Major Components List and the engineering analysis for their selection process.

1. **Airframe**: SonicModell AR WING PRO
   1. The SonicModell was selected as because the larger wing span and increase wing area enabled our design to have a higher carrying capacity needed with the additional weight being added. In addition, this specific airframe has a large enough cargo space that could house the ModiFly Base without significant restructuring.
   2. How much Payload can our plane hold? (60-70g / dm2)
   3. SonicModell Wing Area ~28 dm^2
      1. Estimated Root Chord = 268 mm
      2. Estimated Tip Chord = 170 mm
      3. Wing Span = 1000mm
   4. Estimated 1680-1960g payload capacity
   5. Empty Kity Weight: 340g
2. **VTOL Propellors and motors**: iFlight Xing-E Pro 2207(4pcs)
   1. Base Mounting Pattern: 16x16mm M3 Thread
   2. Motor Wire Length: 150mm / 20AWG
   3. Internal Resistance (Rm): 81.5mΩ
   4. Max Burst Current <10s: 35.22A
   5. Motor Dimension: 28.5x19.7mm
   6. Idle Current @12.6v (Io): 1.2 A
   7. Weight: 33.8g (150mm wires)
   8. Shaft Diameter: 4mm / Steel
   9. Max Power (W) 60s: 845W
   10. Magnets: N52SH Curved
   11. Stator Diameter: 22mm
   12. Configuration: 12N14P
   13. Bearing Size: 9x4x4
   14. Cells (LiPo): 2-6S
3. **VTOL Battery**: Zeee 4S Lipo Battery 2200mAh 14.8V 100C
   1. Weight: 185g
4. **Forward Propulsion Propellor and motor**: Leopard LBP3674 / 2.5D
   1. The Leopard motor was selected with the combination of the ZTW ESC and a 8x4.25 inch propellor to provide enough forward thrust to comfortably fly with the additional weight. Ecalc was used with the airframes specifications and the payload capacity to determine the necessary motor/ESC/prop combo.
   2. Weight: 315g
5. **Forward Propulsion ESC**: ZTW Mantis 85A ESC
   1. Length: 47mm / 1.85in
   2. Width: 35mm / 1.37in
   3. Height: 15mm / 0.59in
   4. Weight: 57g
6. **Forward Propulsion Battery**: Zeee 4S Lipo Battery 6000mAh 14.8V 100C
   1. Weight 580g
7. **Airspeed Sensor**: Matek Digital Airspeed Sensor ASPD-4525
   1. The Matek airspeed sensor was selected due to its compatibility with ardupilot software. The sensor is needed to avoid stalling the aircraft and monitor its current speed.
   2. Weight: 3.5g
8. **Flap Servo Motors**:
   1. 2pcs 9g metal gear servo
9. **Modifly Base Components** (Total Weight not including 3D printed case ~85.6g)
   1. **Flight Controller**: PixHawk 4
      1. The flight controller was upgraded from the Flywoo Goku F745 to the PixHawk4 for the extra serial ports needed to control the additional servo motors and additional motors that come with the VTOL module.
      2. Weight: 15.8g
   2. **Power Distribution Board**
      1. Weight: ~16g
   3. **Radio Transmitter**: Futaba
      1. The Futaba transmitter was selected as it uses the s.bus2 protocol to exchange signals with the radio control receiver. This transmitter is also small and lightweight
      2. 2.4GHz signals
      3. 8/32 Channels
      4. Size: 0.98 x 1.86 x 0.56" (24.9 x 47.3 x 14.3mm)
      5. Weight: 10.1g
      6. Power Requirement: 4.8-7.4V
      7. Battery F/S Voltage: Sets up with a transmitter.
      8. Extra Voltage Port: 0 ~ 70V DC
   4. **I2C Splitter Module**: Smakn Pixhawk I2C
      1. 5 parallel I2C connections
      2. 4-bit socket
      3. Weight: ~5g
   5. **LiDar** : TF-Luna LiDAR single-point ranging module
      1. The LiDar has obstacle avoidance built into the code. This provided the ModiFly Drone 8m of object detection for a low cost.
      2. Detecting Range: 0.2m~8m
      3. Field of View: 2°
      4. Supply Voltage: 5V±0.1V
      5. Frequency: 100Hz
      6. Data Interface: UART/I2C
      7. Weight: 5g
   6. **Bluetooth Module**
      1. The bluetooth module is small and lightweight keeping the overall weight of the modifly down without taking up necessary space for larger components.
      2. Size: 37.5 x 16.5 x 4.4mm
      3. Weight: 10.1g
      4. Power Requirement: 4.8-7.4V
   7. **4:1 ESC**: HAKRC 45A 2-6S BLHeli\_S 4in1 ESC
      1. The HAKRC ESC was chosen due to the PixHawk 4 not having a built in 4:1 ESC like the Flywoo Goku needed to control the VTOL motors.
      2. Weight: 13.6g
   8. **GPS Module**: Goku GM8-5883 v1.0
      1. This GPS module will provide a 2 meter accuracy for outdoor operations and is compatible with the Ardupilot software we are using the firmware. It will allow us to plot flight paths for the drone to fly through autonomously.
      2. Dimension: 28mm x 28mm x 8.5mm
      3. Weight: 10g
      4. Accuracy Position Horizontal: 2.0 m CEP 2D RMS SBAS Enable (Typical Open Sky)
      5. Support Rate: 4800bps to 921600bps, Default 9600bps
      6. Data Level: TTL or RS-232, Default TTL level
      7. Data Protocol: NMEA-0183 or UBX, Default NMEA-0183