

# Implementation of NASA's System Engineering Design Process in the Development of an Optical Guitar Pickup

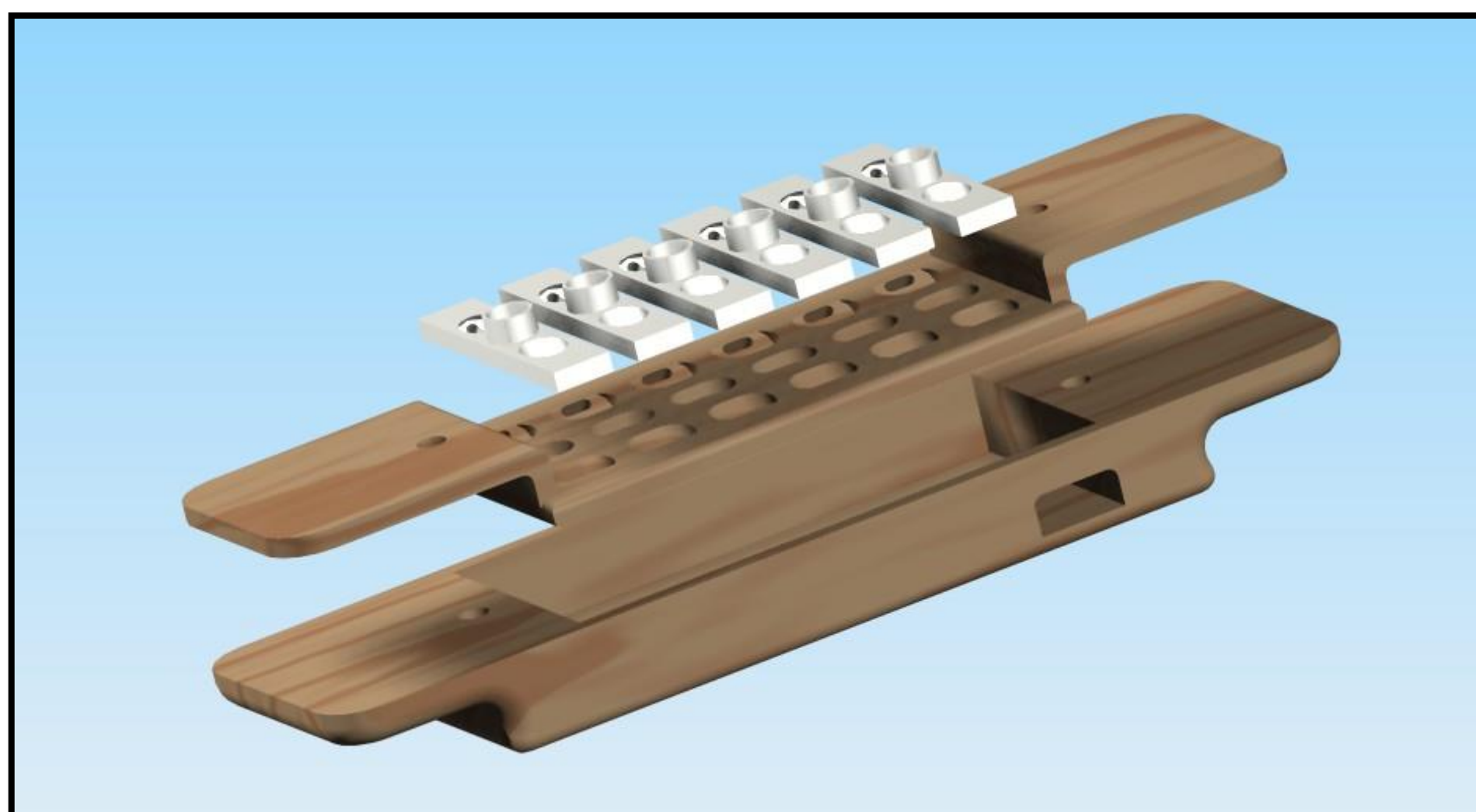
**Stephanie Buckner** (Jared Nelson, Ben Fowler, Samuel Hobbs, Chris Kirchner)  
 Mechanical and Aerospace Engineering Department

## Overview

NASA's Systems Engineering (SE) design process was implemented in the development of the EZ-Tabber Optical Guitar Pickup. The product allows the musical notes played on a guitar to be transformed into a type of readable music. Tablature is an alternative choice to sheet music and is widely used in the guitar industry. The EZ-Tabber reads the frequency of a plucked string with an optical sensor and then transforms the frequency response into tablature through a program on a computer.

## Key Findings

The design team obtained laboratory data to prove that the notes played on a guitar can be visually detected as frequencies. The operational function of the EZ-Tabber is to optically detect the vibration of the string(s). A circuit board will then perform a Fourier Transform to turn this vibration into a frequency. The frequency will be inputted into a computer program, which will in turn write out the musical notes in the form of tablature.



Exploded View of the EZ-Tabber



Isometric View of the EZ-Tabber

## Explanation

The NASA Systems Engineering (SE) engine was applied to the design of the EZ-Tabber. The NASA SE design process is a specific design philosophy that provides guidelines and tools in order to develop a high-quality and safe product. The use of NASA's SE design process and the SE engine in the design of the optical guitar pickup has resulted in a quality product meeting the needs of the customer while exposing the MAE students to NASA's design process.

## Impact

The use of NASA's SE design process has allowed students to garner critical design experience and enabled the students to enter the aerospace workforce prepared to implement NASA's SE engine. Additionally, the invention and production of the EZ Tabber could revolutionize and improve the way musicians play their guitars.

## Acknowledgements

Dr. Carmen – Faculty Sponsor  
 Mr. Tim Blackwell – Technical Advisor/Assembly and Verification Testing  
 Mr. Steve Collins – Production  
 Dr. Frendi – Mechanical Engineering Dept. Chair/Funding

