MEMORANDUM

TO: Mr. Pete Ostafichuk

FROM: Group #8:
Galvin Clancey, Mike McNulty,
Feras Jallad, Haydon Woo,
Colin Mingus

RE: **MECH 251 LAUNCHER PROJECT PROGRESS REPORT** **DATE:** March 10, 2004

To date we have been working on and completed the conceptual design process as well as determined which of the conceptual designs would be ideal choice to construct the most successful device possible. Using the Analytical Hierarchical Process we determined the importance of each of the criteria we felt were important based upon the Minimum Functional Requirements, Design Constraints and Design Considerations. We have determined that an air powered launcher will be the ideal device to enter into the Launcher Competition on March 31, 2004. In the next week we plan to complete the design of the device to allow the remaining two weeks for construction and testing. We are currently one day ahead which could prove to be very useful considering the possibility of unexpected tasks arising as we approach the end of the term.

Enclosures: Original Gantt Chart, Problem Definition, Conceptual Designs, Analytical Hierarchical Process, Weighted Design Matrix, Modified Gantt Chart

Original Gantt Chart

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1	**Project Definition**
2	Review Problem
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9	Weighted Design Matrix
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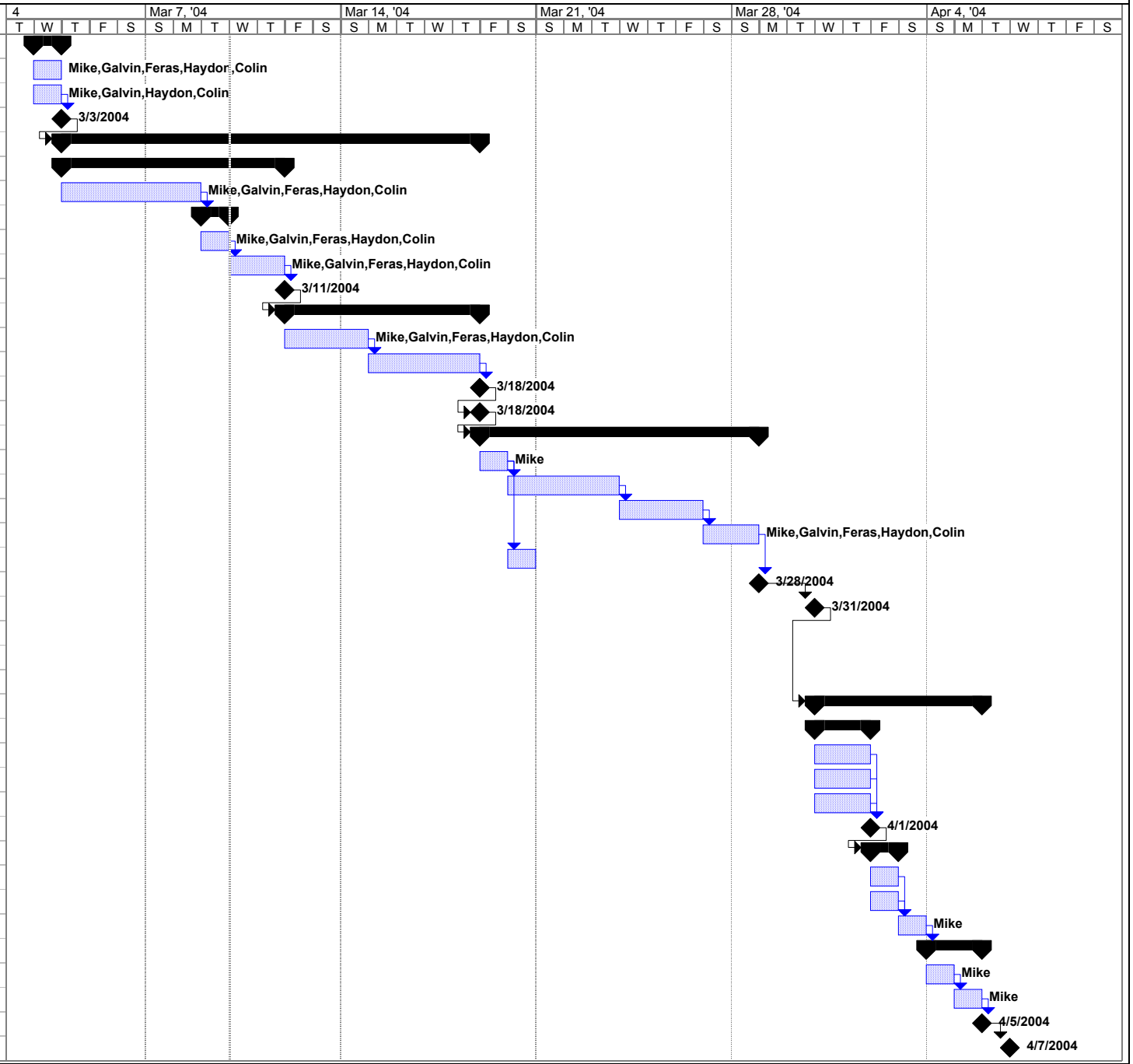
35	Table of Contents
36	List of Figures
37	Format
38	**Final Copy**
39	Print
40	Bind
41	Report Complete
42	Submit Report



Problem Definition

Minimum Functional Requirements

- Must shoot a ball 12m
- Must not fall apart

Constraints

- Cost less than $60
- Must be safe
- Only shoot squash balls
- Equipped with minimal electric devices
- Must be safe to operate
- Human supplied energy
- Shoot 3 balls within 5 minutes

Design Considerations

- Should be accurate within 6” radius
- Easy to operate/ reload/ setup/ transport
- Easy to build/ fabricate
- Utilize materials readily available

Conceptual Designs

Idea	Description	Pros	Cons	Eliminated/Why?
1. Air Gun	Compress a volume of air then rapidly release it to propel the ball directly toward the target	Very Accurate, High Speed, Reliable, Easy to aim	Difficult to construct, potential cost, How to Pressurize	Not Eliminated
2. Trebuchet	Using a mass balance and a whip system, lob the ball towards the target	Easy to construct	Potential for catastrophic failure during operation, Inaccurate	Eliminated due to inaccuracy
3. Sling Shot	Use elastic materials which are stretched and the released to shoot the ball to the target	Very easy to construct, Easy to use	Extremely inaccurate	Eliminated due to inaccuracy and safety concerns
4. Catapult	Use a spring loaded catapult to lob the ball at the target	Easy to construct	Potential for catastrophic failure during operation, Inaccurate	Eliminated due to inaccuracy
5. Crossbow	Using a bent string and a bow, propel the ball at the target using a track for guidance	High Speed, Easy to use.	Reliability, Hard to build, Vibrations, Cost, Could be inaccurate	Not Eliminated
6. Golf Swinger	Use a torsion spring to propel the club head, hit the ball towards the target	High Speed	Inaccurate, potential for spraying ball in unknown direction	Not Eliminated
7. Spring Loaded Gun	Use a compression spring which is compressed as much as possible to launch the ball out a barrel in the desired direction	Very simple, High Speed	Vibrations, Large spring force need to be dissipated	Not Eliminated
8. Pitching Machine	Spin two wheels to high, equal angular velocities and then feed the ball between them.	Accurate	Very hard to build, Spinning parts, Speed, Consistency	Not Eliminated
9. Centrifuge	Spin the ball to a high speed then release the ball	High Speed, Unique	Spinning parts, Hard to construct	Not Eliminated
10. Leaf Spring	Compress a leaf spring from a car to propel the ball along a track	High speed, Consistent performance	Very Unsafe, Hard to construct	Eliminated due to safety concerns

See Figures 1 thru 10 for conceptual design sketches.

Conceptual Design Drawings

Figure 1: Air gun Concept

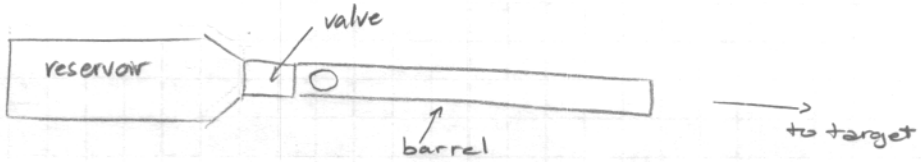


Figure 2: Trebuchet

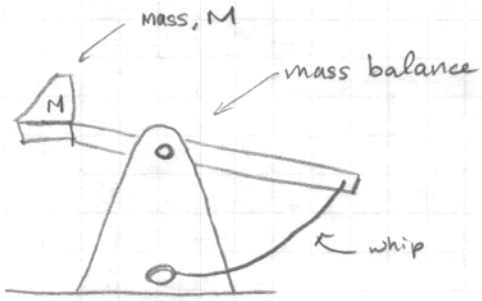


Figure 3: Sling Shot

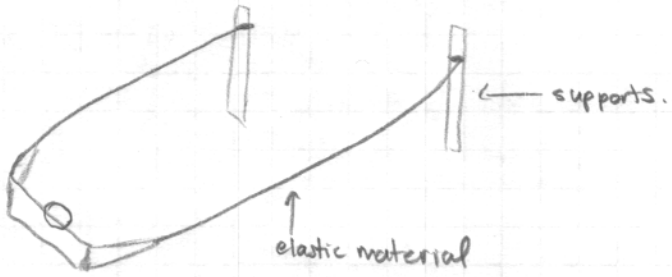


Figure 4: Catapult

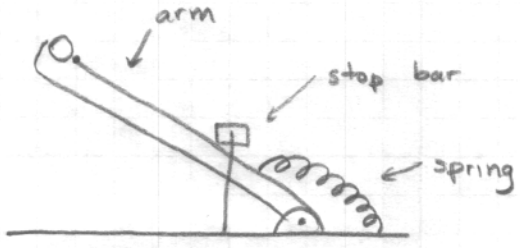


FIGURE 5: CROSSBOW

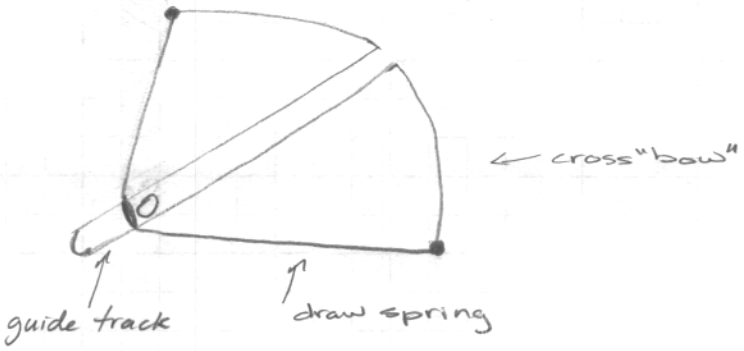


FIGURE 6: GOLF SWINGER

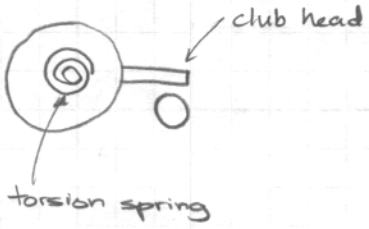


FIGURE 7: SPRING LOADED GUN

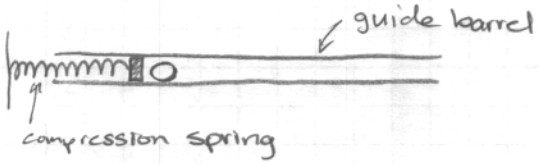


FIGURE 8: PITCHING MACHINE

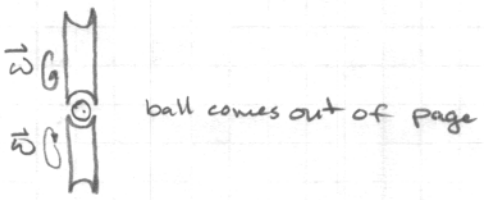
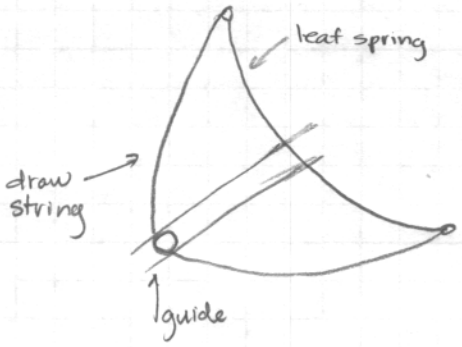


FIGURE 9: CENTRIFUGE

FIGURE 10: LEAF SPRING



Analytical Hierarchical Process

		More Important					
		Accuracy	**Safety**	**Reliability**	**Cost**	**Ease of Use**	**Ease of Construction**
	Accuracy	1.00	0.33	4.00	7.00	5.00	5.00
	Safety	3.00	1.00	3.00	5.00	5.00	5.00
Less Important	**Reliability**	0.25	0.33	1.00	6.00	3.00	3.00
	Cost	0.14	0.20	0.17	1.00	2.00	0.25
	Ease of Use	0.20	0.20	0.33	0.50	1.00	1.00
	Ease of Construction	0.20	0.20	0.33	4.00	1.00	1.00
	Total	*4.79*	*2.27*	*8.83*	*23.50*	*17.00*	*15.25*

		More Important						
		Accuracy	**Safety**	**Reliability**	**Cost**	**Ease of Use**	**Ease of Construction**	***Total***
	Accuracy	0.21	0.15	0.45	0.30	0.29	0.33	*1.73*
	Safety	0.63	0.44	0.34	0.21	0.29	0.33	*2.24*
Less Important	**Reliability**	0.05	0.15	0.11	0.26	0.18	0.20	*0.94*
	Cost	0.03	0.09	0.02	0.04	0.12	0.02	*0.31*
	Ease of Use	0.04	0.09	0.04	0.02	0.06	0.07	*0.31*
	Ease of Construction	0.04	0.09	0.04	0.17	0.06	0.07	*0.46*
	Total	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*6.00*

Weighted Values

Accuracy	0.29
Safety	0.37
Reliability	0.16
Cost	0.05
Ease of Use	0.05
Ease of Construction	0.08
Check Total	*1.00*

Weighted Design Matrix

	Concepts	***Air Gun***	**Crossbow**	**Golf Swing**	**Spring Gun**	**Pitching Machine**	**Centrifuge**
Criteria							
Accuracy		9	6	3	8	6	1
Safety		7	6	3	4	9	3
Reliability		7	5	1	6	6	2
Cost		4	5	7	7	2	6
Ease of Use		7	6	8	7	9	9
Ease of Construction		3	2	9	3	1	4

	Concepts	***Air Gun***	**Crossbow**	**Golf Swing**	**Spring Gun**	**Pitching Machine**	**Centrifuge**
Criteria	*Weight*						
Accuracy	*0.29*	***2.593***	1.728	0.864	2.305	1.728	0.288
Safety	*0.37*	***2.615***	2.241	1.121	1.494	3.362	1.121
Reliability	*0.16*	***1.098***	0.784	0.157	0.941	0.941	0.314
Cost	*0.05*	***0.209***	0.261	0.366	0.366	0.105	0.314
Ease of Use	*0.05*	***0.366***	0.313	0.418	0.366	0.470	0.470
Ease of Construction	*0.08*	***0.231***	0.154	0.693	0.231	0.077	0.308
Total	*1.00*	***7.111***	5.483	3.619	5.702	6.683	2.814

Using the Weighted Design Matrix Concept Evaluation Method, The Air Gun is the best concept based upon the criteria weights set forth by the Analytical Hierarchal Process.

Modified Gantt Chart

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