Design of New Fixture for Material Testing Machine

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Overview

- Project Description
- Current Problem
- Needs Statement
- Problem Statement
- Objectives
- Constraints
- Test Environment

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Project Description

▸ Design a new test fixture for a magnetic shape memory alloy.

▸ To be installed on an Instron 8874 hydraulic bi-axial testing rig.

▸ Will operate in the presence of a magnetic field.

▸ Axial alignment is critical.

Current Problem

- Eccentric Loading
- Magnetic Field
- Push rod connection
- Only compression testing

Needs Statement

The eccentric loading of test specimens causes fatigue failure, which is undesirable because of the high cost and limited availability of the material.

Problem Statement

Goal:

Design an improved material testing fixture.

Scope of Goal:

Limitations:

▸ Tension / Compression

▸ Small Scale Testing

Objectives

▸ Ensure Axial Alignment

▸ Perform Tensile/Compression Tests

▸ Not Damage Specimen

▸ Inexpensive

Objectives – Cont.

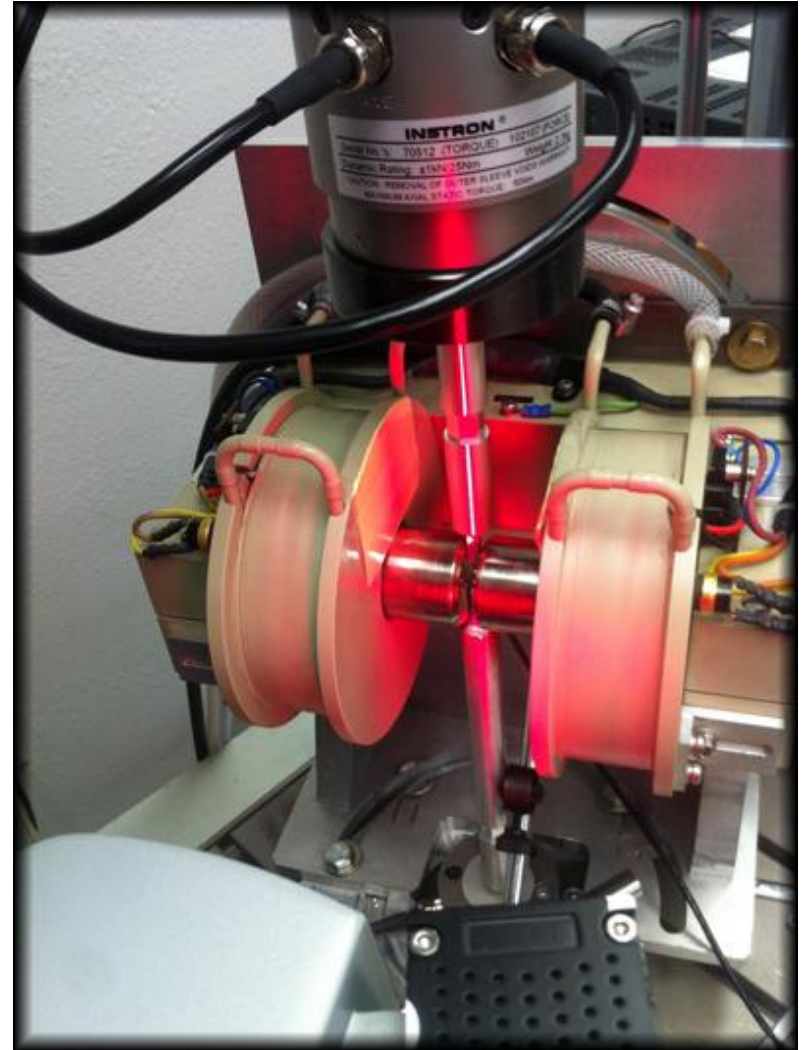| Objective	Basis for Measurement	Units
Axial Alignment	Distance from "perfect" axial alignment	µm
Tensile/Compression Tests	Repeated Testing	# of Tests
Not Damage Specimen	Cost of new specimen / Time for replacement	$$ / Months
Inexpensive	Cost to machine and purchase material	$$

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)
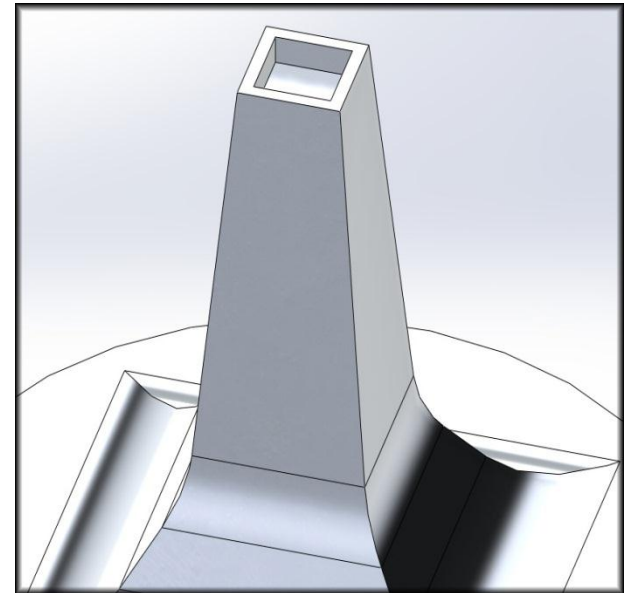
Testing Environment

- Magnetic Field

- Video Camera

- Measuring Devices

Recapitulation

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

Goal: Design an improved material testing fixture.

Objectives:

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Quality Function Deployment

|		Strain	Tension	Compression	Exposed Length	Grip Size	Magnetic Field	Cost
		Engineering Requirements						
Customer Requirements	Does not break	X	X	X				
	Tension Test		X					
	Axial Loading		X	X		X		
	Inexpensive				X			X
	Fits in Testing Device				X	X		
	Magnetic Field				X		X	
	See Specimen				X	X		
Units		mm/mm	N	N	mm	mm^2	T	$$
		1.2	18	60	6	100	1	TBD
Engineering Targets								

House of Quality

+ Implies a positive relationship   - Implies an inverse relationship
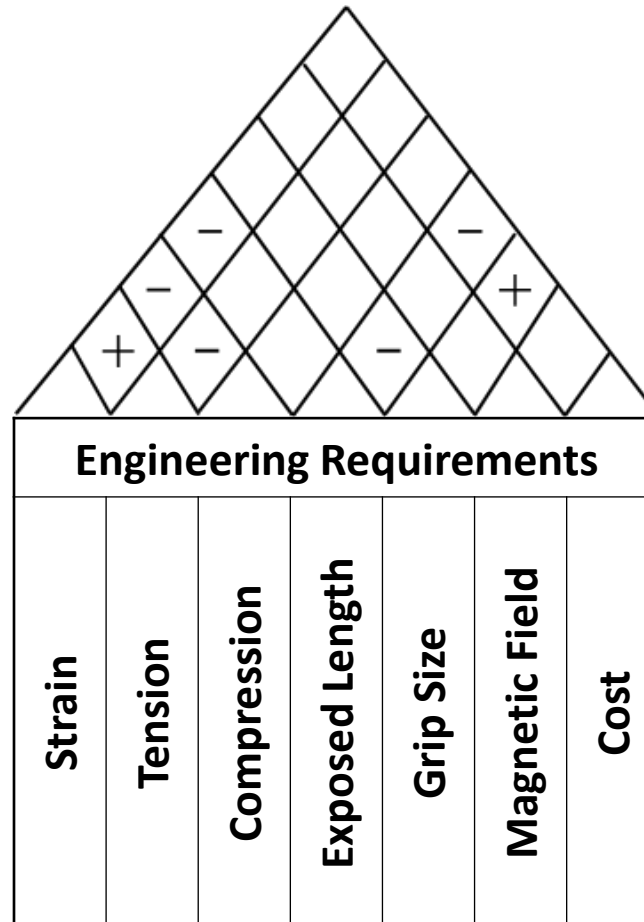
Gantt
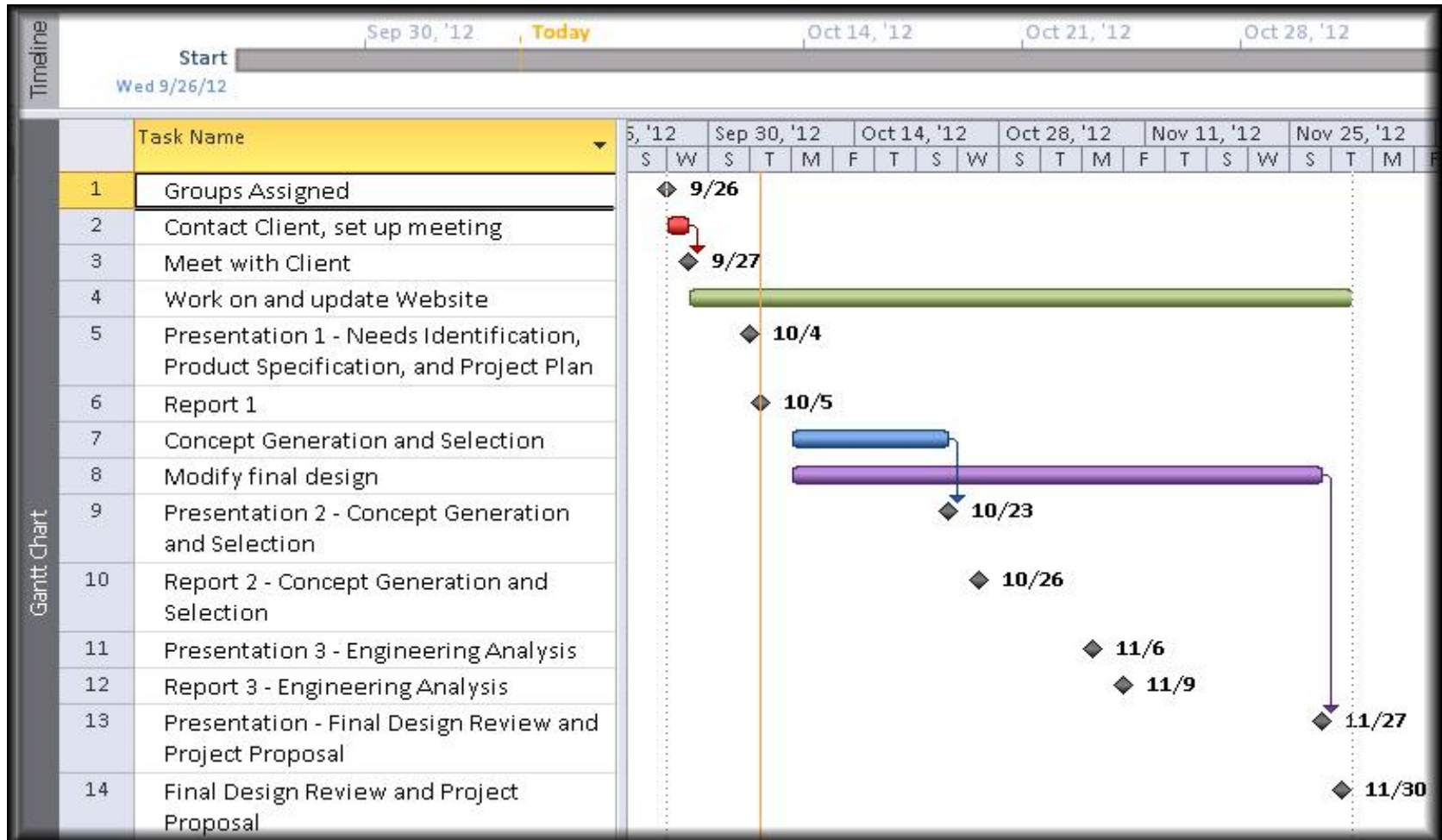
References

- **Gantt Chart Creation:**

  http://www.youtube.com/watch?v=sPwURRG9_Gs

- **Magnetic Shape Memory Alloy:**

  http://nau.edu/Research/Feature-Stories/NAU-on-Leading-Edge-of-Smart-Materials-Research/

- **Dr. Constantin Ciocanel**

  http://nau.edu/CEFNS/Engineering/Mechanical/Faculty-Staff/

- **SolidsWorks 2012**

  http://www.solidworks.com/