



Senior Design Clinic II Spring 2003



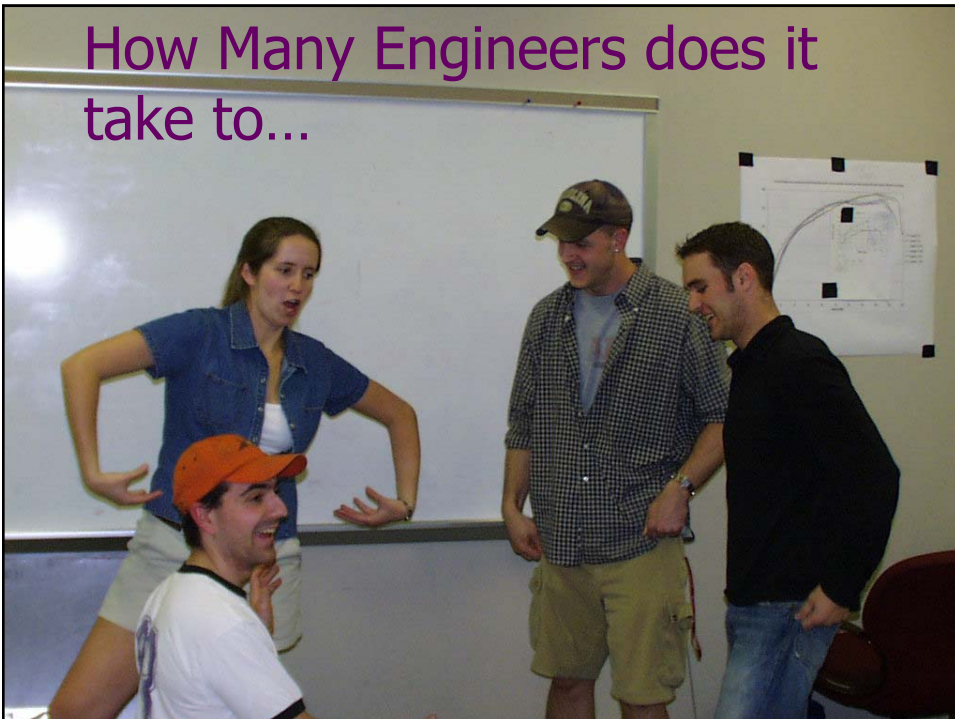
Damper Standard System for MTS Systems Corporation

Benn Horrisberger
Scott McClelland
Brad Sell
Holly Wilcox

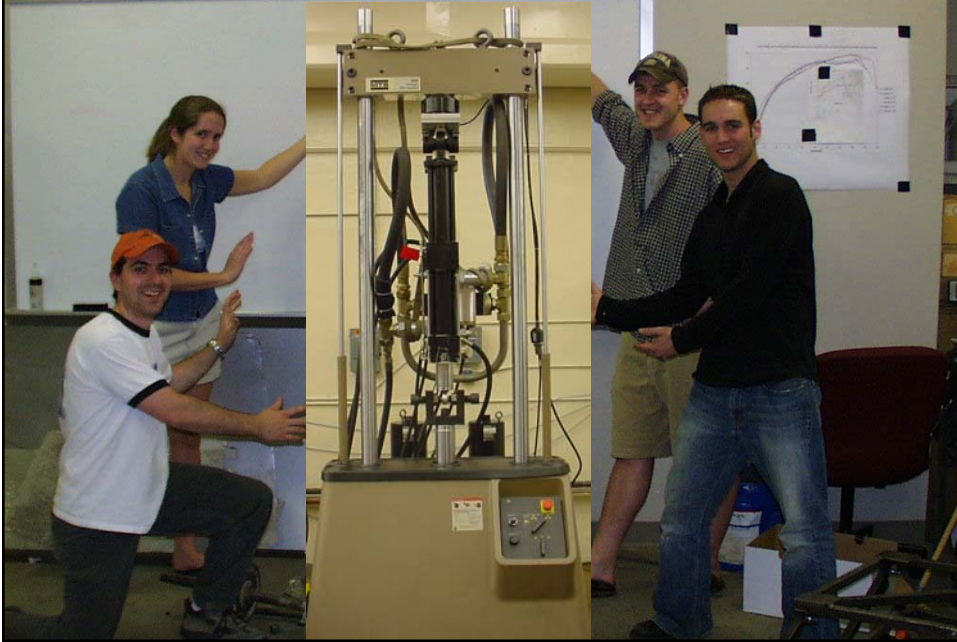


Advisor: Mike Hennessey

How Many Engineers does it
take to...



Turns out ...only 6!



Problem Statement

- ◆ To develop a damper standard which will be used to characterize the performance of MTS damper systems.
- ◆ For internal use on the 850 system



850 System

What is a Damper?



Why is there a need for this system?

◆ Currently MTS can accomplish:

- No-Load velocity testing
- Static load testing

◆ **NO STANDARD FOR DYNAMIC LOAD AND VELOCITY TESTING!**

◆ **MAXIMUM LIMITS OF THE SYSTEM ARE UNKNOWN!**

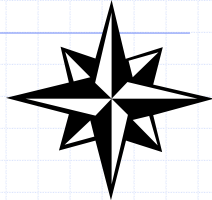




Considered Designs

Hydraulic Systems

Pneumatic Systems



Electro-Magnets

Magneto-Resistive Fluids

Selected Design

MTS
Technician

Program



Damper Standard

850



Force & Velocity Feedback

Damper Standard Breakdown



Servo valve



Manifold



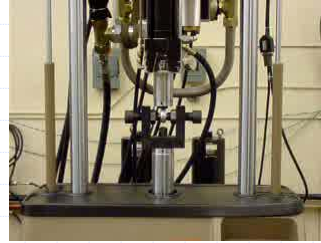
Actuator

Software Design

The screenshot shows a software window titled "Drive File Generator" with a standard Windows-style title bar. The interface is divided into several sections:

- Test Parameters:** A vertical list of input fields with numerical values:
 - Displacement (in.)
 - Frequency (Hz)
 - V
 - # of Cycles
 - % Valve Opening
 - Amplitude Coefficient
 - Valve Scale
 - Sample Rate (Hz)
- Drive File Creation Utilities:** Contains two buttons: "Generate" and "Write". Below them is a text field for "File Name and Location:" with the value "C:\UST\test1.blk".
- Interpret Results:** Contains a text field for "# of Result Header Lines" with the value "7", a text field for "Lines of data to read" with the value "4500", and a text field for "From File:" with the value "C:\siis\mp\Specimens\spec02\Specimen.dat". Below these are two buttons: "Read Data" and "Find Force". At the bottom of this section are two input fields for "Fmin" and "Fmax".
- For Future Use:** Contains a button labeled "calculator of Beta/%" and three input fields for "Beta Up", "b", and "%".

Completed Damper Standard



10 Hz or 126 in / sec

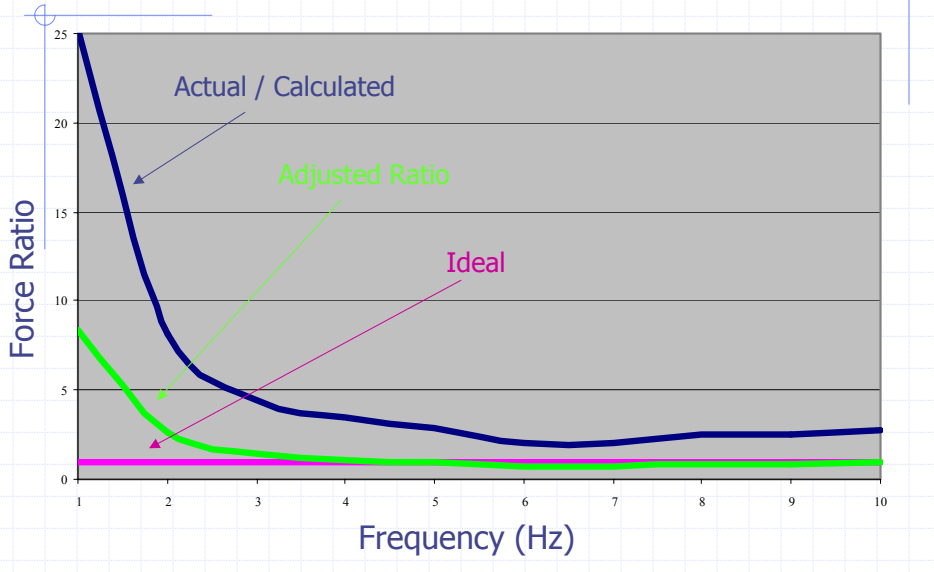
Testing

◆ Procedure

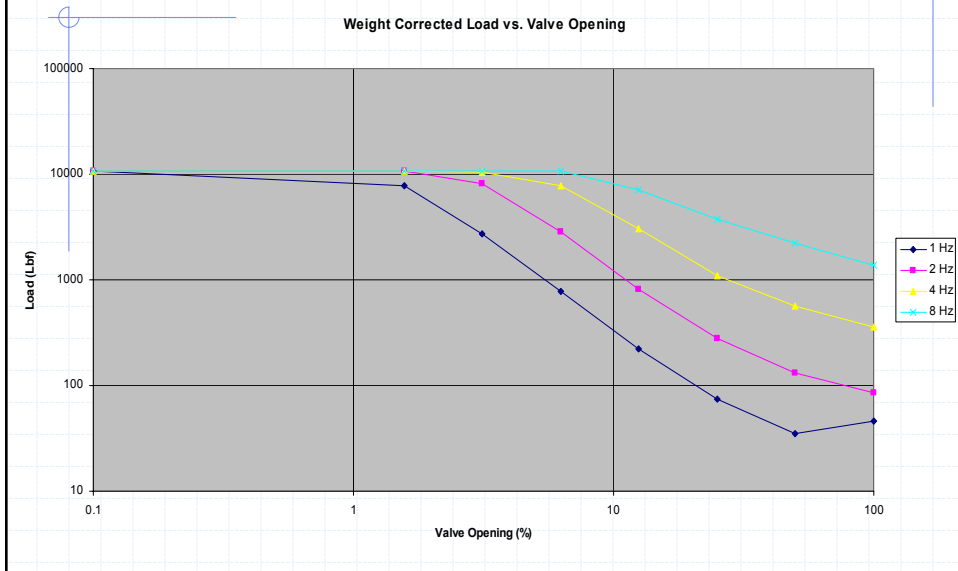
- Half orifice adjustments
- Force limited by tested machine
- 1Hz – 16Hz frequencies

$$F = A_p \left(\frac{A_{850} \cdot V}{S \cdot Q_{rated}} \right)^2 \cdot \Delta P_{rated}$$

Theoretical Model



Test Results



User's Manual

- ◆ Instructions on how to use the damper specimen
 - Initial setup
 - How to run tests
 - Product information about the specimen
 - Warnings / Cautions
 - Trouble Shooting

Project Costs

- ◆ Total Cost ~ \$31,500
 - Materials (actuator, servo-valve, manifold, hoses, fittings etc...)
 - ◆ 143 parts
 - ◆ Estimated \$10,700
 - Labor
 - ◆ Student @ \$10.00/hr = \$13,000
 - About 1300 hours
 - ◆ Assembly = \$6400
 - 19 hours
 - ◆ Engineering = \$1400
 - 69 hours

Conclusions

◆ Multi-Disciplinary Project

- Mechanical Design
- Manufacturing
- Fluid Flow
- Heat Transfer
- Software Design
- Testing
- Project Management

Questions?

