HUMMER

By Pawel “Sariel” Kmieć

Datasheet:

Completion date: 18/06/2014
Power: electric (Power Functions)
Dimensions: length 63 studs / width 30 studs / height 30 studs
Weight: 3.947 kg
Suspension: full independent
Propulsion: 4 x PF XL motor geared 7:1 (low gear) / 2.5:1 (high gear)
Motors: 4 x PF XL, 1 x PF Servo, 4 x PF M, 1 x micromotor

Ever since the 42021 Snowmobile set came out, with the new steering arms, I wanted to combine them with the LEGO® portal wheel hubs. The result would be a proper, robust portal axle with independent suspension, something I have tried to build using less specialized pieces in my Humvee, but failed. Of course, such an axle would be wide, and there is only one very wide vehicle with portal axles and independent suspension that comes to my mind: the Hummer. I have built two Hummers before, in 2010 and 2011, but seeing as they had their flaws, I decided to give it a third, final try. Which also happens to mark 30th anniversary of introducing the original Humvee, which comes off the same assembly line as the Hummer, into service. Incredibly, after 30 years the Humvee is still being produced, with 10,000 units deployed in Iraq War alone – while the Hummer went out of production in 2006.

2010

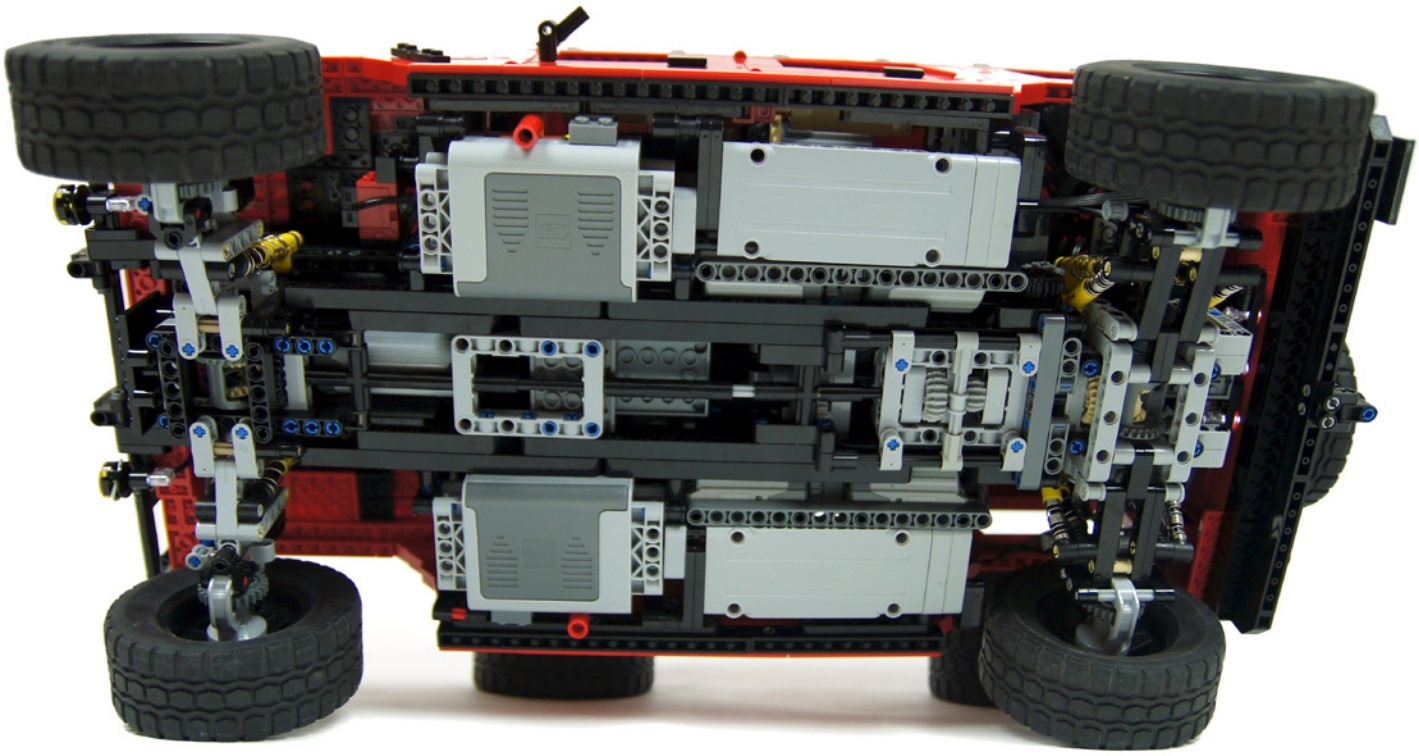
2011

2014

The model was built with two goals in mind: to look better than the two Hummers before it, and to drive better than my last large-scale off-road model, the Dakar Truck. Large scale enabled me to include some details that were missing from earlier models, while using PF system instead of the RC one made sure the model had plenty of torque needed for off-road driving.

Dakar Truck

On the technical side, the model was built around a massive studless chassis, heavily reinforced to prevent bending despite the enormous wheel span. A simple 2-speed gearbox was located in front of the rear axle, shifted by a PF M motor using one small linear actuator. The input and output of the gearbox remain fixed, and it shifted by simply forcing double bevel gear wheels to slide along axles. In front of the gearbox were the four hard-coupled PF XL motors, two of which had their directions inverted by a PF switch to reduce the number of gear wheels required. In front of the cabin, below and between the front seats, were two PF battery boxes, each powering two PF XL motors, and a 8878 PF rechargeable battery powering everything else. Such location of the battery boxes improved the weight distribution, which was impaired by the very rear-heavy Wagon body.



The body itself, while massive in appearance, was actually just a thin shell attached around the studless frame. It was actually quite delicate, full of windows and doors, and it was simply sitting on top of the chassis, not bearing any loads. The entire model was held together by chassis alone, which was robust enough for the model to be picked up while holding just front and rear. The body included four opening doors, hood and a trunk with two doors. The interior was simple, with some tan detail on the doors' inside, and with two tan seats taken straight from my 2010 Dodge Challenger.

The suspension system relied on the steering arms attached to portal hubs in "upside down" position – that is, the upper arm is facing upwards and the lower arm is facing downwards, exactly the opposite of standard design – and being spaced 3 studs apart, which improved stability of wheels, as the hubs were attached to the arms near their topmost and lowermost points. It wasn't easy to balance such a heavy model with a rear-heavy body on an independent suspension. In the end, the front and rear suspension assemblies varied a lot, with the rear suspension being supported by additional four short shock absorbers.

The steering was controlled by PF Servo motor located under the hood, and coupled with a micromotor rotating the steering wheel. The model was so heavy, the PF Servo struggled with the return-to-center function even on flat floor.

Other functions included motorized windshield wipers, automated turn signals and automated reverse lights. The last two functions were controlled by a single PF M motor each, using a number of PF switches, exactly the same way as in my old Tow Truck 2.

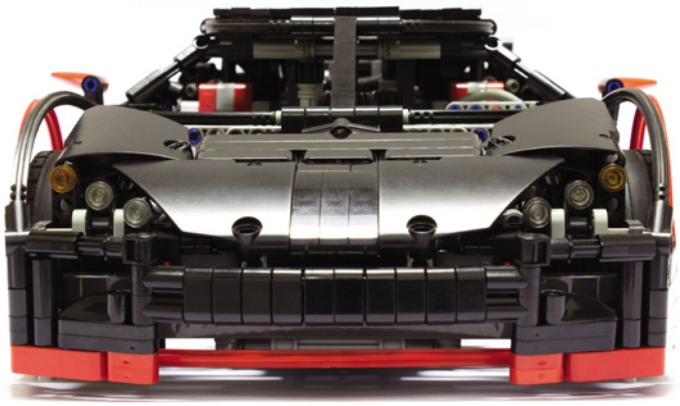
The interesting thing about the original Hummer is that it's not as simple as it appears. Upon closer inspection, one discovers that the sides of the body are slightly tapering upwards, that the lower edge of the body sides is slanted near the rear wheels, or that the rear windows reach all the way up to the roof, and are topped with arches whose shape doesn't match any existing LEGO® pieces. These were the details I was forced to omit because of how the body was built and how it was attached to the chassis. Also, there was a studless frame behind the second pair of doors, to which the body was attached, and it forced me to move the rear side windows further away from the doors, and to ignore the Hummer's indented fuel inlet. Modeling the inlet required building "into" the body, and it was not possible with the body being just a thin shell with beams underneath.

The finished model turned out much heavier and slower than I have anticipated. The high gear was intended primarily for driving downhill, and it was impressive that it could be used on flat ground, too. The low gear provided enough torque to tow the 42030 Volvo loader without much effort – however, an attempt to scale a curb damaged gears between the gearbox and the motors. One of the problems with this model was that its sheer size and weight made it difficult to transport it far from my home, which is why I found no ground suitable for downhill driving.

In the end, the model was sluggish, but good-looking and mechanically sound. I was happy that it handled its immense weight without serious problems, and that the suspension, especially the front one, remained stable and functional under such weight, even when negotiating difficult obstacles. However, I consider it an argument against building heavy.
#

INCREDIBLE LEGO® TECHNIC

CARS, TRUCKS, ROBOTS & MORE!



Paweł “Sariel” Kmieć

Incredible LEGO® Technic

Enter a world of machines in Incredible LEGO® Technic, a unique gallery of LEGO models with a technical twist. From tanks to tow trucks, all the models use the LEGO Technic system’s collection of gears, pulleys, pneumatics, and electric motors to really move. You’ll see how expert builders use differentials, suspensions, and complex gearing in their creations. Photos of over 70 LEGO models include design notes and breakaway views of the mechanisms inside. Whether you’re a beginning builder or a long-time LEGO fan, Incredible LEGO Technic offers you a unique look into the artistry and engineering that make LEGO come alive.

About the Author

Paweł “Sariel” Kmieć is a LEGO Technic enthusiast based in Warsaw, Poland. His LEGO creations have been featured in many magazines and on the world’s most popular LEGO blogs. Sariel is a guest blogger for the official LEGO Technic website and is a LEGO Ambassador for Poland. He is YouTube’s most viewed LEGO Technic builder and the author of The Unofficial LEGO Technic Builder’s Guide.

You can find more information about the book at: http://sariel.pl/book2
#

Pictures courtesy of No Starch Press.