

University of Wales Trinity Saint David

Wales Institute of Science and Art



Report On Vehicle Development

Introduction to Automotive Engineering (ACHA4009)

April 2022

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Chapter 1 – Introduction

In this report, I will be discussing the forward development of my vehicle of choice throughout the eight chapters that I have chosen throughout the eleven lessons. I will be going through each chapter with the best capability to show and discuss my vehicle of choice.

For this report, my vehicle of choice is going to be the 1990 Acura/ Honda NSX as I feel this car fits well in my chosen topics and I believe the Acura/ Honda NSX has enough interesting history and detail that would be fitting for this report.

In this report, I would also like to mention that I will be referring to this vehicle as the Honda NSX but it was also known as the Acura NSX.



Figure 1: Picture of the NSX (Jxopays, 2022)

Chapter 2 – Impact of The topics

For the next eight topics, I will be discussing and showing the impacts the following topics have on the Honda NSX. I will also be inserting references to show that the information is valid and trustworthy.

2.1 – Materials

When Honda started to develop the NSX they had to choose a material that was light and ridged because this vehicle aimed to be a lightweight sports car, they had experimented with carbon fibre but their final choice was going to be aluminium. (Media, Aug 2nd, 2018)

When Honda decided to make the chassis out of aluminium they had to make a special request from their suppliers as Honda has never had a vehicle that is purely made of aluminium. Once Honda received the five specific aluminium alloys they got to produce their lightweight ridged monocoque chassis. When the vehicle was produced, Honda wanted to test and refine its vehicle by giving the car to Ayrton Senna to test on the Suzuka race track. Senna claimed the car felt “fragile” so Honda went back to the design boards and managed to make the car 50% stiffer than the last prototype and 40% lighter than an equivalent chassis made of steel. (Media, Aug 2nd, 2018)

Once the Honda was released to the public the critics couldn't get enough of the lightweight aluminium chassis saying that it handles similar to vehicles in its class whilst being 450lbs lighter than its competitors making it handle far better and making it more fuel economic. (flaminio, feb 27, 2008)

When it came to the motor of this vehicle Honda made the engine block out of aluminium the pistons were made out of forged aluminium and the connecting rods were made out of forged titanium alloy. Alongside the double wishbones being made of forged aluminium. Honda wanted to use the lightest most ridged materials they can get to make this car the best they could. (Media, Aug 2nd, 2018)



Figure 2: Bare monocoque of the NSX (Honda, Jun 18, 2018)

2.2 – Manufacturing Processes

Honda requested from the material supplier that the body of the car would be stamped sheets of aluminium that would be spot welded together to form the body of the car, the suppliers were shocked as a request like this was never asked of beforehand as they thought during this process the metal will buckle and bend during the process. Some of the parts of the vehicle would cause problems such as the side seals of the car so a new metal forming process had to be thought of, this would be heating the metal to 600 degrees, then pouring it into dies and then extruding whilst being drawn. This caused the metal to have very strong highly rigid honeycomb frames. So after this, this technique was adopted as it satisfied the needs of the vehicle. (Honda, Jun 18, 2018)

For the engine and suspension of the NSX Honda decided that forged components would be best suited for the case (Media, Aug 2nd, 2018). Forging is when you get the ingots of the aluminium or blocks and through high compressive forces, the piece is formed into the desired shape giving the internal microstructure a different and more accommodating structure that follows the shape of the new forged piece also if an alloy is being forged all the internal voids that are created will be eliminated due to the crushing forces hence making the piece even stronger. (Solutions, 2021)



Figure 3: Pre pressed door sides from dies (Walendy, Sep 27, 2016)

2.3 – Aerodynamics

Honda achieved a CD of 0.32 for the NSX this is due to the wedge profile of the vehicle. The front of the NSX displaces a small amount of air it then instantly picks up the air which causes the attached flow which then is held on up until the sharply cut rear trailing edged. The air that is used to cool down the engine enters the motor through the integrated side scoops of the car which causes a minimal amount of flow disturbance that exits underneath the car in a low-pressure area. As the rear slope of the car continues throughout the bodywork up until the trailing edge, the wake that is produced by the car is very small. With no need for the rear wing to be mounted up high the wing is placed in the laminar flow path as there is no area of turbulence behind the rear window, which the rear window tapers to the centre of the vehicle to reduce turbulence. (Knowing, feb 15, 2007)

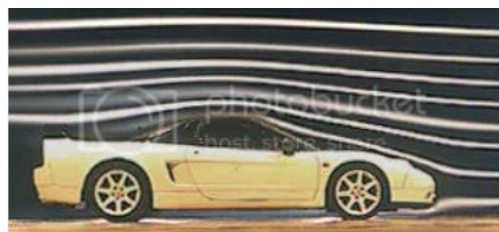


Figure 4: a wind tunnel of the NSX (stuntman, Jan 7, 2015)

2.4 – Electronic Control Systems

Even though this car was made in 1990 Honda did equip this car with some modern amenities such as traction control and a four-channel anti-lock braking system. For the anti-lock braking system (ABS) Honda put a sensor on each wheel, this gives each wheel independence when being controlled and when maximum braking force is applied the pressure is modulated through each wheel to prevent lock-up. This system was beneficial due to the mid-engine chassis as there is a mass majority weight to the rear of the car. (blue_myridn, March 29, 2016)

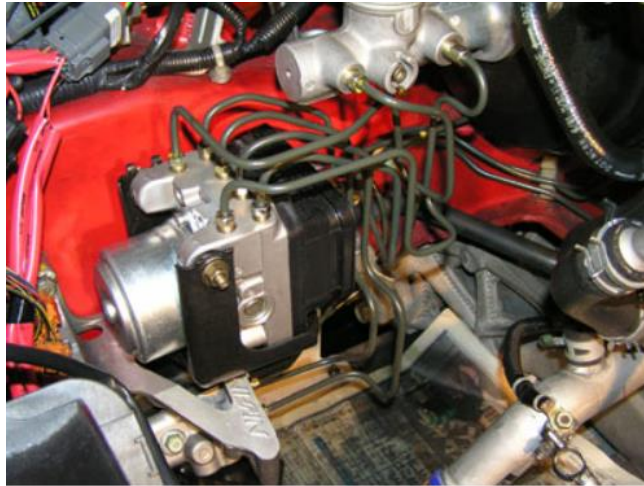


Figure 5: A Honda ABS unit (GTOneUSA, Nov 7, 2007)

2.5 – Emissions

The Honda NSX had a fuel consumption of 10 litres/100k- 28mpg UK and 24 mpg-US, each tank had an estimated range of 700km or 435 miles and the car had made 239g/km of carbon dioxide (ultimateSPECS, March 19, 2016). If you compare this to its competitors with the same v6 platform such as the Mitsubishi 3000GT 3.0 V6 this car had a fuel consumption of 11.1/100km- 25mpg UK and 21 mpg-US, it had a range of 675 Km or 420 miles and the car made 265g/km of carbon dioxide (ultimateSPECS, Oct 23, 2021). As you can see Honda's NSX performed better in the emissions than the 3000GT and the Honda was lighter and faster than the 3000GT even though they had the same v6 platform.



Figure 6: NSX Exhaust (Motorsports, 2021)

2.6 – Data Analysis

The NSX was a great car for its day and still is today and if we compare its specifications to the 3000GT we can see that even though the Honda was less powerful it was overall a better vehicle for the track. First of all the 1990 NSX was a rear-wheel-drive car that had a 3.0 naturally aspirated V6 that was producing 270 Horsepower and 284Nm of torque (ultimateSPECS, March 19, 2016). Whilst the 3000GT V6 was an all-wheel-drive twin-turbocharged car that also has a V6 that was producing 282 Horsepower and 407Nm of torque (ultimateSPECS, Oct 23, 2021).

Now after looking at the power specifications, you may think how was the NSX was faster than the 3000GT V6, this is due to the huge weight difference as the NSX has a fully aluminium monocoque chassis giving a weight difference of 360 kilograms, therefore this makes the NSX faster in 0-60 and lighter. The NSX 0-60: 5.5s. The 3000GT 0-60: 5.9s. Also, the implementation of VTEC helped the NSX with its fast acceleration. All of these factors make the NSX keep the same speed as the 3000GT whilst being lighter and less powerful, this means the car can be more fuel-efficient and less stress on the motor is applied due to the car needing to do less work to achieve the same result as its competitor.

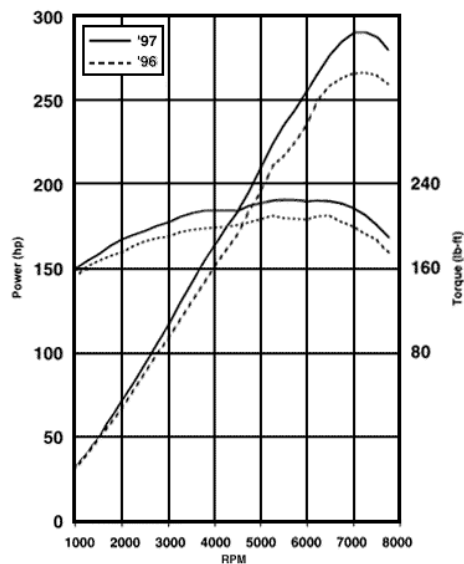


Figure 8: Dyno Graph on 1990 NSX (nsxtasy, Aug 22, 2006)

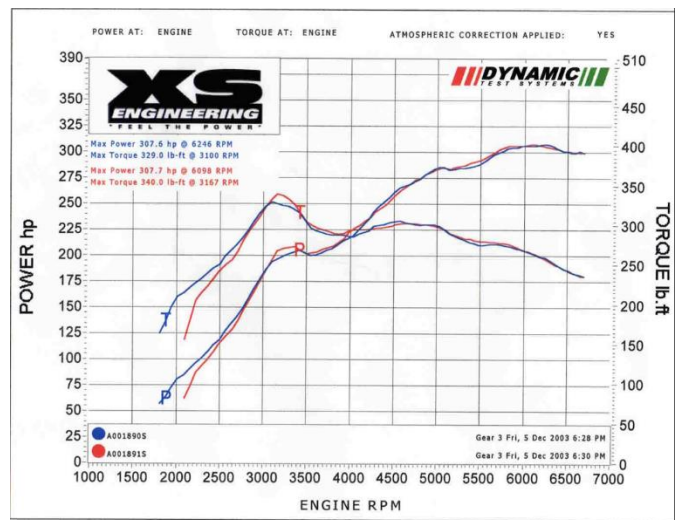


Figure 7: Dyno Graph on 1992 3000GT (MagnumForceGTO, Dec 8, 2003)

2.7 – Computational Engineering

For the first-generation NSX, there isn't a lot of information out there for computational engineering but I am sure that Honda had done a lot of testing of the vehicle and revised thought it. Honda did go through 6000 different tire sets before they selected a compound and tire size they were happy with. (Media, Aug 2nd, 2018)

2.8 – Computational Simulation

The same follows for the simulation aspect of this car, there isn't much available information about this car publicly. I am most definitely positive that Honda did their best making the NSX what it is today.

Chapter 3 – State of the Current Industry

Even though the NSX is as legendary as it is it wouldn't fit in today's standard of the vehicle due to its age and style. First of all the car wouldn't fit into the euro six standard because when the car was first made the euro standard wasn't even a thing up until 1992, and that's when the car followed the euro 1 emission standard. As well as the features and styling of the vehicle, today's cars have moved on so far along looking more and more futuristic every day and the technology that is given to these modern-day cars is remarkable. Even though the electronic management for the NSX was advanced and impressive for a sports car in its day there are now more advanced features in your average road car than the NSX. I feel the change in the car industry has been dramatic but a good thing for manufacturers and finding ways to make safer and more environmentally friendly cars is a very good thing, although as a car enthusiast it is a bit upsetting seeing the cool classics become redundant in today's standard and it's not because they are bad cars they just don't simply fit anymore due to a change of demand.

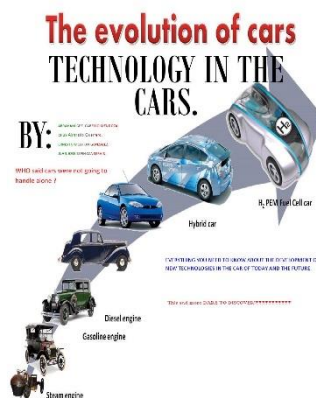


Figure 9: An image showing the evolution of the car (chinkin, Sep 16, 2014)

Chapter 4 – Conclusion

Overall I feel the NSX was a great car for its day and age and going over this report and researching the car helped me learn a lot more about the car than I thought. I feel the car was a remarkable and ground-breaking vehicle for its time. I feel that this car satisfies all the points with great information and heritage, but I feel that for this car to continue into the future a third rendition will have to be made to meet today's standards of emissions and technology and futuristic design, I know the second generation follows this a lot better than the first due to the car being made closer to the modern age but it would be nice to see Honda make a new exciting concept.

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