Old CHAD Notes

- CHAD: It controls the rotation of the payload for prolonged target acquisition

- CHAD is a form of active orientation control
- It uses a single stepper motor to control payload **attitude and heading** using input from AHRS
    - AHRS uses IMU and other components to measure angular rate, acceleration, and Earth's magnetic field
    - 3-axis magnetometer → **(AHRS Input)**
        - Detects a magnetic field
    - 6-axis gyroscope + accelerometer → **(AHRS Input)**
        - Detects angular rate and acceleration

- Goals: To allow stepper motor to rotate payload without bearing its weight
- To hold the AHRS in a constant position relative to the stepper motor

- Serial communication means output communication
    - Serial communication between AHRS and Motor Controller

- 2 arduinos present - Motor Controller and AHRS

- Stepper motor is protected by steel magnetic shield in order to not allow Earth's magnetic field tamper with electrical devices
    - Its magnetic field was interfering with the magnetometer's measurement, so the shield was built

- Four parts - Main Housing, Motor Seat, Payload System, Turntable
- Stepper motor and 2 arduinos go on Main Housing
- The payload arm attached to Turntable; it bears the weight of the Payload
- **The additional piece needed to attach Payload arm to Payload**

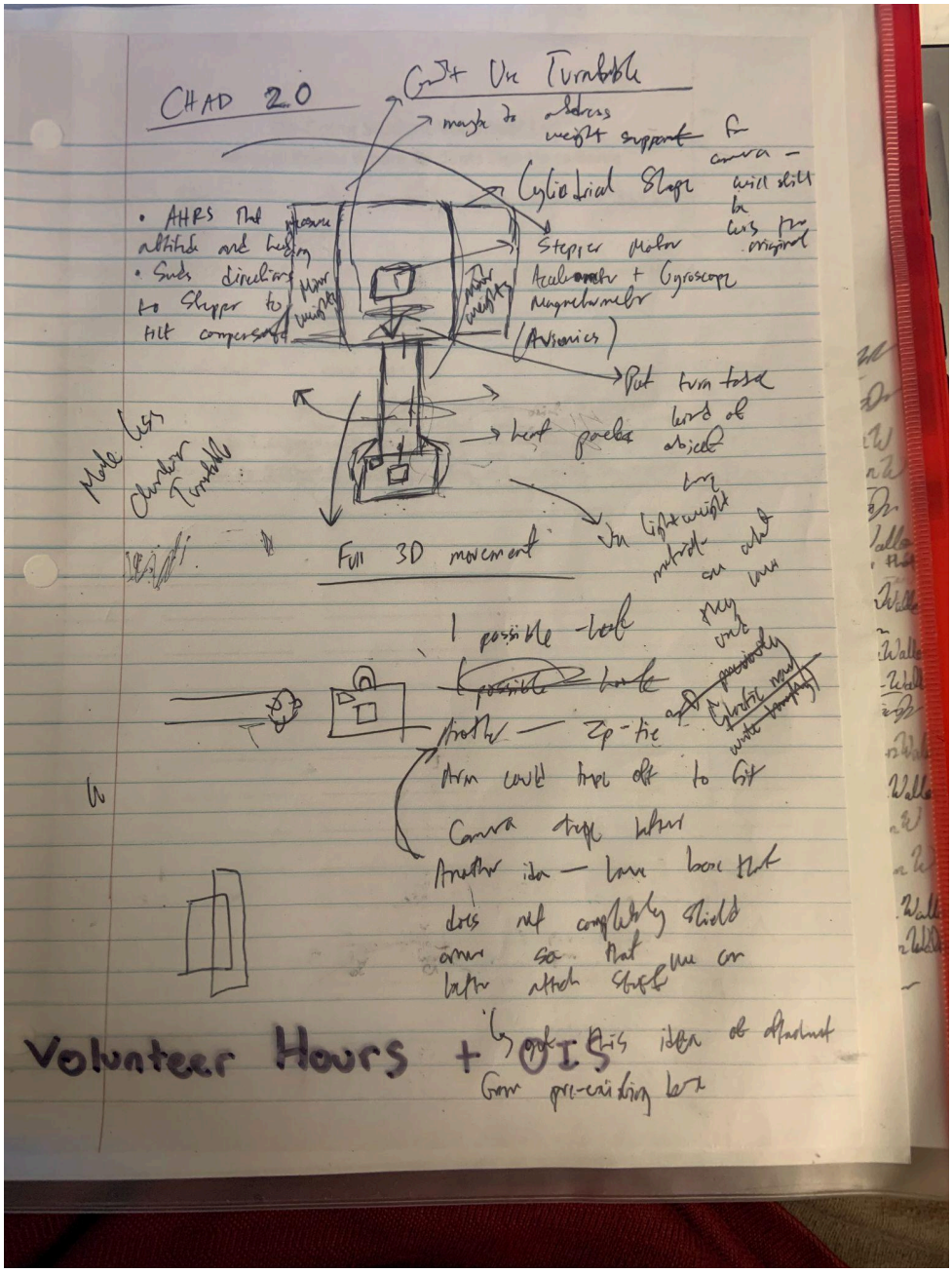
- An Arduino program calibrated the 6-axis accelerometer and gyroscope offsets
    - Calibration: Ensuring that the equipment is still accurate

- Magnetometer has to be calibrated after CHAD is built
    - Prevents hard iron effects in data → caused by external magnetic field
    - Prevents soft iron effects in data → caused by ferromagnetic materials
- To calibrate Magnetometer data, an algorithm called **MagCal** was used (MatLab)

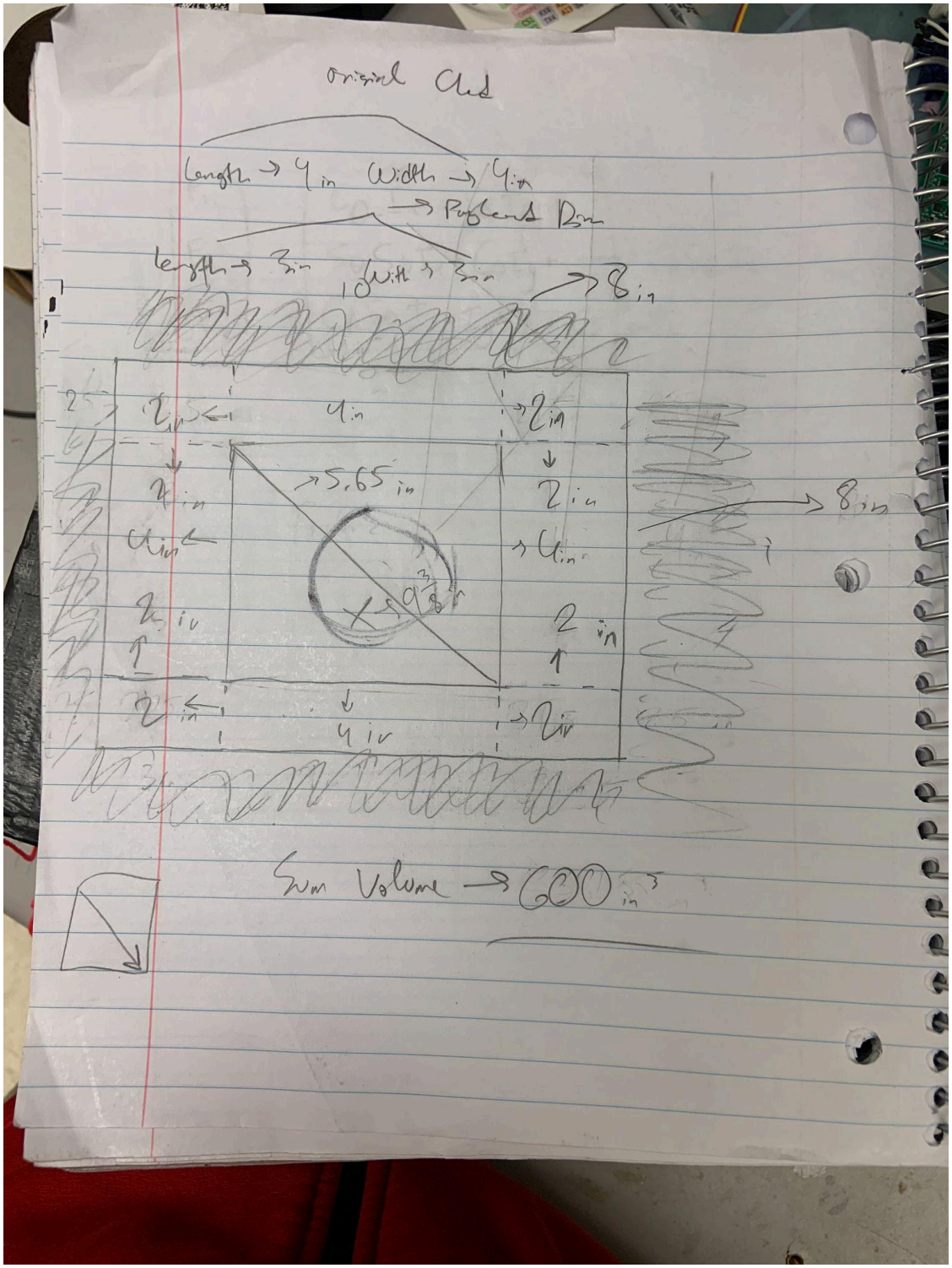
- Tilt Compensation (Finding North): Necessary to find an accurate heading for the payload; allows CHAD to focus on the target
    - By "derotating" the data given by the magnetometer, we can find the yaw from the horizontal components
- To perform the de-rotation, the pitch and roll of the accelerometer and gyroscope is measured and used

- This allows us to find the X-angle
- The NED model is used to describe the axes of the magnetometer when it is in its normal position

Picture of my new CHAD Design:



Picture of my Pointing Project Payload Box Design


original Cut
Length → 4 in Width → 4 in
→ Prefered Dim
length → 3 in Width → 3 in
→ 8 in
2 in
4 in
5.65 in
8 in
Sum Volume → 600 in³