P07110 Vertical Test Stand

Goals:
• Design & Build One Vertical Test Stand
• Design & Build a Data Acquisition (DAQ) System
• Improve upon the existing Horizontal Stand

Benefit of this Project:
• The Payload will be riding on a rocket
• The test stand will allow the Flying Rocket (p07109) and Guidance (P07106) teams to test their systems and improve performance

Customer Needs/Design Specs Met:
• Force, Pressure, & Temperature Readings
• Rocket Restraint
• Plume Removal/Deflection
• Safety Issues with Bunker Stability
• Simplified Set-Up Procedure
• Improved DAQ System

Final Vertical Test Stand Design:
• Steel support frame anchored into the concrete test bunker
• Rocket housing
  • Adaptable issues with rocket design changes while holding safety paramount
  • Rocket is supported from the nosecone
  • Utilizes freedom of motion via linear bearings, thrust bearings, and universal joints
  • Freedom of motion allows six force sensors to obtain accurate readings
• Safeguards
  • High strength structure
  • Blast shield
  • Containment bunker

Theory & Analysis:
• Performed rigorous mechanical analysis of all failure methods
• Conducted FE analysis on many complex aspects of the design to verify failure would not occur
• Maintained a high factor of safety in all failure modes
• Addressed all possible risks in a facilities risk assessment

Final DAQ System Design:
• The “Box”
  • Centralize the collection & transmission of data
  • Protect the electronics and circuitry
  • Allow for quick set-up
  • Ease in addition or switching out of sensor connections
• Load Cell Amplifier Circuit
  • Placed in its own box to limit outside noise
  • 2-18V battery packs and linear regulators (+12V) power the amplifiers
  • Use of terminal blocks to eliminate connection errors at the inputs and outputs of the amplifier circuit
  • Large operating temperature range (-45°C to 85°C) to minimize the effect of the environment on the amplifier

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This project is based upon work completed by previous Sr. Design teams (i.e. P06006) involved with Project METEOR who have laid a foundation that we have been building off of and improving upon, as well as additional research provided by concurrent Project METEOR teams.
For more information on Project METEOR, please visit http://meteor.rit.edu.