F-402 Engine Tester

NAVAIR FRC East

PROBLEM STATEMENT

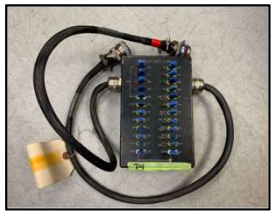
The team was tasked to design a new and more efficient way to test the voltages on the certain pins in the F-402 engine. Currently each pin must be tested manually for the voltage and is costing significant time and labor. This project is designed to test the pins all at once and display a way to show a positive or negative result for the voltage on the pins.

REQUIREMENTS

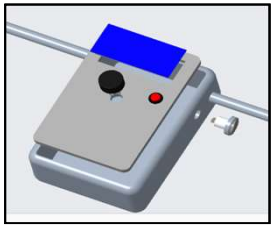
#	Description
1	Include Interface to display selected modes and test pass/fail status.
2	Include 15 test modes.
3	Batteries operated.
4	Contain at least 2 MΩ of isolation.
5	Boots to reinforce and cover the connectors.

CONCEPTS

- Currently the device is being manually tested for each mode using the DECU.



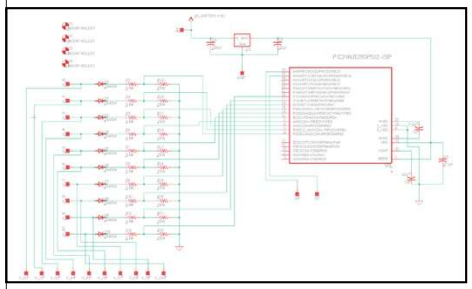
- The project concept is developing a similar device that uses a microprocessor to test the different pins.



FINAL DESIGN, APPROACH, PLAN

The final design for this project is a portable device that can be connected in line with the engine. Once connected to the engine, a rotary switch determines which test to perform. After the test is performed the device will display pass or fail. In the event of a failure, the device will display which electrical pins failed.

Electrical Schematic



Device Housing

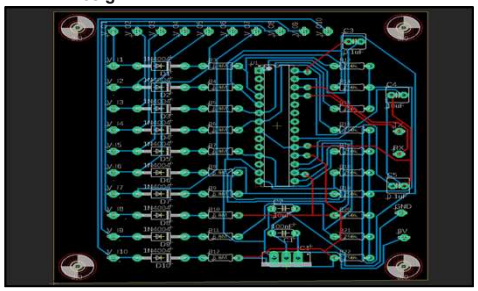
FUTURE WORK-

- Final debugging of code and circuitry.
- Development of the PCBs based on Team 21's schematics.
- Streamline the development process for mass production.

RESULTS

The team successfully made all three microcontrollers work together to measure voltages, determine a pass/fail for the test, and output the results to an LCD screen.

PCB Design



Pic 24 Microcontroller Code example

```
/*
* File:   adcconversion.c
* Author: Dr. Peter Tay, Jeremy Simmons
*
* Created on February 13, 2023, 4:36 PM
*/


#include "xc.h"
#include <p24hj128gp502.h>
#define FCY 4000000UL
#include <libpic30.h>
#include "UART2.h"

int main(void) {
    OSCTUN=0x0011;
    AD1PCFGL=0xffff;
    TRISB=0xefff;
    char temp;
    UART2Init(14,15,25,0);
    __delay_ms(10);

    while(1)
    {
        temp=UART2GetChar();
        temp=PORTB&0x00ff;
        UART2PutChar(temp);
        temp=PORTB>>8;
        UART2PutChar(temp);

    }
    return 0;
}
```

SUMMARY AND CONCLUSIONS

Over the course of this project, the team was able to develop the code for the engine tester. The team also completed the design and assembly of the housing for the engine tester.

- Three stages of code completed
  - Code to read the voltages received from the engine.
  - Code to decide which test to perform and perform the test.
  - Code to detect electrical pin failure and display an output to the LCD screen.
- Housing design
  - Design of a portable box
  - Ease of assembly for battery changes
  - Mounted components (LCD screen, rotary switch, cables)
  - Boots on connections to ensure no loose particles.

TEAM & ACKNOWLEDGEMENTS

- **Cray McCall** – ET
- **CJ Jobe** – EE
- **Jeremy Simmons** – ECET
- **Brandon Pitman** – EE

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  - John Hinson
  - Joshua Guthrie

- **Faculty Mentor-** Dr. Peter Tay
- **Academic Advisor-** Dr. Patrick Gardner