

Mechanical Wonders of All Sizes

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The industrial arts of mechanical engineering are all around us and seen in many forms and technologies. Of greatest interest is how these wonders are designed, constructed and used. From the smallest home appliance to the behemoths used for outside building and excavation projects, for example, mechanical engineering drives the conception and completion of such wonders. And while, as mentioned, these machines are everywhere, a surprising number of them go unnoticed and unheralded. Following are just a few examples of the power, motion control and ingenuity needed to make these machines and devices a reality.

Aircraft Carrier USS GEORGE H.W. BUSH (CVN-77)

Named for President George H.W. Bush, the (CVN-77) was built by Northrop Grumman Newport News and commissioned in 2009. CVN-77 is the last among the Nimitz Class aircraft carriers that are nuclear powered. The total cost of building the ship was \$6.2 billion. This giant carries two nuclear reactors that can power the ship for more than 20 years without refueling. The CVN's maximum speed is recorded at more than 30 knots. She has a unique bow design that reduces the drag by providing better hull efficiency and bet-



Aircraft Carrier USS GEORGE H.W. BUSH (CVN-77) (Source: U.S. Navy photo by Mass Communication Specialist 3rd Class Nicholas Hall/Wikimedia Commons.)

ter buoyancy to the forward portion of the carrier. The vessel stretches to about 1,092 feet and has a flight deck 76.8 m wide and 332.9 m long. She carries a total of 6,000 crew members and accommodates more than 60 aircraft. Including the stores, fuel, ammunition, and water, it has a full load displacement of about 102,000t.

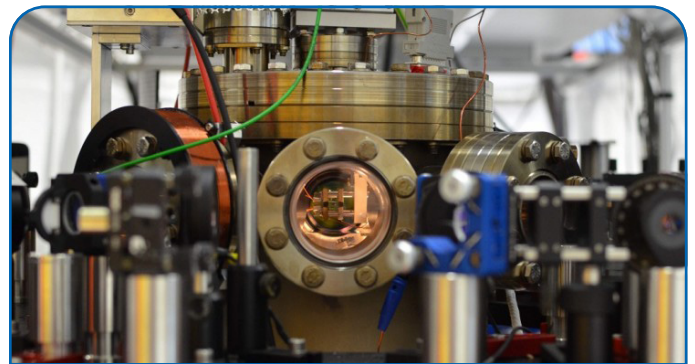
RoboFly — A Tiny Flying Robot That Can Operate Wirelessly

No, this not a Hollywood special effect. Engineers from the University of Washington have designed a robotic fly that is half the size of a paper clip and weighs in at only one-tenth of a gram. The wireless flying robot is made possible through a photovoltaic cell, which is attached above the RoboFly and converts the remotely pointed invisible laser beam to elec-

tricity. The fly is also equipped with a microcontroller that acts as a brain to help the RoboFly gain control over its own wings. It essentially directs the wing muscles when to flap hard and when not to. While the current iteration of RoboFly is still limited in terms of capabilities, there are plans to develop an advanced version with integrated batteries, advanced brains and sensor systems which will help the fly to navigate and perform tasks on its own. Most importantly, the completely realized robotic fly will have significant potential in areas of search and rescue missions, surveillance, climate monitoring and more.

Nano Engine — An Engine that Works on a Single Atom

Scientists at the University of Mainz in Germany were successful in building the smallest working engine ever created. It is powered by a single electrically-charged calcium atom and reputedly has the similar thermodynamic efficiency (when scaled to size) of an average automobile engine. Indeed, the nano engine follows the same thermodynamic cycle that occurs in a normal car engine. However, in this case, the power generated is converted into a vibration of an atom that provides the mechanical motion. The scientists in their experiment were also able to observe a power output of 10^{-22} watts with an efficiency of around 0.3 percent. While there admittedly at this time may not be any direct application of the single-atom engine, with modifications, this micro-engine can lead to more opportunities in studying small quantum machines.



Nano Engine – Engine That Works On A Single Atom (Source: AG QUANTUM/JGU.)

Belaz 75710 — World's Largest Dump Truck

With a massive weight of 793,664 lbs., the Belaz 75710 is indeed the world's largest dump truck with a hauling capacity of 992,080 lbs. To achieve such a feat, the giant dump truck consists of eight wheels, each capable of supporting 224,872 lbs. The gigantic truck is powered by two 16-cylinder diesel engines that churn out an incredible 3,430 kW of horsepower with a top speed of 64 km/h. Built by a Belarusian company, this big guy comes with a cost of about \$6 million. **PTE**

Source: Kashyap Vyas, *Interesting Engineering*.