

101年大學部國際交流甄選專題成果展



Analysis and Improvement of Leonardo's Tank

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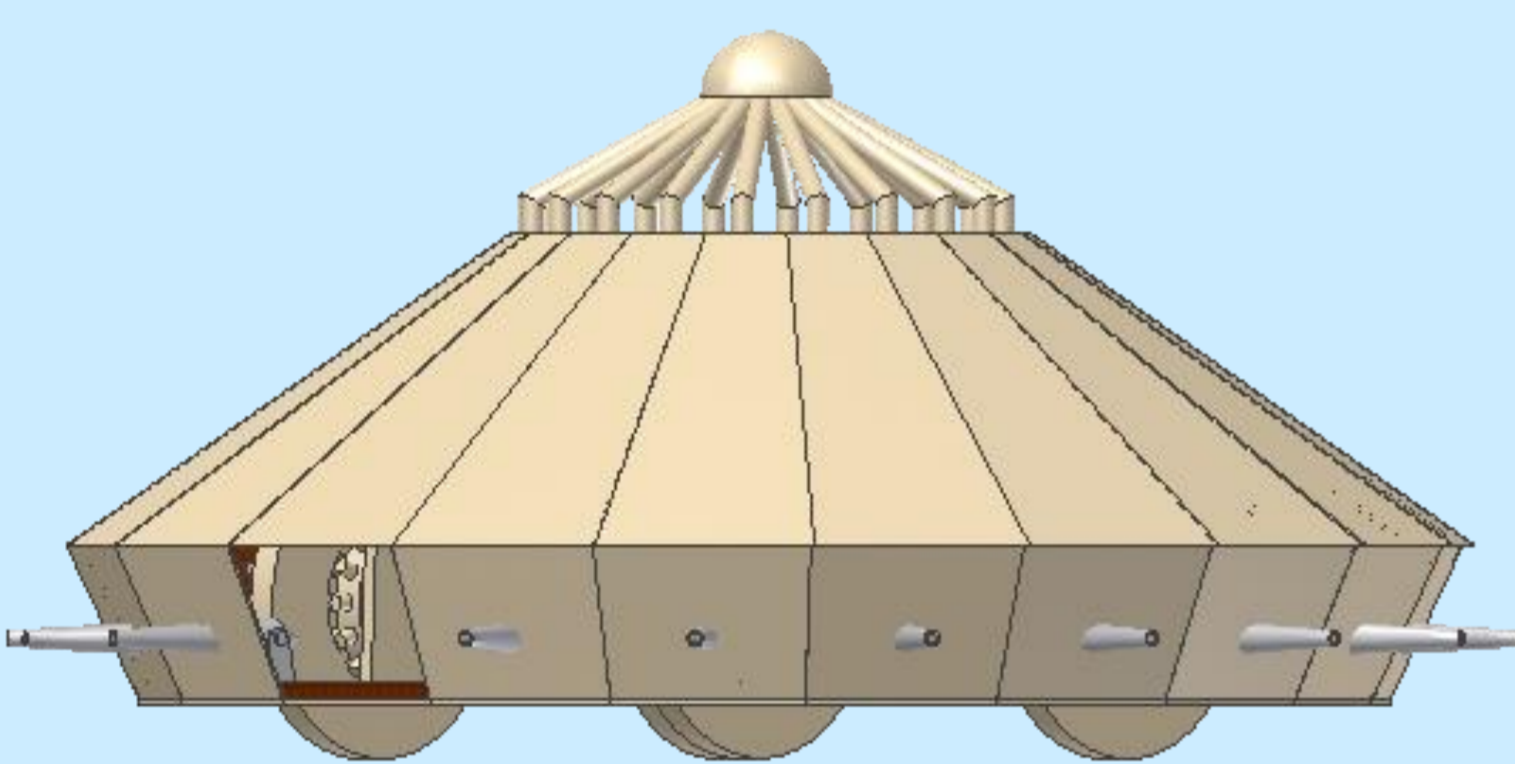
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Abstract

Based on Leonardo's codex, we analyzed and redesign the tank to make the capacities of the tank better than the traditional design. We divided the capacities into three parts those are transmission, turning and moving on the slope.



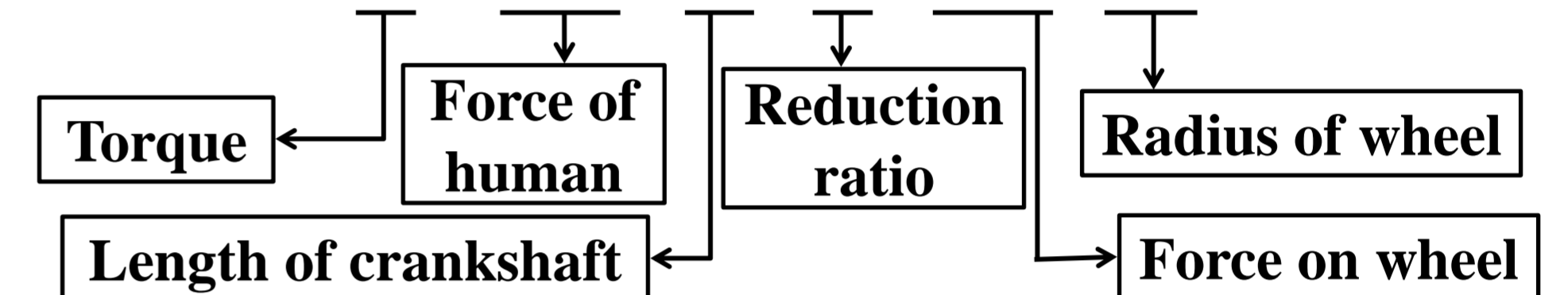
Leonardo design the transmission of tank in two sides, left and right. But we consider that to improve the problems, we should change them into the front part and the back part.



From the codex, we can know that the tank is driven by human force. Human's maximum force.

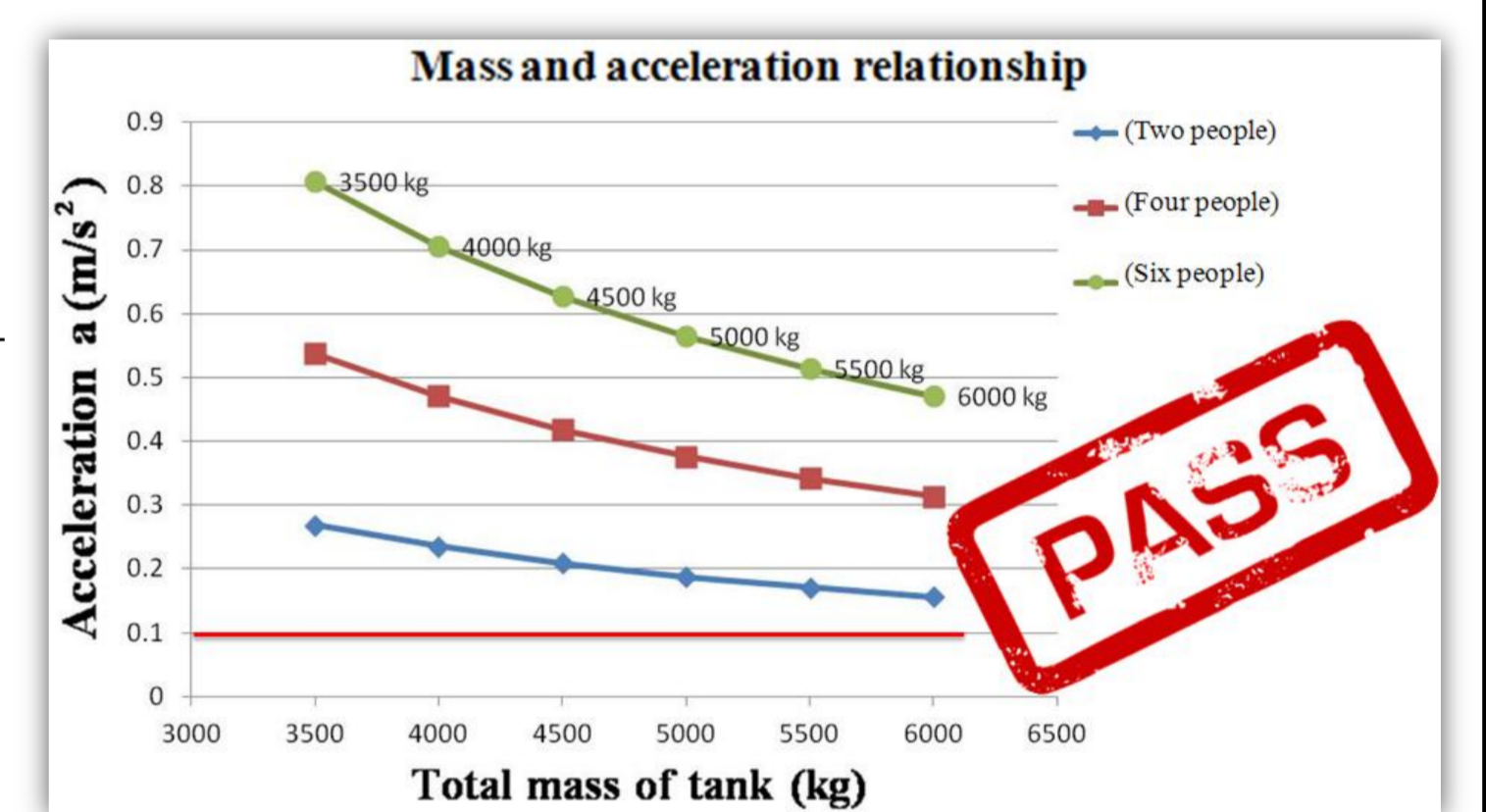
$$F_m = (\text{weight} + 10) \times 0.6 \times 9.8 \text{ (N)}$$

$$T = F_m \times L \times i = F_w \times R$$

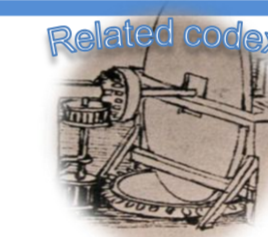


$$F_w = M \times a = \frac{F_m \times L \times i}{R}$$

$$a = \frac{F_m \times L \times i}{R \times M}$$



The acceleration should be higher than 0.1 m/s².

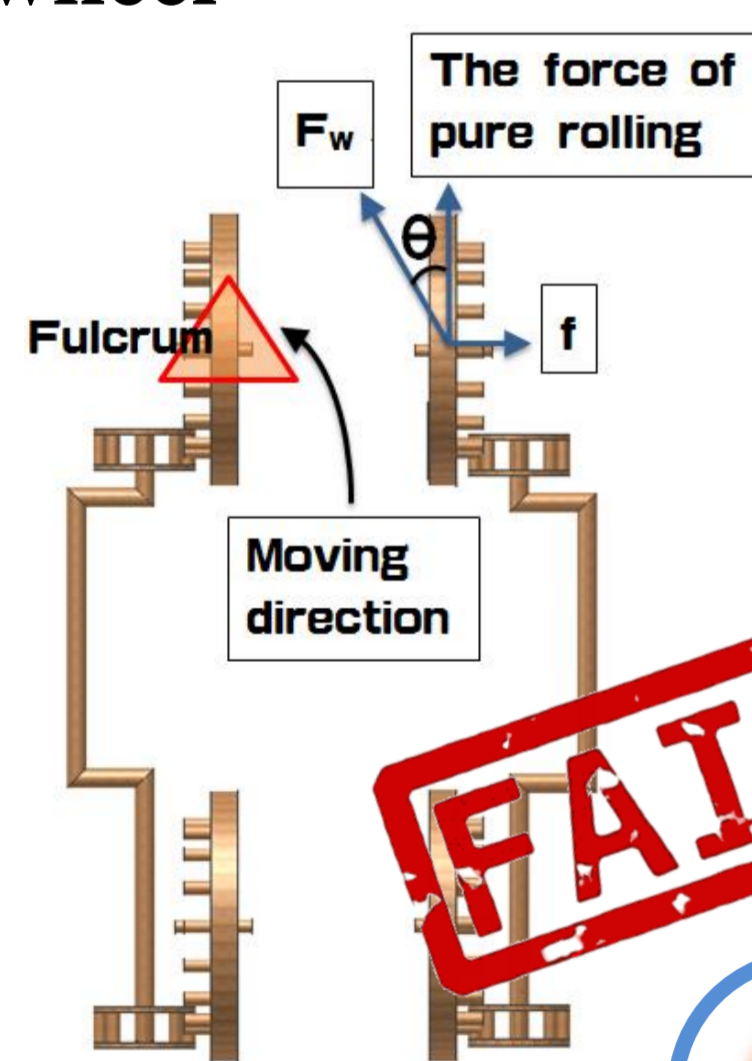


New Designs

Codex and Redesign

Turning

Assume there are six people's force (1411.2 N), and fixed the left top wheel



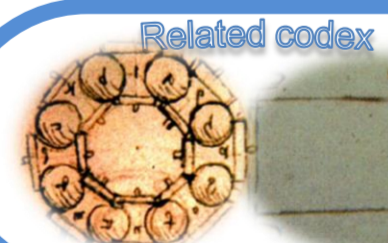
$$T = F_w \times L \times i = F_w \times R$$

$$F_w \times \sin\theta < \mu_s \times N$$

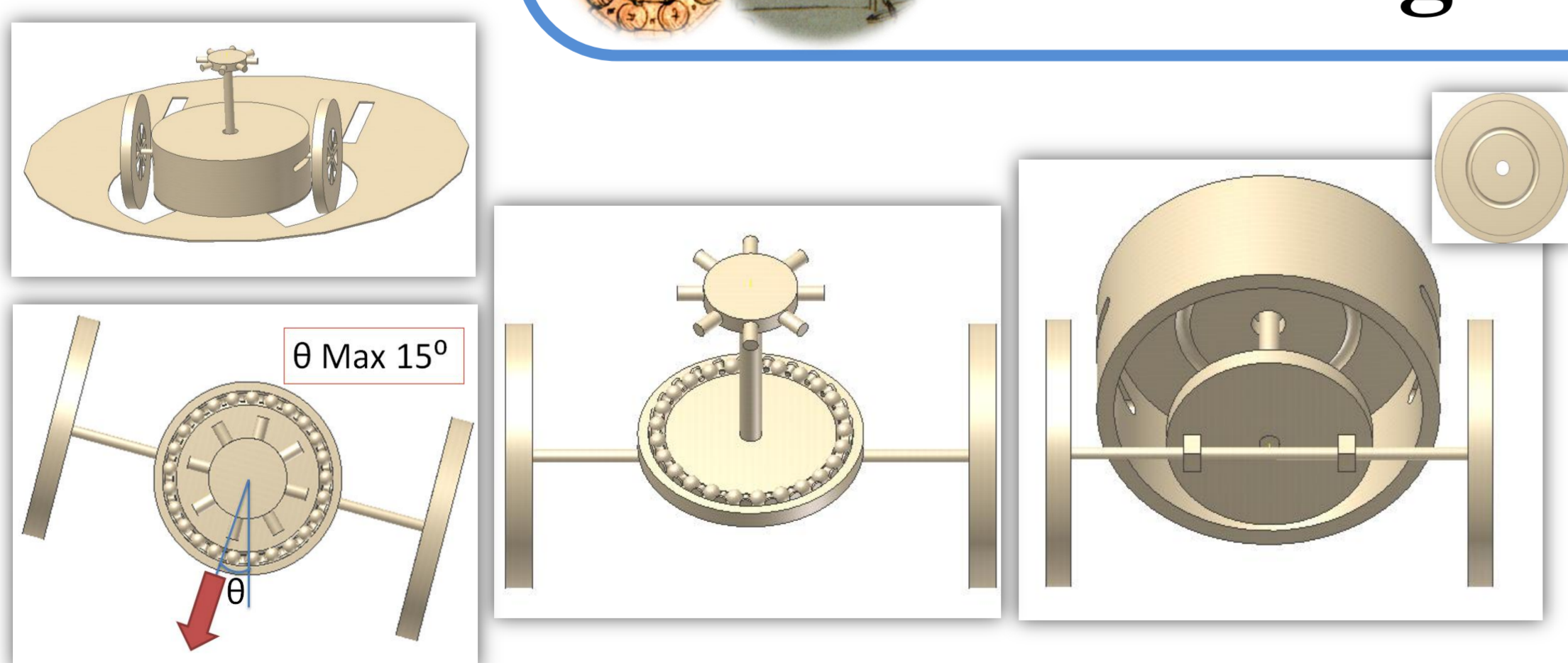
$$\sin\theta = \frac{125}{6} > 1$$

theta is not exist

FAILED

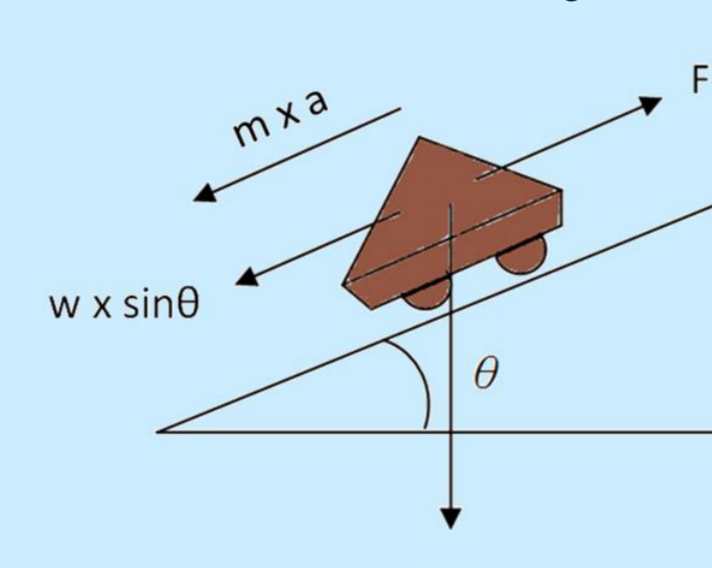


New Designs



We designed the front part of the tank as a turning part. We added a bearing in the turning part and the maximum of the turning angle theta is 15 degree.

The free-body diagram of tank

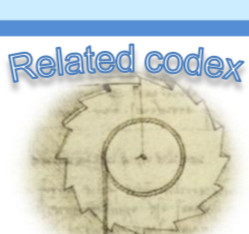


$$F = M \times a + w \times \sin\theta$$

$$M \times a_0 = M \times a_c + w \times \sin\theta$$

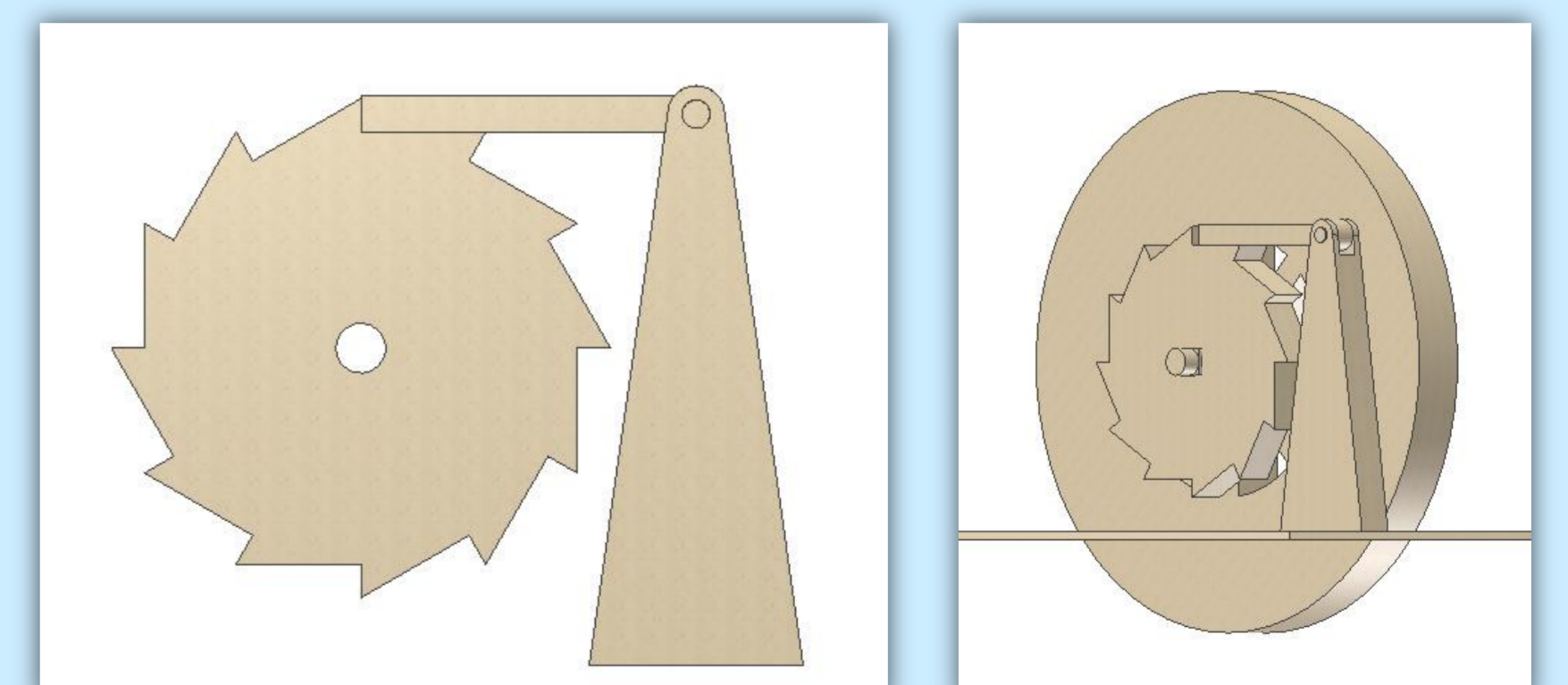
$$\sin\theta = \frac{a_c}{g}$$

General slope is between 10% to 15%. It means each 100m will raise 10m-15m, also equals 5.7° to 8.5°.



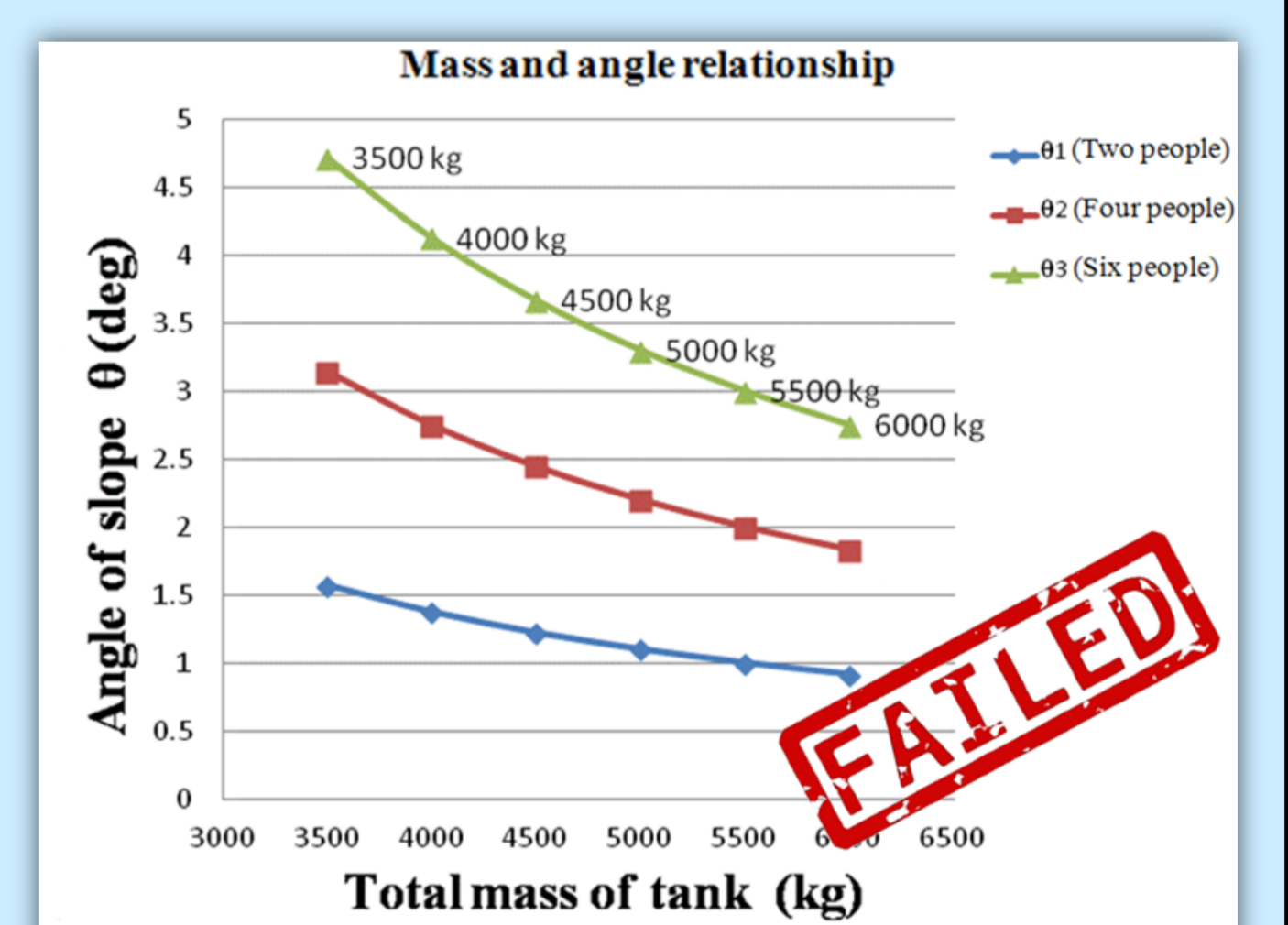
New Designs

We designed a ratchet to prevent the tank going backward.



Transmission

Moving on the slope



FAILED

Conclusion

After we did those calculations and modified the model by Inventor, we figure out Leonardo's tank can be a powerful weapon that he just need to combine with his other designs.

