BlueSky Group

Wireless Engine Downloader – Bluetooth Prototype

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What nobody wants to see

Why care?

- In 2016 - there were 8,185,533 flights in the U.S.
- 65 had accidents 10 of which had fatalities because of them

2016 Safety Performance

	2016	2015	5 YEAR AVERAGE (2011-2015)
Fatalities*	268	136	371
Total Accidents	65	68	81
Fatal Accidents	10	4	13.4

How to prevent engine failure

- Gathering data after every flight
- Collecting and analyzing data from many different flights
- Data is stored on an onboard computer called the engine control unit or ECU
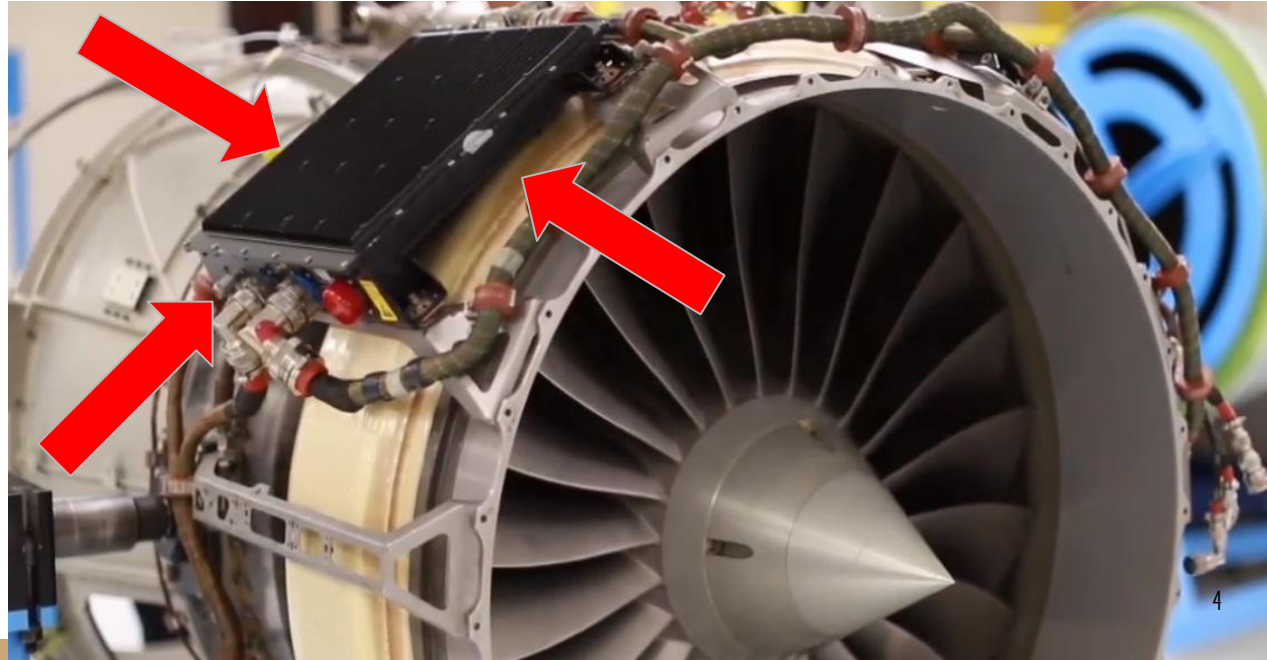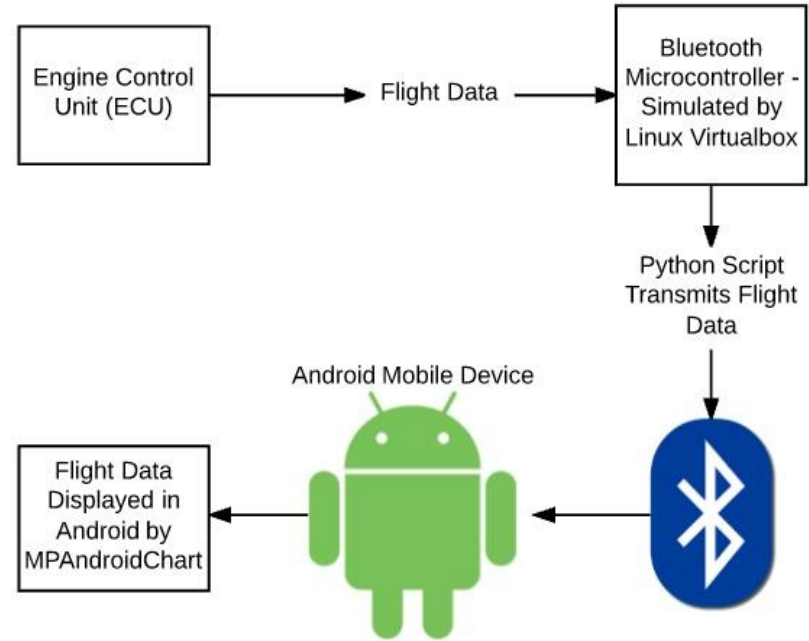
Current problem

- Data must be downloaded manually through bulky and slow cables
- Cables must be carried into the plane and manually connected
- Download speed is very slow currently it takes around 30 minutes to get the data off the plane
- All this makes for data that is collected rarely

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Solution overview

- Bluetooth connection to the ECU is paramount
- The functions of the ECU will be simulated with *Linux Virtualbox* for testing purposes
- *Android Studio* will be our mobile platform of choice
- Flight data will be displayed using *MPAndroid Chart*

Engine Control Unit (ECU) → Flight Data → Bluetooth Microcontroller - Simulated by Linux Virtualbox → Python Script Transmits Flight Data → Android Mobile Device → Flight Data Displayed in Android by MPAndroidChart

Key Requirements

- Engine download application is accessible to users with a smartphone or tablet
- Engine data can be downloaded anytime or place the plane has landed, with only a smartphone running the engine download application
- Application should be able to download all of the data from the ECU
- Application should allow for review of engine data, with functionality similar to EEI
- Test script should simulate the ECU

Requirements cont.

- Functional
  - Engine download application connects to the ECU via Bluetooth and downloads engine data
  - Application uses a library to display charted data
  - Application allows users to select data they would like to view
  - Application sends data directly to Honeywell at specified intervals
  - Test script connects to application via Bluetooth and sends engine data
  - Test script generates test engine data

Requirements cont.

- Performance
  - Application downloads data with minimal to no data loss or corruption
  - Application downloads data within 5 minutes
  - Application and test script establish connection in under 1 minute
  - Test script generates test data with no errors
- Environmental
  - Application should run on iOS or Android
  - Application should be able to parse data in the format specified by the ECU

Requirement Breakdown

- Engine download application connects to the ECU via Bluetooth and downloads engine data
  - Obtains Bluetooth socket
    - Connects to Bluetooth socket
  - Receives input stream
    - Reads from input stream
    - Data stored on device
  - Closes input stream and Bluetooth socket

Risks

- Bluetooth Connectivity Issues
  - Prevents data download
- Errors with Data Parsing
  - Issues aren't found
  - Wrong issues are diagnosed
- Data Download Time
  - Depends on size of data
  - Ideally does not exceed 5 minutes

Feasibility

- Bluetooth Security
- Bluetooth Transfer Speeds
  - • Bluetooth 2.x ~ .25 MB/s
  - • Bluetooth 3.x ~ 3 MB/s
  - • Bluetooth 4.x ~ 3 MB/s
  - • Bluetooth 5.x ~ 6 MB/s
- Displaying data
- Testing (Simulating the ECU)

Schedule

Schedule	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Team Standards	▓								
Technological Feasability		▓							
Tech Demos			▓						
Bluetooth Data Transfer				▓	▓				
UI Design					▓	▓			
Flight Data Display and Processing						▓	▓		
Testing and Bug Fixes								▓	
Deployment									▓

Conclusion

- Problem Introduction
  - Problems in aircraft engines can be fatal.
  - Our client builds and maintains aircraft engines.
  - Solve the issue of a cumbersome download process.
- Solution Overview
  - Build an application that downloads the engine data over Bluetooth.
  - The application should then display the data so that the technician can review it.