How to Design and Create a Commercial Aircraft Radar Receiver and Decryptor

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What is ADS-B

- Automatic Dependent Surveillance – Broadcast
- FAA Replacement for Radar Stations
- Federally required since January 2020
- Provides location and position updates to ground stations and other aircraft

nBits	Bits	Abbr.	Name
5	1 - 5	DF	Downlink Format
3	6 - 8	CA	Capability (additional identifer)
24	9 - 32	ICAO	ICAO aircraft address
56	33 - 88	DATA	Data
	[33 - 37]	[TC]	Type code
24	89 - 112	PI	Parity/Interrogator ID

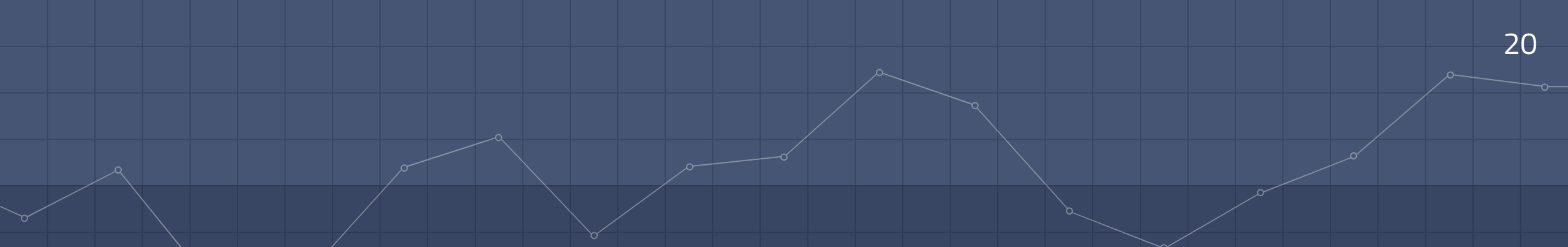| Type Code	Content
1 - 4	Aircraft identification
5 - 8	Surface position
9 - 18	Airborne position (w/ Baro Altitude)
19	Airborne velocities
20 - 22	Airborne position (w/ GNSS Height)
23 - 27	Reserved
28	Aircraft status
29	Target state and status information
31	Aircraft operation status

ADS-B Downlink Format and Type Codes

What does ADS-B Do?

- Replacement for conventional radar systems

- Provides regional airports and ARTCC with position data

- Allows airports and air traffic control accurate timely data

- Cheaper services for rural airports
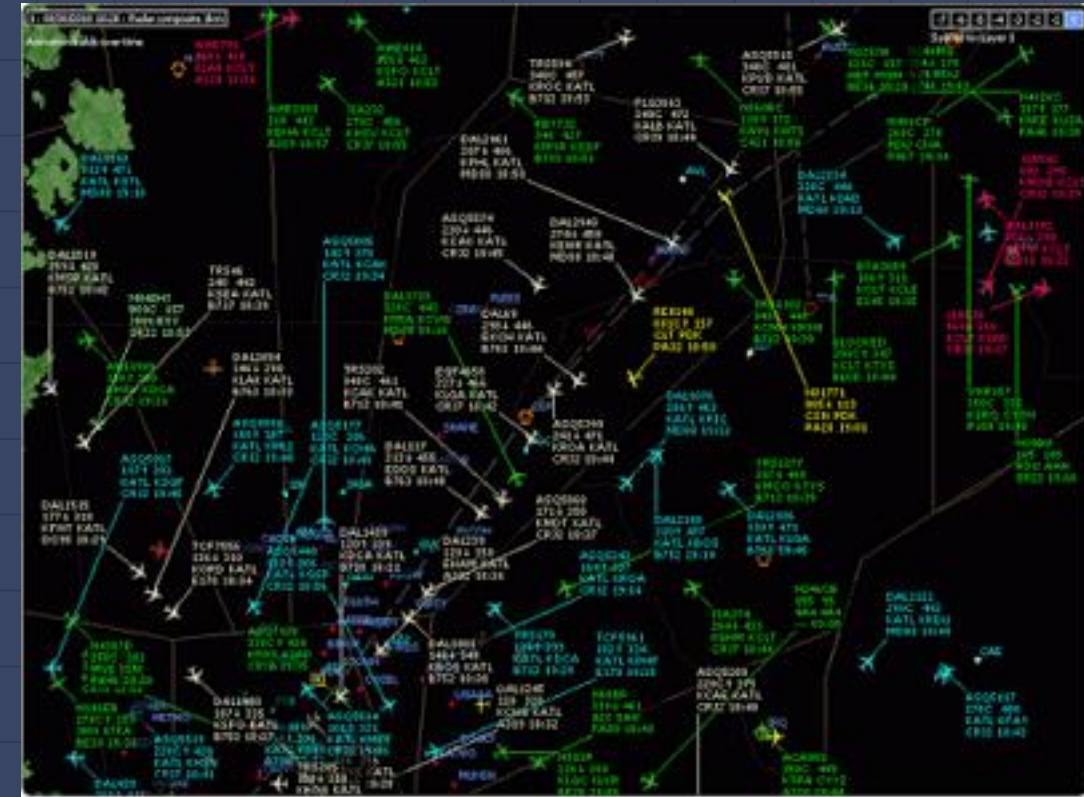
Example Air Traffic Control Screen

"…that effective January 1, 2020, aircraft operating in airspace defined in 91.225 are required to have an Automatic Dependent Surveillance – Broadcast (ADS-B) system that includes a certified position source capable of meeting requirements defined in 91.227."

– FAA Regulation 14 CFR 91.225

ADS-B Reception and Display

- Takes the output from the dump1090 software and put it on a map

- Gathers information from flight such as country of registration, speed, track and position

- Multiple map types available including aviation navigation maps, street maps, and satellite maps

ADS-B Radar Screen with Aircraft in Range

METAR Weather Information

- METAR: Meteorological Aerodrome Report.

- Gets the closest METAR report to the station in the middle of the map.

- Parses one line report into specific fields.

- Services provided by AVWX.rest

Local METAR Reporting Station:

KMCO

Orlando International Airport

KMCO 072353Z 16007KT 10SM FEW047 BKN180 17/12 A2995 RMK AO2 SLP140 T01720122 10233 20172 51004

62.6 °F	98 Feet	10 Miles
Temperature	Altimeter	Visibility
8 MPH	SSE	N/A

METAR Information Screen

Local METAR Reporting Station:

KBGR

Bangor International Airport

KBGR 072353Z 31010KT 10SM FEW200 M02/M08 A2993 RMK AO2 SLP138 4/005 T10221083 10011 21022 51010

28.4 °F	98 Feet	10 Miles
Temperature	Altimeter	Visibility
12 MPH	NW	N/A

Live Aircraft Audio by LiveATC
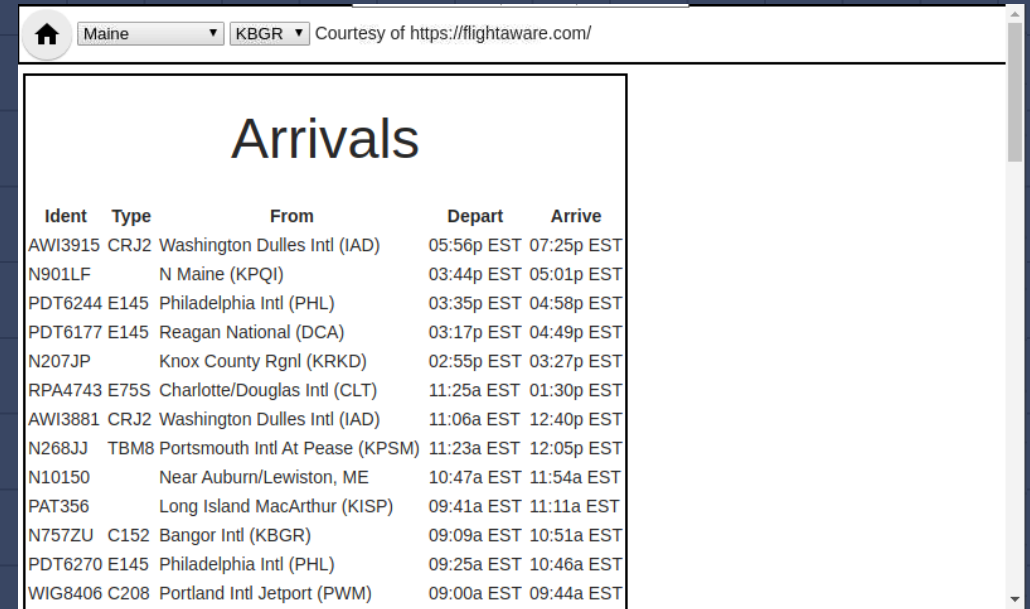
- Draws information from custom generated file

- Fetches audio streams from liveatc.net

- Wrote the file generation script, the web crawler, and the interface all myself
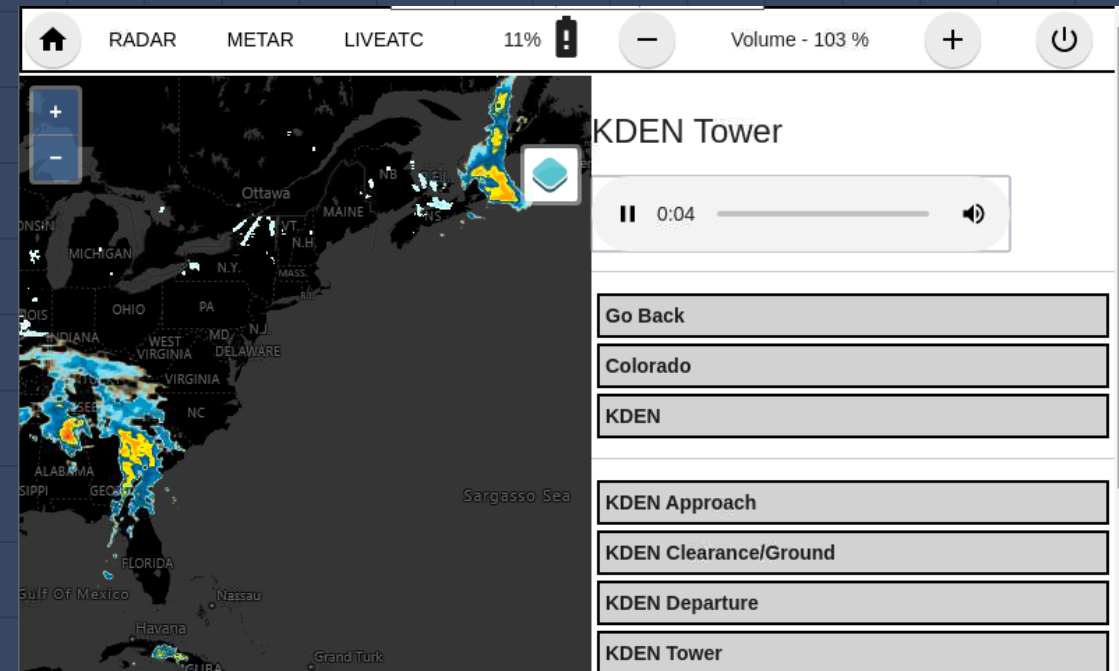
Live Air Traffic Control Screen
(Audio Excerpt from KDEN Tower)
1/7/2021
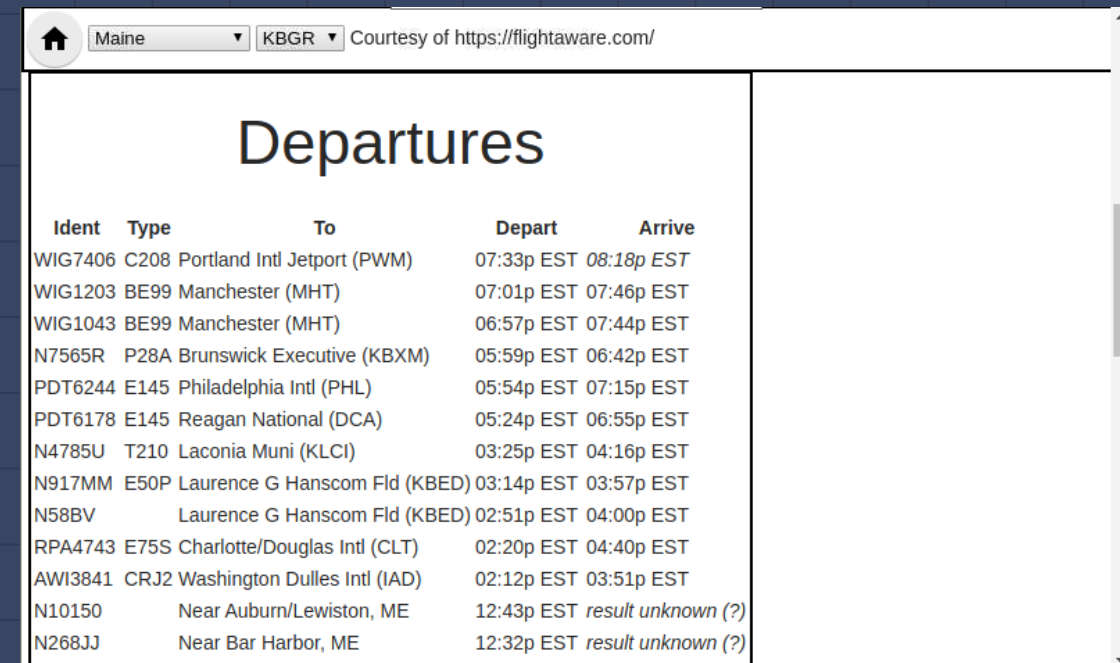
Airport Arrivals and Departures

- Pulls airport arrivals and departures from selected airport

- Created the api and generated the lookup file

- Data fetched from flightaware.com

Example Arrivals and Departures Screens

Planning and Research

- Drew quick sketches to get general flow down

- Researched current technologies and capabilities

- Identified offline maps as primary concern

Email Chain from 2018 with FlightAware

Code Makeup By Language

CSS
46%

HTML
3%

Python
1%

Other
1%

Javascript
50%
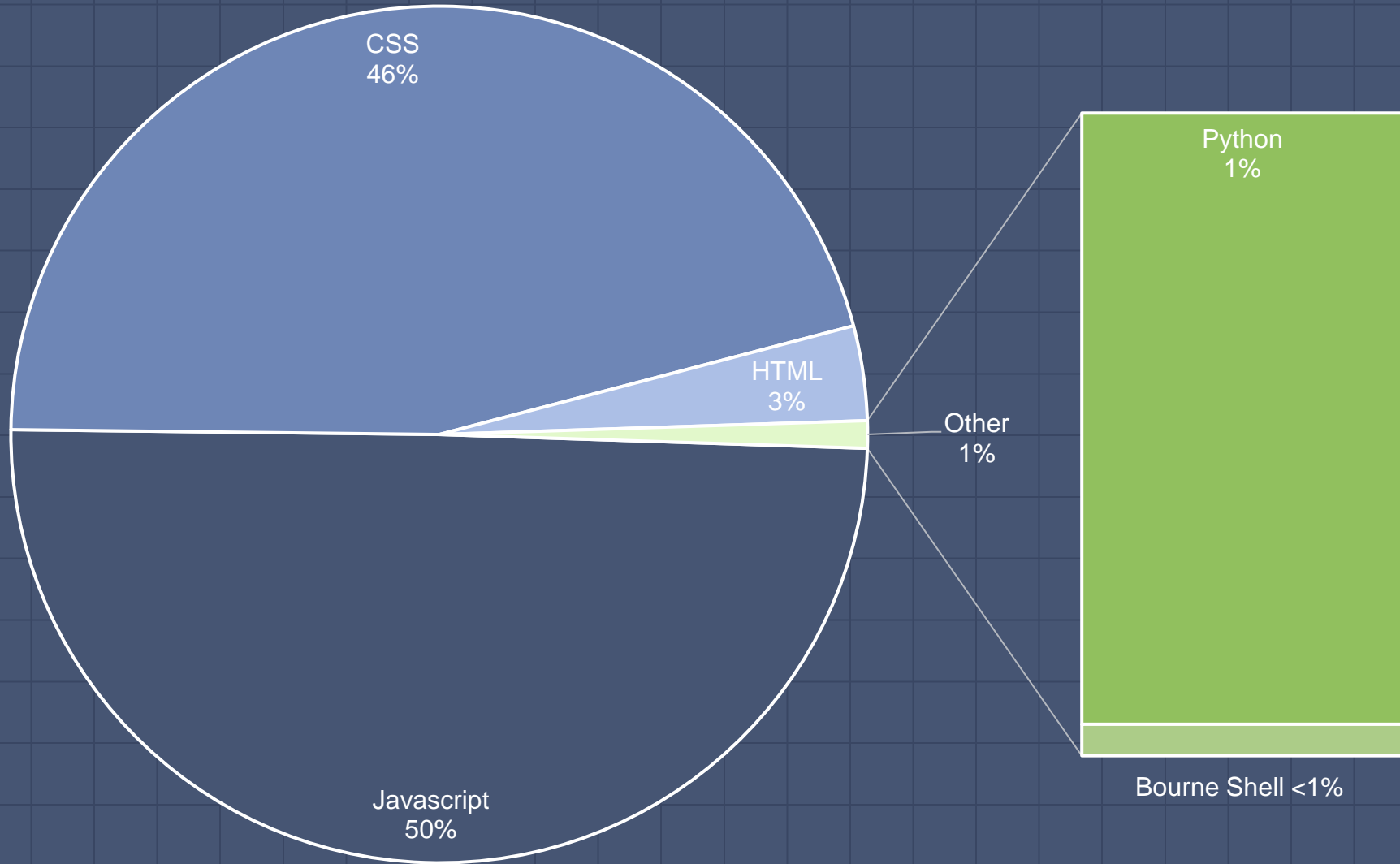
Bourne Shell <1%

Javascript CSS HTML Python Bourne Shell

Visual UI
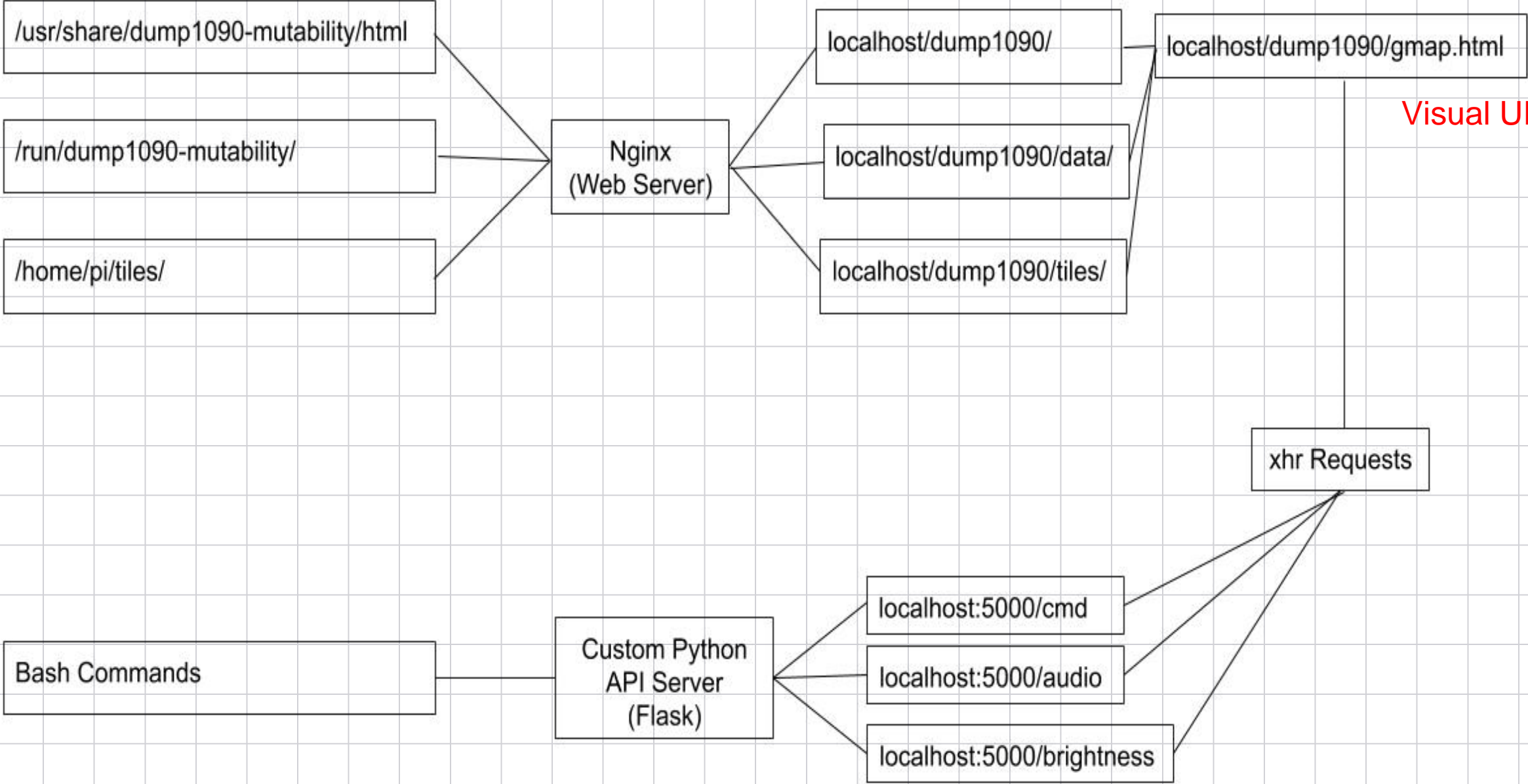
Software Diagram

3D Modeling

Aviation Assistant
ADS-B   METAR   LiveATC
Secondary Case Printing
12/31/2020 - 1/2/2021
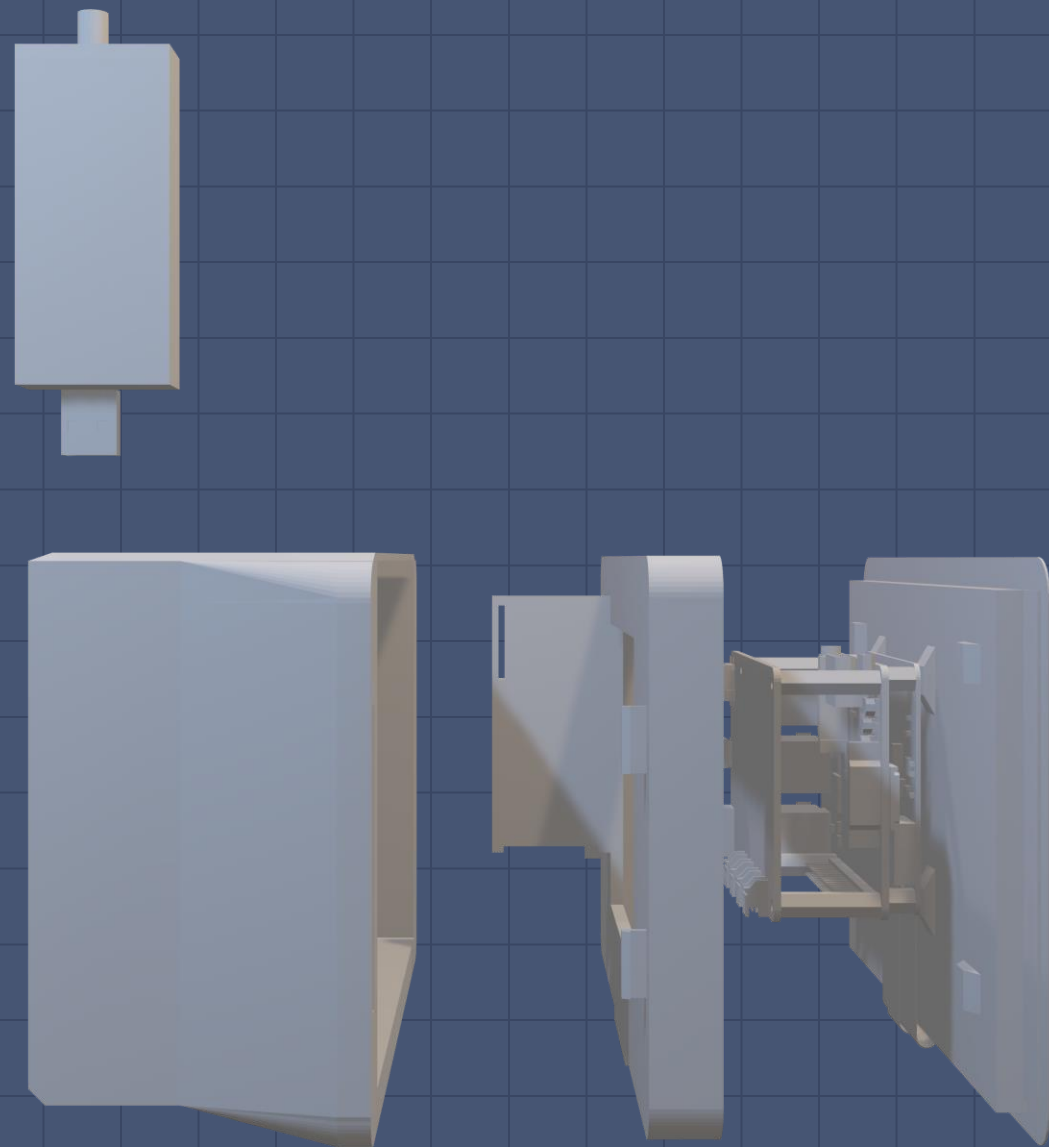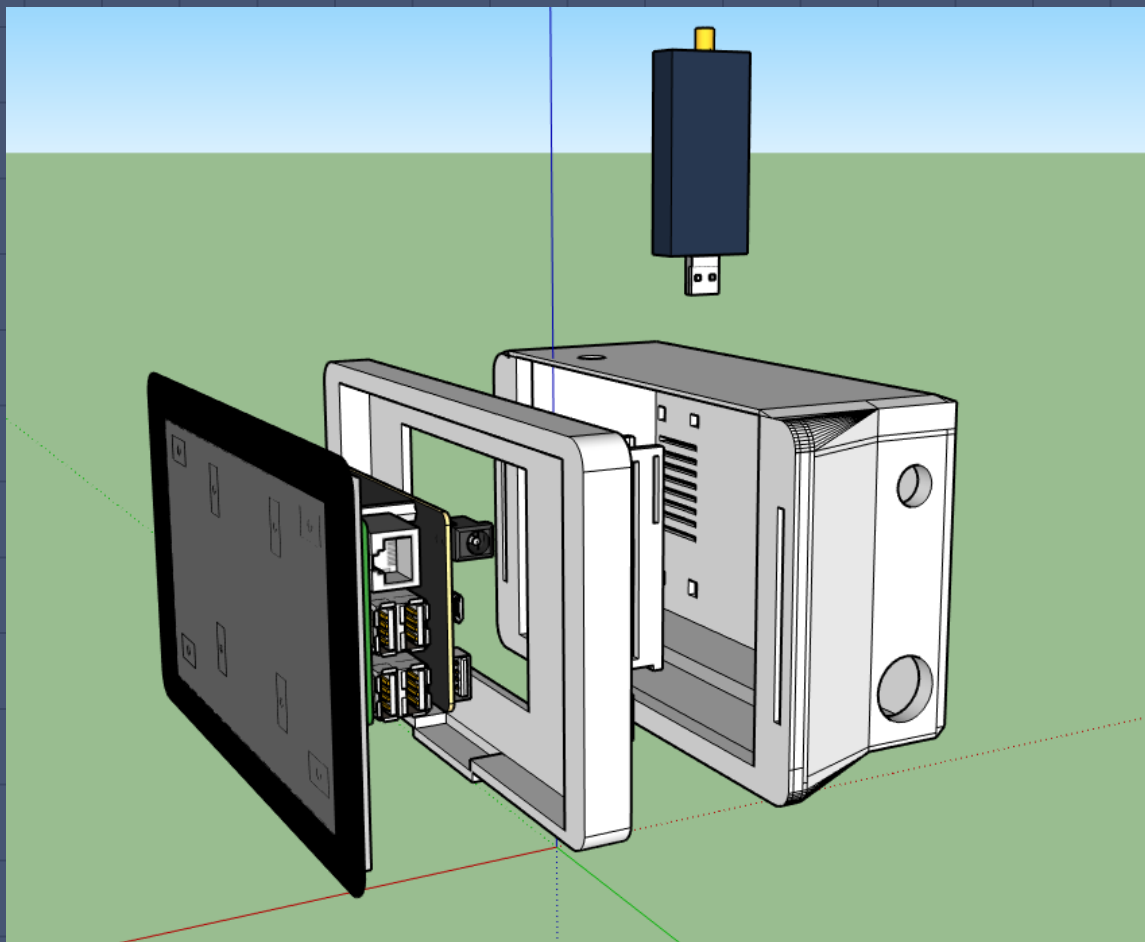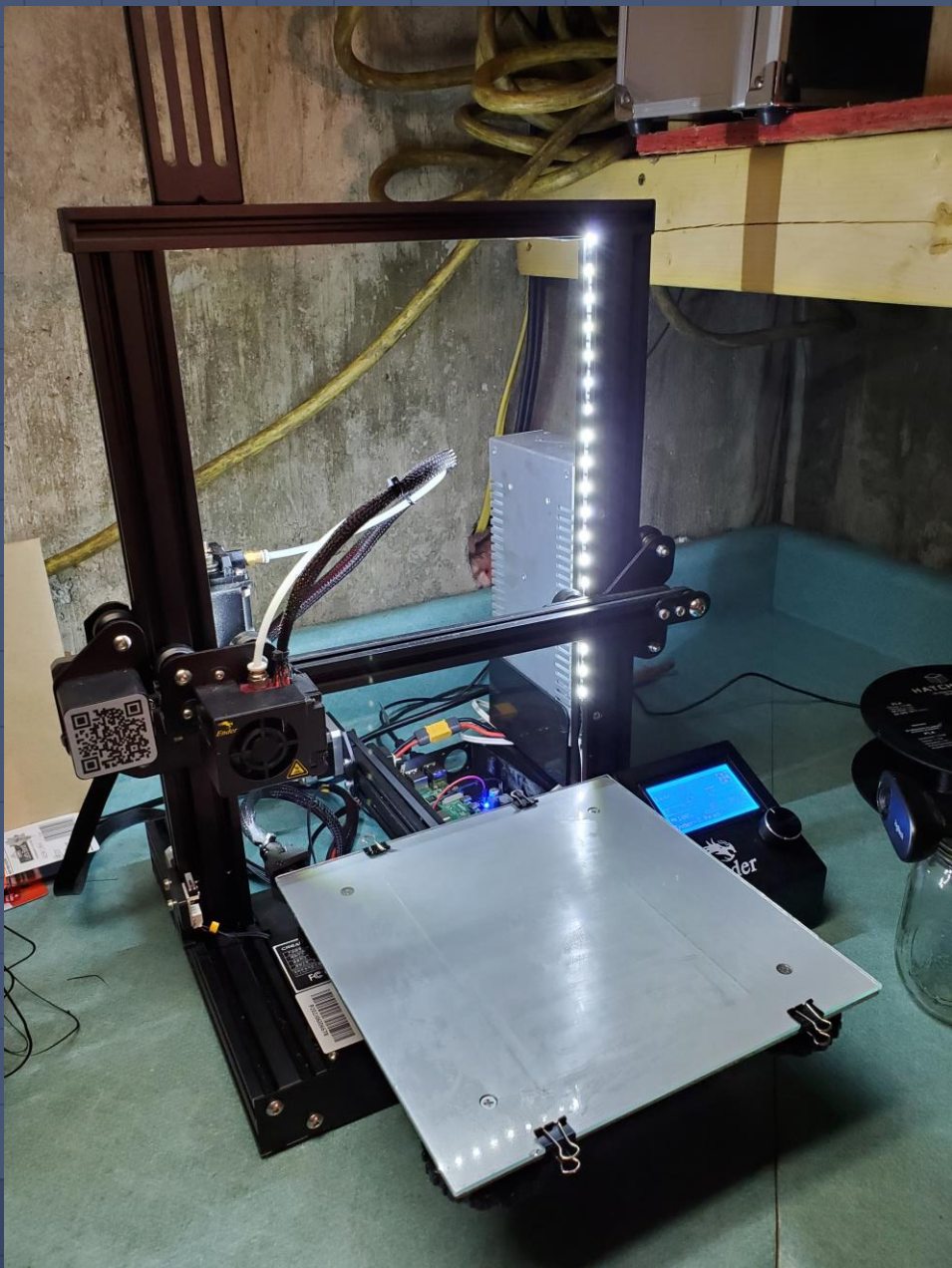
3D Printing

Assembly

Final Result