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Silly Speed: What if production cars continue to get faster at the same rate?

Jake Morris
The Centre for Interdisciplinary Science, University of Leicester
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Abstract
This paper aims to quantify the trend of the top speed of production cars and extrapolate this information to make predictions of possible speeds in the future. The trend obtained predicts that production cars will be able to break the sound barrier in the year 2253, and taken to the greatest extreme predicts light speed capable production cars in the year 310493610. The paper will aim to discuss why this prediction is unrealistic, but also entertain the idea of it being true, by estimating the power output of these hypothetical cars. The power output of a supersonic production car was calculated to be 20486.9 horsepower.

Introduction

The top speed of production cars has steadily increased ever since the introduction of the first production car, with manufacturers now aiming to pass 300 miles per hour (mph) [1]. This paper aims to analyse and extrapolate the trend of increasing speed over time, entertaining the unrealistic idea that they will continue to get faster at the same rate indefinitely.

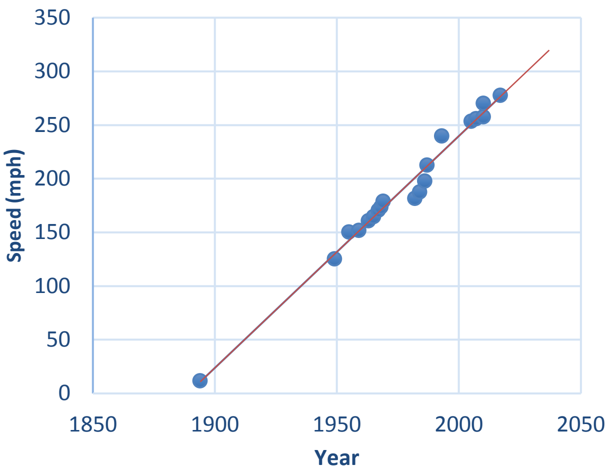

Figure 1 – Trend of production car top speed

Determination of the Trend

The first production car is considered to be the 1894 Benz Velo, which had a 1.5 horsepower (hp) single cylinder engine that took it to a top speed of 12 mph [2]. In 2017 the 1341 hp Koenigsegg Agera RS reached a top speed of 277.87 mph [3], making it the current fastest production car. To plot the trend of top speed over the years the Benz Velo was used as the first point. Every subsequent fastest production car starting from the end of World War 2 [4] was plotted until the Koenigsegg in 2017 to give the trend shown in figure 1. This shows a remarkably linear trend, with an R^2 value of 0.982 indicating very little deviation from the linear regression line. From this regression, the year at which production cars will reach a certain speed can be predicted. This is assuming the linear trend continues indefinitely. The year and speed approximate the following relationship:

$$Year = \frac{Speed + 4080}{2.16}. \tag{1}$$

Using equation 1 it was determined that if this trend continues, production cars will be breaking the sound barrier at 767.3 mph in the year 2253, and in the year 310493610 the production cars will be capable of light speed.

Limitations and Power Requirements

Obviously, these predictions are extremely unlikely to be representative of reality. Cars are never going to be driving around at the speed of light due to many limitations. The most significant of which being the relativistic mass increase close to the speed of light.

Tires need to be specially designed for them not to be torn apart at current speeds. They are already close to their limits of g force tolerance on current production cars, let alone vehicles capable of orders of magnitude greater speed. Humans will also be incapable of controlling a vehicle at such speeds. It should also be noted that land speed record vehicles have already reached supersonic speeds, with the Thrust SSC holding the record at 763 mph, and the 135,000 hp Bloodhound SSC looking to reach over 1,000 mph [5]. However, these jet engine powered cars share more in common with jet planes than production cars, and their designs are in no way suitable for road use. It is however interesting to ignore these fundamental issues to consider certain factors in this hypothetical scenario. For instance, how many horsepower would the engine of a sound barrier and light speed capable production car have? This can be estimated from the power required to overcome the drag forces of travelling at such high speeds, which will be primarily air resistance. The rolling resistance from the tyres will be assumed to be negligible at very high speeds compared to air resistance. The power required to overcome air resistance is given by:

$$P = C_D \frac{1}{2} \rho v^3 A, \tag{2}$$

where C_D is the drag coefficient, ρ is air density, v is velocity and A is the body area of the car [6]. The Koenigsegg has a drag coefficient of 0.33 [7], and a frontal area of 1.873 m² [8], and air density can be assumed to be 1.225 kg m^{-3} [9]. Assuming future production cars will share similar aerodynamic properties to the Koenigsegg, equation 2 can be used to estimate the power required to overcome air resistance at different speeds. The power required for a production car to break the sound barrier is therefore:

$$P = 0.33 \times \frac{1}{2} 1.225 \times 343^3 \times 1.873$$

$$P = 15.3\ MW = 20{,}486.9\ hp.$$

While this is an extremely large amount of power, it is not completely unreasonable, Top Fuel dragsters are currently capable of around half this amount, also using internal combustion engines [10].

To achieve light speed however (ignoring relativistic effects), the power required would be 1×10^{19} MW, or 1.3×10^{22} hp, this is roughly 5×10^{15} times greater than the maximum output of the Hoover Dam [11].

An engine capable of such a power output would likely never be possible at all, let alone in the form factor of a production car, the cooling requirements of such an engine would also be immense, in addition to the fuel and air consumption being unsustainable.

It does appear however that the trend of increasing top speed will continue for the immediate future, the Hennessey Venom F5 is set to be released within the next couple of years. This car is said to develop over 1600 hp and is projected to have a top speed exceeding 300 mph [1]. If these projections are true, this car will exceed 300 mph roughly 16 years earlier than predicted by equation 1. The trend of top speed will eventually plateau, but it appears that point may be further off then perhaps expected.

Figure 2 – Hennessey Venom F5 [1]

Conclusion

It appears that the top speed of production cars has increased over time following a remarkably linear trend. Extrapolating this trend predicts that production cars will be supersonic by the year 2253, and capable of light speed in the year 310493610. It was calculated that this would require an engine capable of developing 1.3×10^{22} hp. Due to the impossibility of these figures it can only be assumed that the linearity of this trend will eventually end, but cars may get significantly faster before then.

References

[1] Hennesseyperformance.com (2018) *Hennessey Venom F5 | Hennessey Performance*. Available at: http://hennesseyperformance.com/vehicles/hennessey/venom-f5/ [Accessed 15th March. 2018]

[2] En.wikipedia.org (2018a) *Benz Velo*. Wikipedia. Available at: https://en.wikipedia.org/wiki/Benz_Velo [Accessed 15th March 2018]

[3] Koenigsegg (2018) *Koenigsegg Agera RS - NEW WORLD RECORD - Fastest production car in the world*. YouTube. Available at: https://www.youtube.com/watch?v=KD82XB7t8Xo [Accessed 15th March 2018]

[4] En.wikipedia.org (2018b) *Production car speed record*. Wikipedia. Available at: https://en.wikipedia.org/wiki/Production_car_speed_record [Accessed 15th March 2018]

[5] Bloodhound SSC (2018. *BLOODHOUND SSC*. The Bloodhound Project. Available at: http://www.bloodhoundssc.com/ [Accessed 15th March 2018]

[6] Engineeringtoolbox.com (2018) *Lift and Drag*. Engineeringtoolbox. Available at: https://www.engineeringtoolbox.com/lift-drag-fluid-flow-d_1657.html [Accessed 15th March 2018]

[7] En.wikipedia.org (2018c) *Koenigsegg Agera*. Wikipedia. Available at: https://en.wikipedia.org/wiki/Koenigsegg_Agera [Accessed 15th March 2018]

[8] Wade, S. & Astrén, E. (2017). *Agera RS - Koenigsegg*. Koenigsegg. Available at: https://www.koenigsegg.com/agera-rs/ [Accessed 15th March 2018]

[9] En.wikipedia.org (2018d) *Density of air*. Wikipedia. Available at: https://en.wikipedia.org/wiki/Density_of_air [Accessed 15th March 2018]

[10] En.wikipedia.org (2018e) *Top Fuel*. Wikipedia. Available at: https://en.wikipedia.org/wiki/Top_Fuel [Accessed 15th March 2018]

[11] En.wikipedia.org (2018f) *Hoover Dam*. Wikipedia. Available at: https://en.wikipedia.org/wiki/Hoover_Dam [Accessed 15th March 2018]