Meeting with Robert Hudson: Wednesday, November 29, 2017

Students were evaluating the system in the wrong order. We needed find the power required to maintain the system, find the volumetric flow rate required at that power, then evaluate for the time to reach equilibrium.

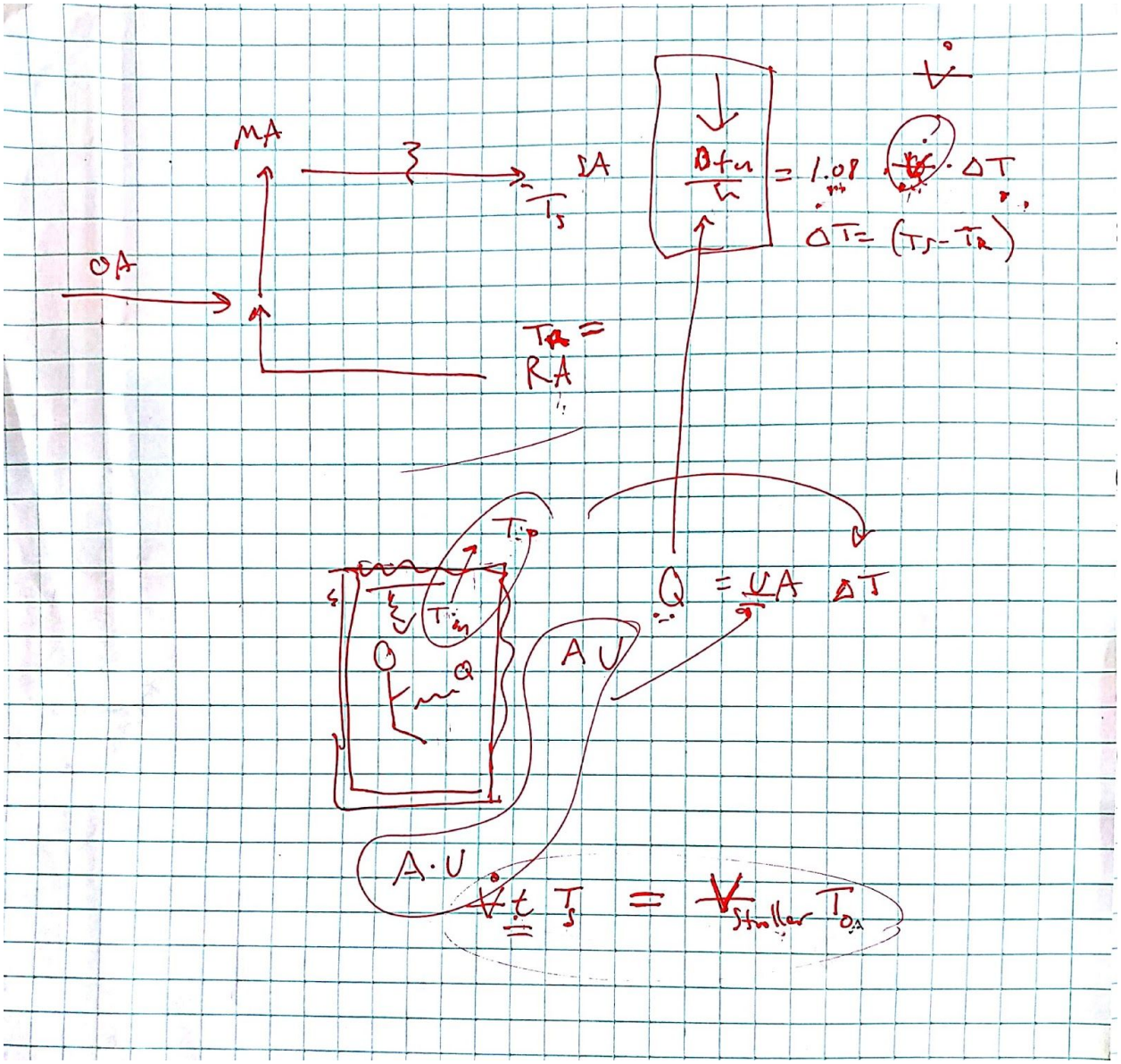

Figure 1: Schematics of Static and Dynamic System Model

DYNAMIC SYSTEM

OA = OUTSIDE AIR
SA = SUPPLY AIR
RA = RETURN AIR

$$\dot{V} t T_{SA} = V_{STROLLER} T_{OA}$$

$$t = \frac{V_{STROLLER} T_{OA}}{\dot{V} \quad T_{SA}}$$

STATIC SYSTEM

$$Q = 1.08 \dot{V} \Delta T = 1.08 \dot{V} (T_{SA} - T_{RA})$$

T_{OA} = 40 [°F] to (-40 [°F])
4.4 [°C] to (-40 [°C])

T_{RA} = [redacted] [°F] to 55 [°F]

$T_{SA} = T_{OA}$

$$Q = UA \Delta T$$

U-VALUE/ R-VALUE (THERMAL TRANSMITTANCE)

A = AREA

(ΔT = TEMP DIFF. $T_2 - T_1$)

Figure 3: Student Implementation of Analysis

Reference ASHRAE Standard 55 (change of human comfort zone)

For complex analysis of the system, California Berkeley Comfort Tool:
http://comfort.cbe.berkeley.edu/

- Can set various environmental temperatures and change what the child is wearing to see if the baby would truly be comfortable in the stroller pod

Additional Information/Considerations:

Supply Temp ↑ = Volumetric Flow Rate ↓

Home forced convection systems discharge supply air at ~ 85-95 [°F]

How much oxygen does a baby use per breath?

Is there enough oxygen in the space to last 1 hour?

General design rule of thumb: 5 [cfm]/person in office space

We'll need significantly less because children have lower respiration rates and we don't have to force air through a large space.

Alternative Design Options

Electric heating coils: radiant heat tape/rope

Battery selection: USB UPS (uninterrupted power supply)

Ventilation design: use permeable fabrics (or mesh) instead of nozzles/vents