Concept Generation and Selection

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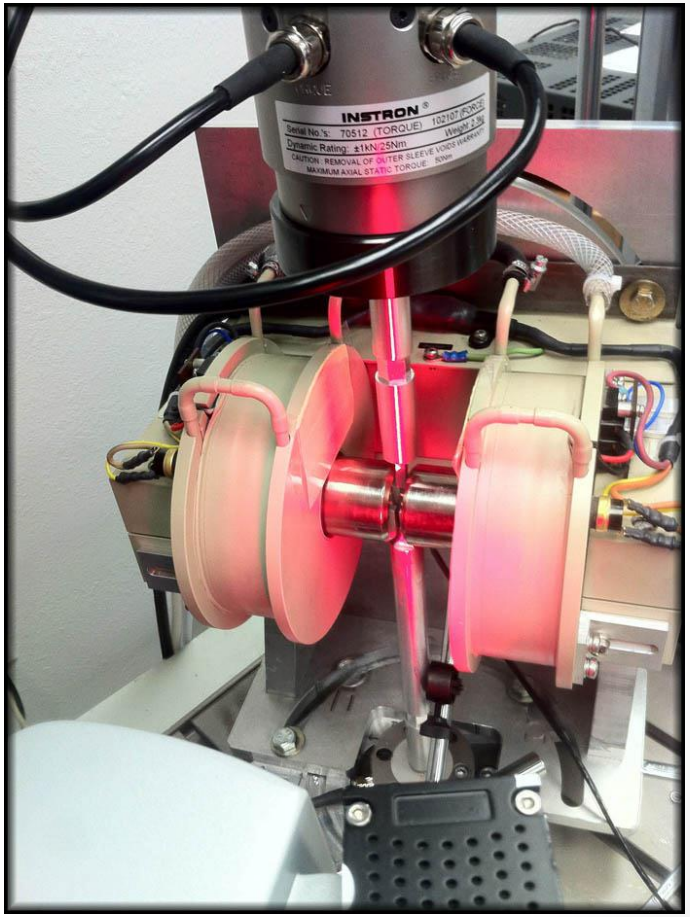
Matt Garcia, Randy Jackson, Jeremy Mountain, Qian Tong, Hui Yao

College of Engineering, Forestry, and Natural Sciences
Northern Arizona University

Overview

- **Problem Statement**
- **Concept Generation**
  - Tip Designs
  - Base Designs
- **Concept Selection**
  - Importance of objectives
  - How well designs match objectives
- **Selected Design**
- **Updated Timeline**



Matt

Problem Statement

Need: *The eccentric loading of the test specimens causes fatigue failure.*

Goal: *Design an improved material testing fixture.*

Constraints:

1. Specimen size (3 x 3 x 20) mm
2. Exposed Length (6 mm)
3. Grips cannot bite into specimen
4. Push rods and grips must be non-magnetic
5. Distance between magnets (10mm)
6. Magnetic Field (0.5 - 1.0 T)
7. Axial Alignment (50 µm)

Objectives:

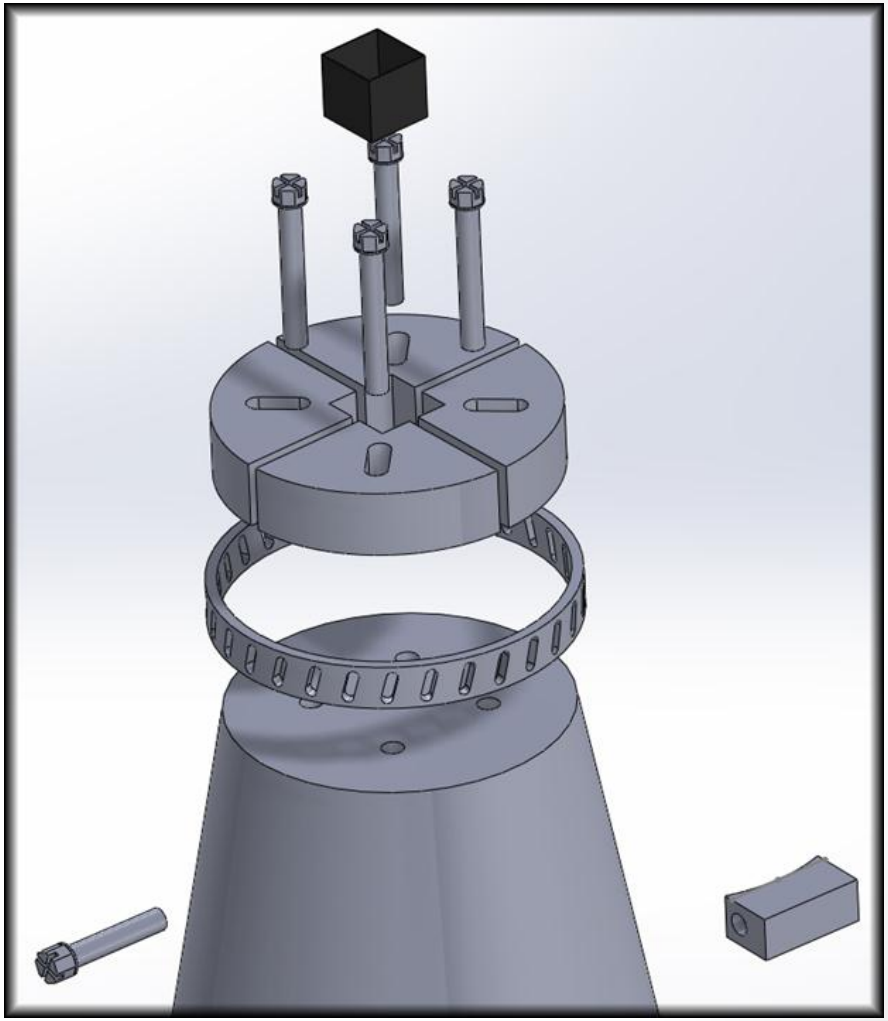
Objectives	Basis for Measurement	Units
Axially Aligned	Distance from Perfect Alginment	µm
Tension Compression Testing	Repeated Testing	# of Tests
Damage Specimen	Cost of Specimen Time to Replace	$$ / Month
Inexpensive	Machining Cost Material Cost	$$

Jeremy

Concept Generation

Clamp Tip

- Allows Tension Tests
- Axial Alignment
- Easy Adjustment
- Rubber Insert / Rubber Coating
- Tight Tolerances (50µm)

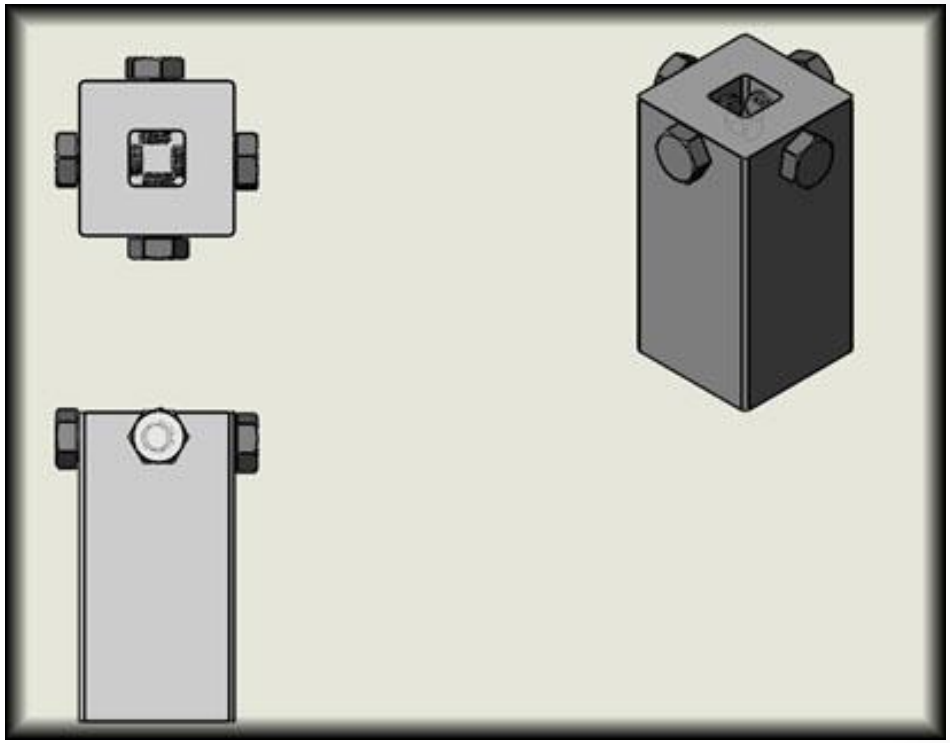


Jeremy

Concept Generation – Cont.

Screw Tip

- 4 Set – Screws
- Rubber Insert
- Allows Tension Tests
- Axial Alignment

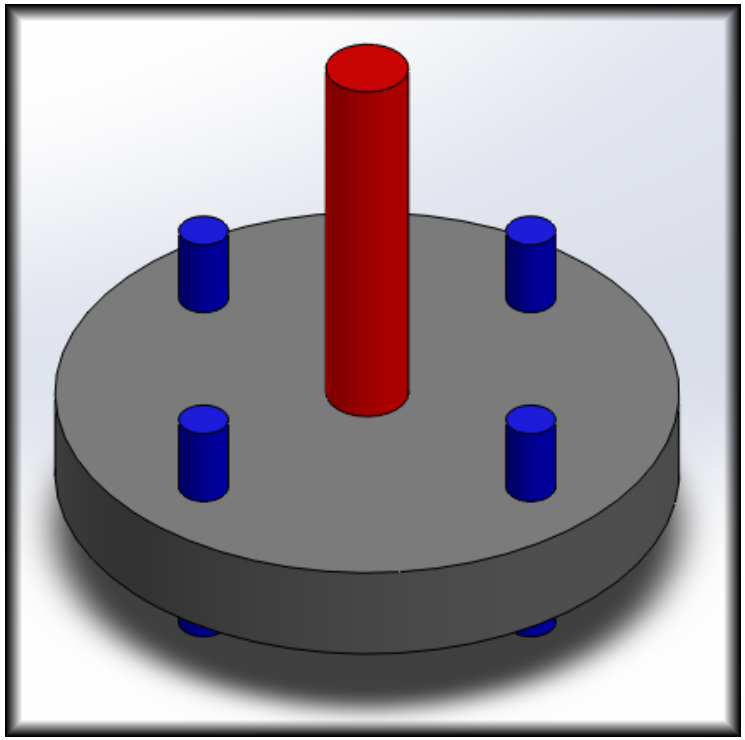


Qian

Concept Generation – Cont.

Adjustable Base

- 4 Adjustments Screws
- Axial Alignment
- Stable Base
- Easy to manufacture

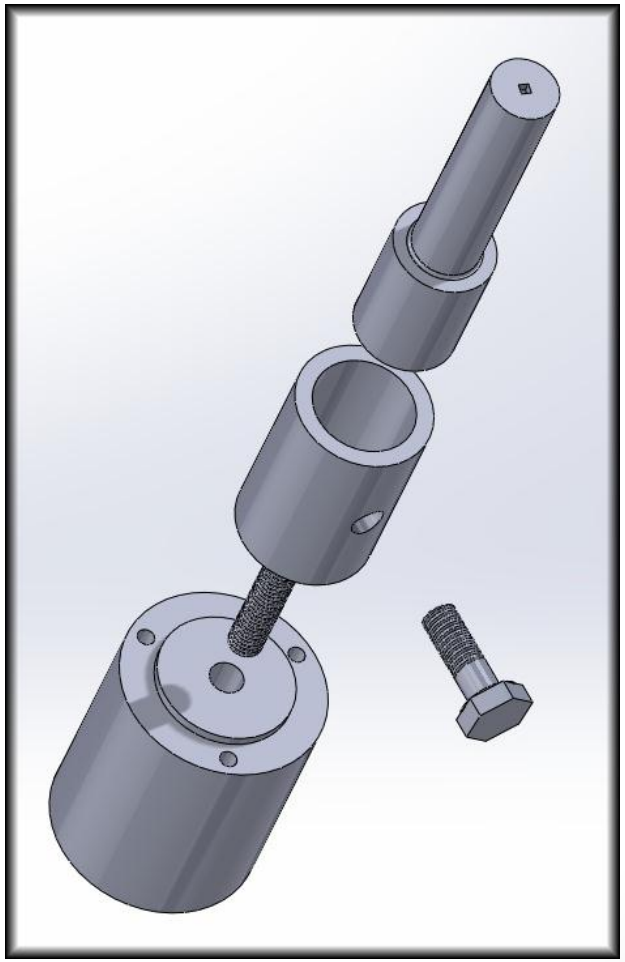


Qian

Concept Generation – Cont.

Base Sleeve

- Axial Alignment
- Tight Tolerances (50µm)
- No Adjustment
- Stable Base



Hui

Concept Generation – Cont.

Collar Base

- 3 Securing Screws
- 1 Set – Screw
- Tight Tolerances (50µm)
- No Adjustment
- Axial Alignment

Hui

Concept Selection

Importance of Objectives

Judgment of Importance	Numerical Rating
Extremely Important	9
	8
Very Important	7
	6
Strongly Important	5
	4
Moderately Important	3
	2
Equally Important	1

Objective Weight

Axial Alignment	9
Tension & Compression	5
Damage To Specimen	9
Inexpensive	4

Randy

Concept Selection – Cont.

Scale of how well designs match our objectives

Meets Objective	Numerical Rating
Extremely Well	5
Very Well	4
Well	3
Not Well	2
Not At All	1

Randy

Concept Selection – Cont.

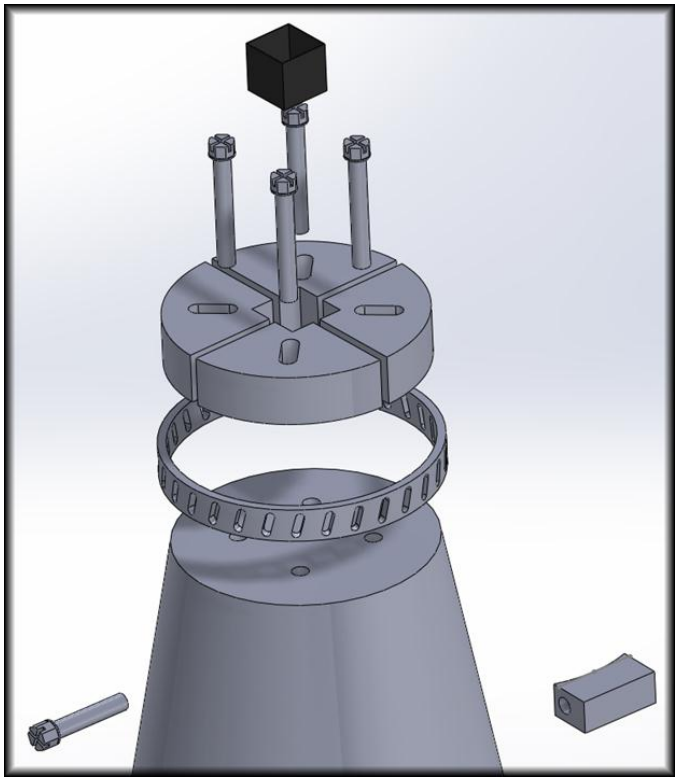
Decision Matrix

	Tip		Base			Objective Weight
Objectives	**Clamp Tip**	**Set Screw Tip**	**Adjustable Base**	**Base Sleeve**	**Collar Base**	
Axial Alignment	5	2	1	4	5	9
Tension & Compression	4	4	3	3	4	5
Damage To Specimen	4	4	N/A	N/A	N/A	9
Inexpensive	2	4	4	3	2	4
Total	15	14	8	10	11	
Weighted Total	109	90	40	63	73	

Randy

Selected Design

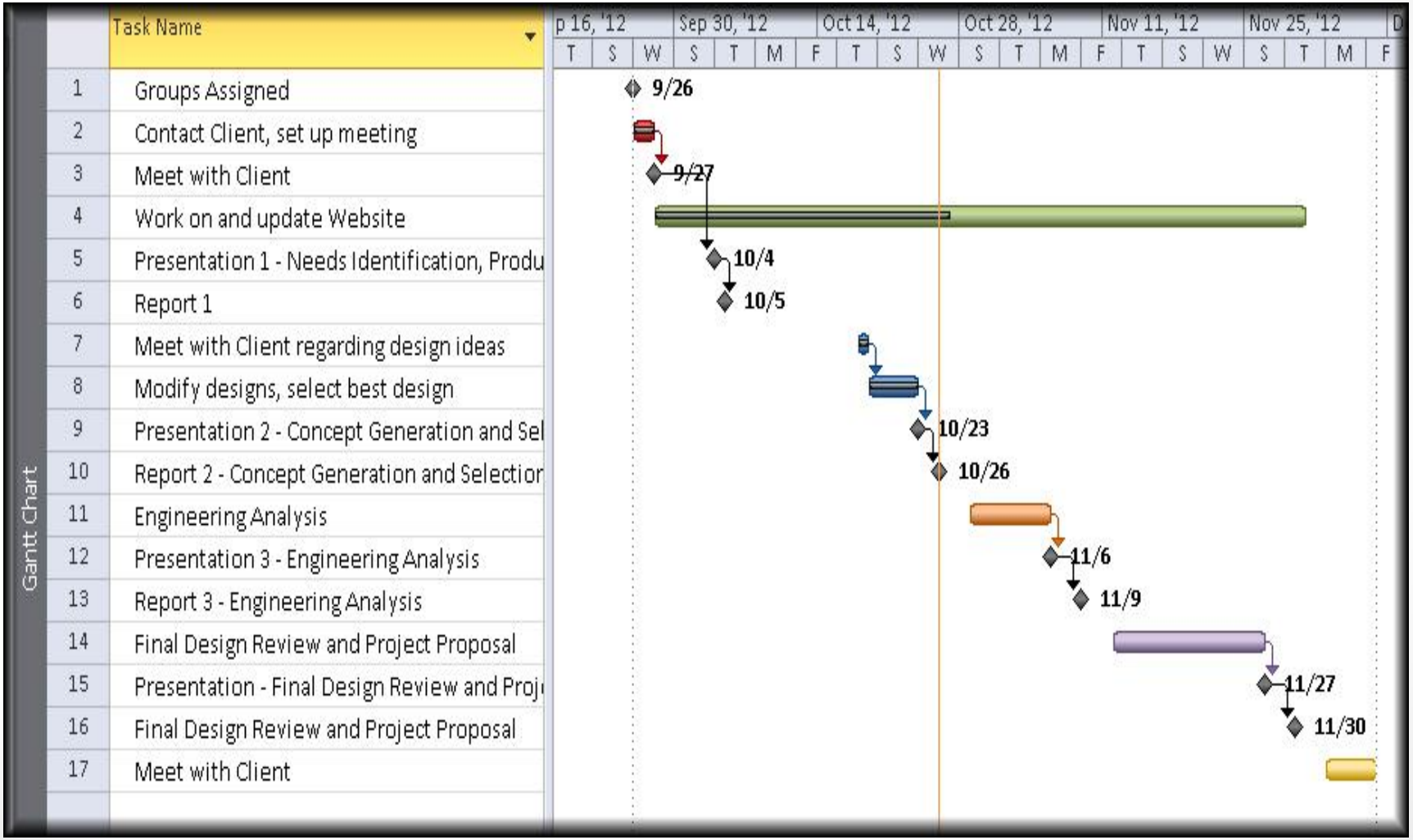
Clamp Tip



Collar Base

Randy

Updated Gantt Chart



Matt

Conclusion

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Jeremy

References

- **Gantt Chart Creation:**
  http://www.youtube.com/watch?v=sPwURRG9_Gs

- **Magnetic Shape Memory Alloy:**
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- **Dr. Constantin Ciocanel**
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- **SolidsWorks 2012**
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