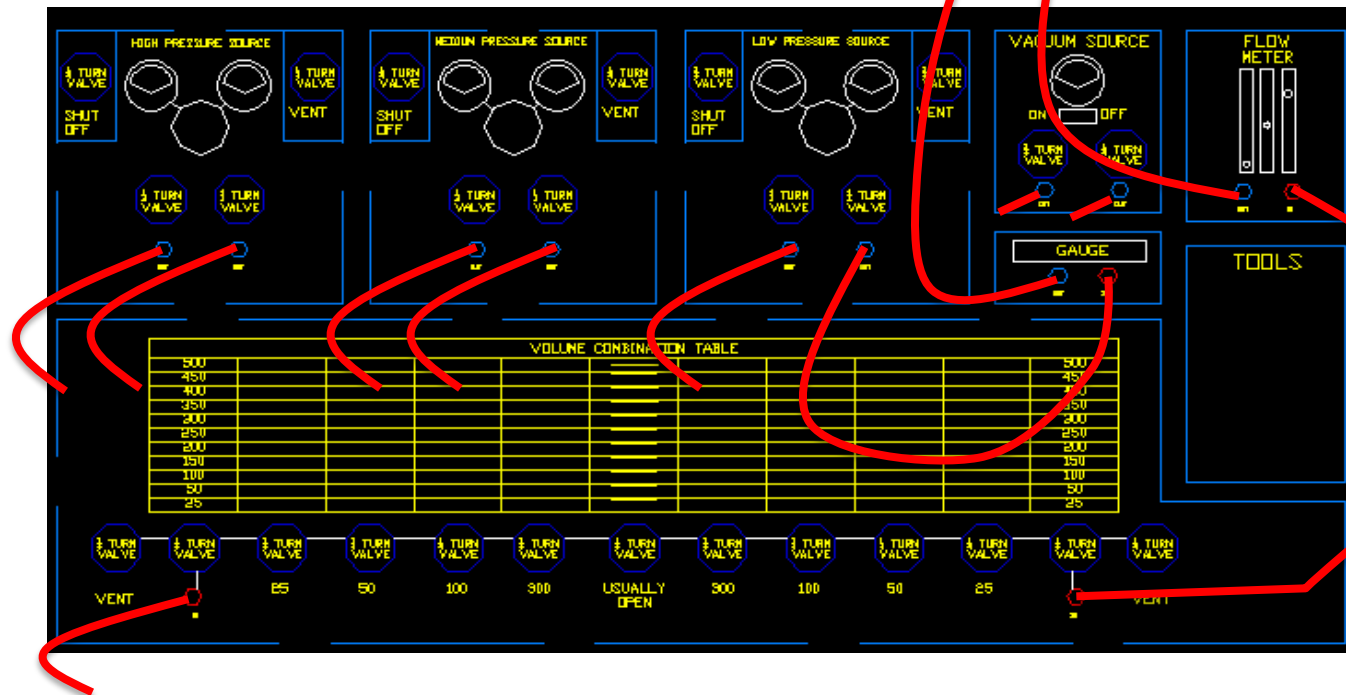
Panel: final design

- Changes
  - No extra components
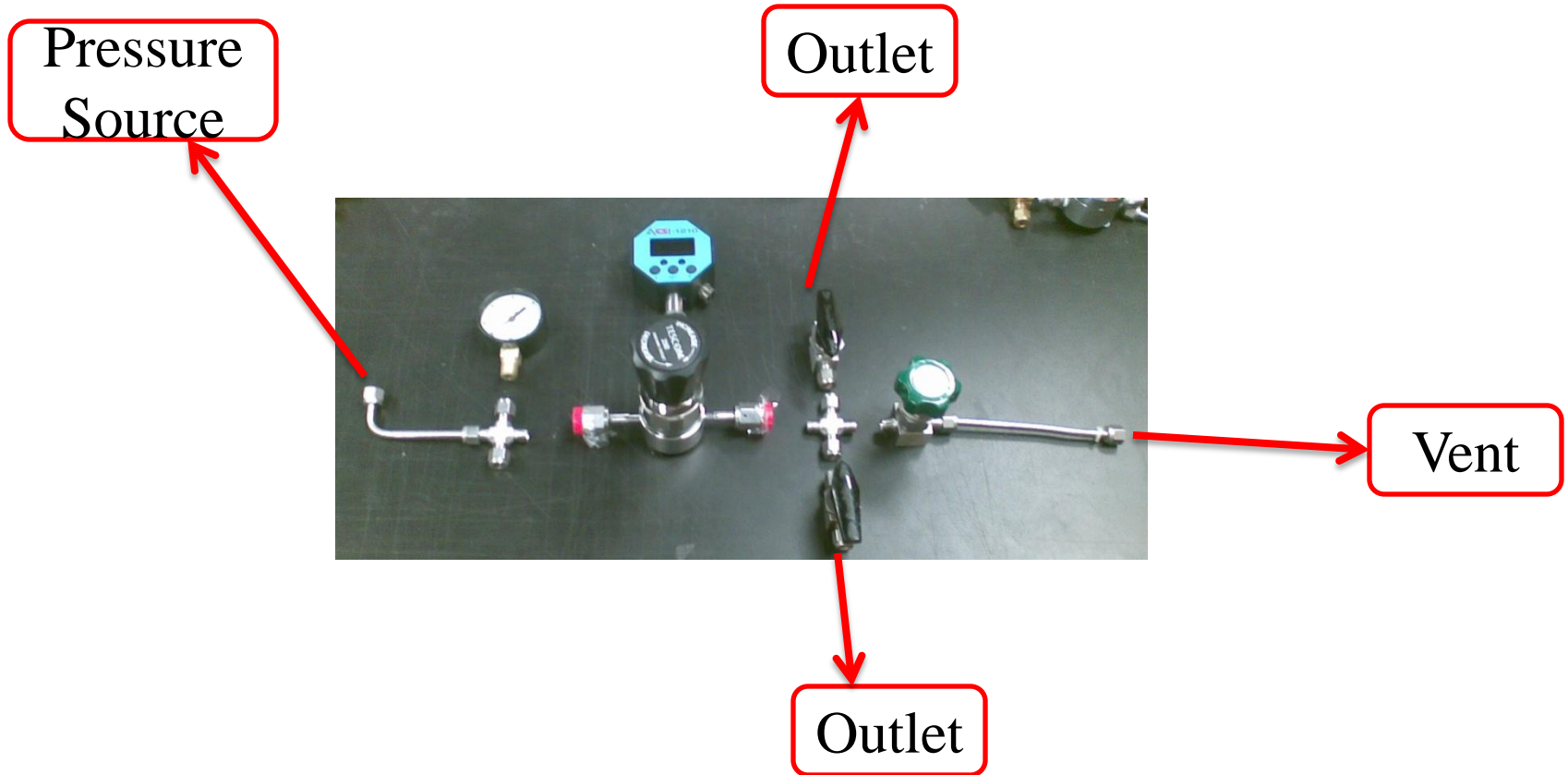 - Digital Gauges for each system
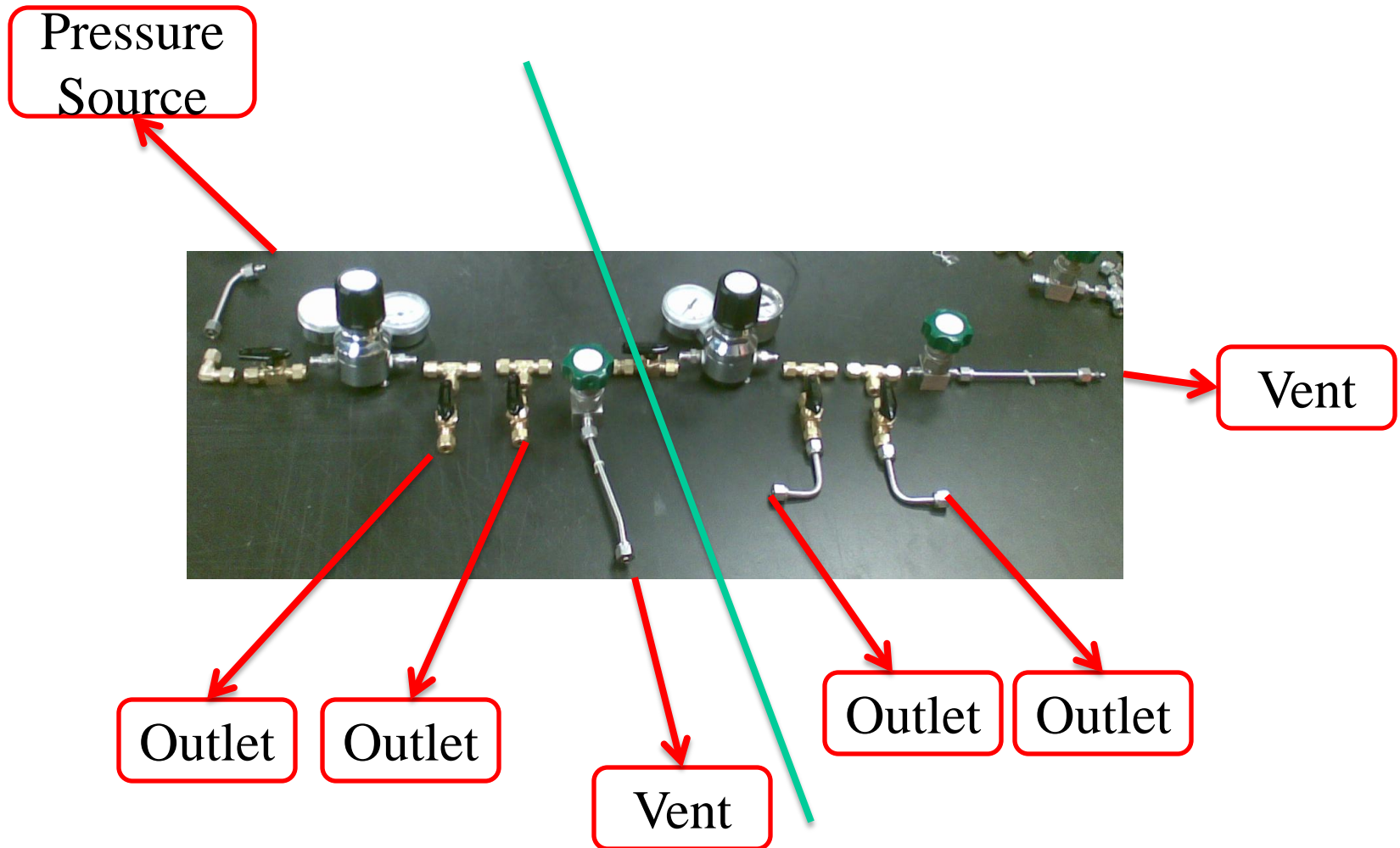 - Extra Switches

Bench final design

Volume combination system

50cc 100cc 100 cc 300 cc 300 cc 100 cc 100 cc 50cc

Vent Vent

Valve Valve Valve Valve

Inlet Extra Volume Extra Volume Inlet

Pressure panel: high pressure source

Pressure Source
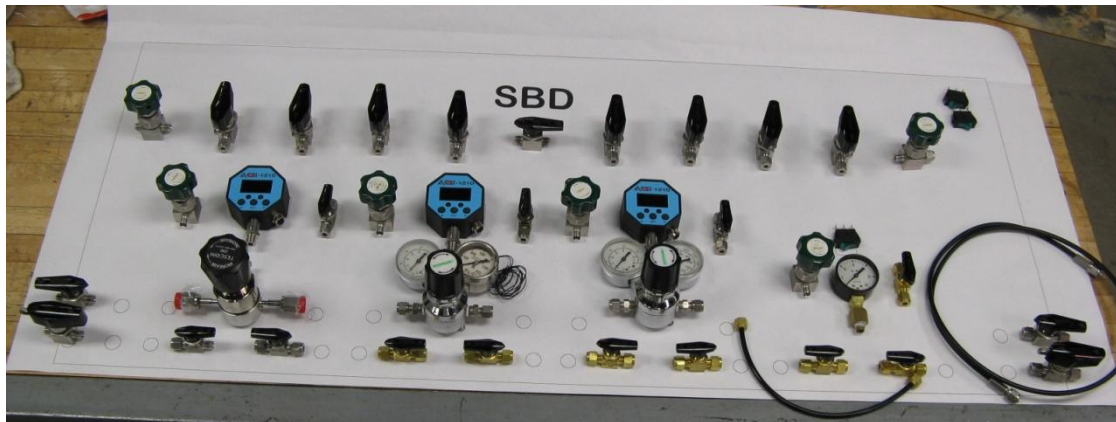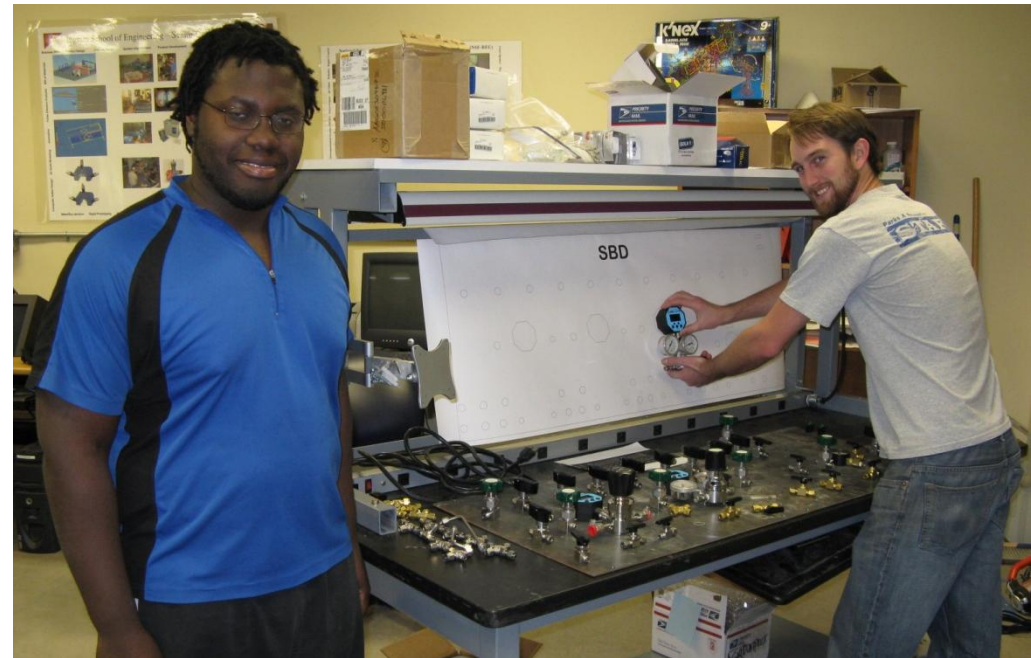
Outlet

Vent

Outlet

Medium/low pressure sources

Panel fabrication

- Printing real size plot
- Verifying arrangement
- Modifications
- Water Jet
- Painting

Finished system

Presentation

Panel of experts

Panel of experts

Result? It's a Three-way tie!

2008 winners after tie breaker!

Samer Morad and Nicolos Deland