The statistical analysis of the space race

The space race

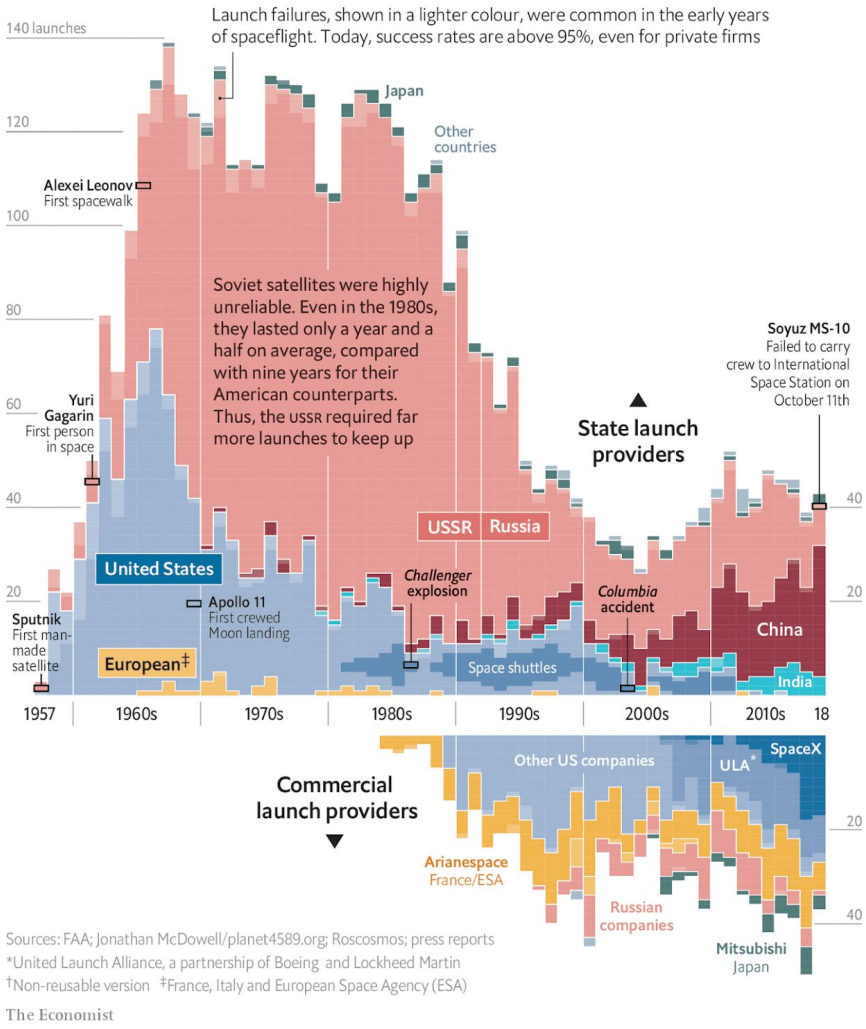
The spaceflight industry is worth 450bilion dollars. Also according to cbs news
In 2018, governments and companies around the world spent a record $415 billion on satellite-based entertainment, weather forecasting and other services. Wall Street analysts expect the "**space** economy" to top $1 trillion within the next 20 years. This is why big names such as Elon Musk, Jeff Besos and others are flocking in. Despite all this traffic Elon Musk and SpaceX Came out on top.

SpaceX

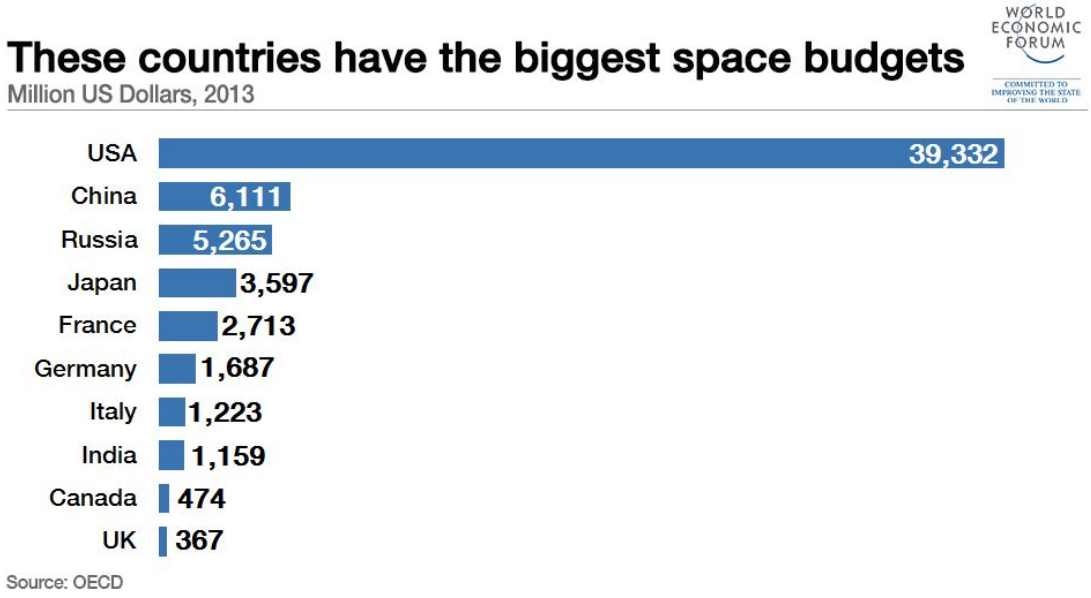
made history on Sunday August 30 2020 when they successfully launched and landed two Falcon 9 rockets. According to wikipedia **Falcon 9** is a partially reusable two-stage-to-orbit medium-lift launch vehicle designed and manufactured by SpaceX in the United States. It is powered by Merlin engines, also developed by SpaceX, burning cryogenic liquid oxygen and rocket-grade kerosene (RP-1) as propellants. Its name is derived from the fictional Star Wars spacecraft, the *Millennium Falcon,* and the nine Merlin engines of the rocket's first stage.[15][16] The rocket evolved with versions v1.0 (2010–2013), v1.1 (2013–2016), v1.2 "Full Thrust" (2015–present), including the Block 5 Full Thrust variant, flying since May 2018. Unlike most rockets, which are expendable launch systems, since the introduction of the Full Thrust version, Falcon 9 is partially reusable, with the first stage capable of re-entering the atmosphere and landing vertically after separating from the second stage. This feat was achieved for the first time on flight 20 with the v1.2 version in December 2015.

Falcon 9 can lift payloads of up to 22,800 kilograms (50,300 lb) to low Earth orbit, 8,300 kg (18,300 lb) to geostationary transfer orbit (GTO) when expended, and 5,500 kg (12,100 lb) to GTO when the first stage is recovered.[1][17][18] The heaviest GTO payloads flown have been Intelsat 35e with 6,761 kg (14,905 lb), and Telstar 19V with 7,075 kg (15,598 lb). The latter was launched into a lower-energy GTO orbit achieving an apogee well below the geostationary altitude,[19] while the former was launched into an advantageous supersynchronous transfer orbit.[20]

This statistic (below) shows that Russia is dominating satellites



But this statistic shows that the USA has the biggest budget



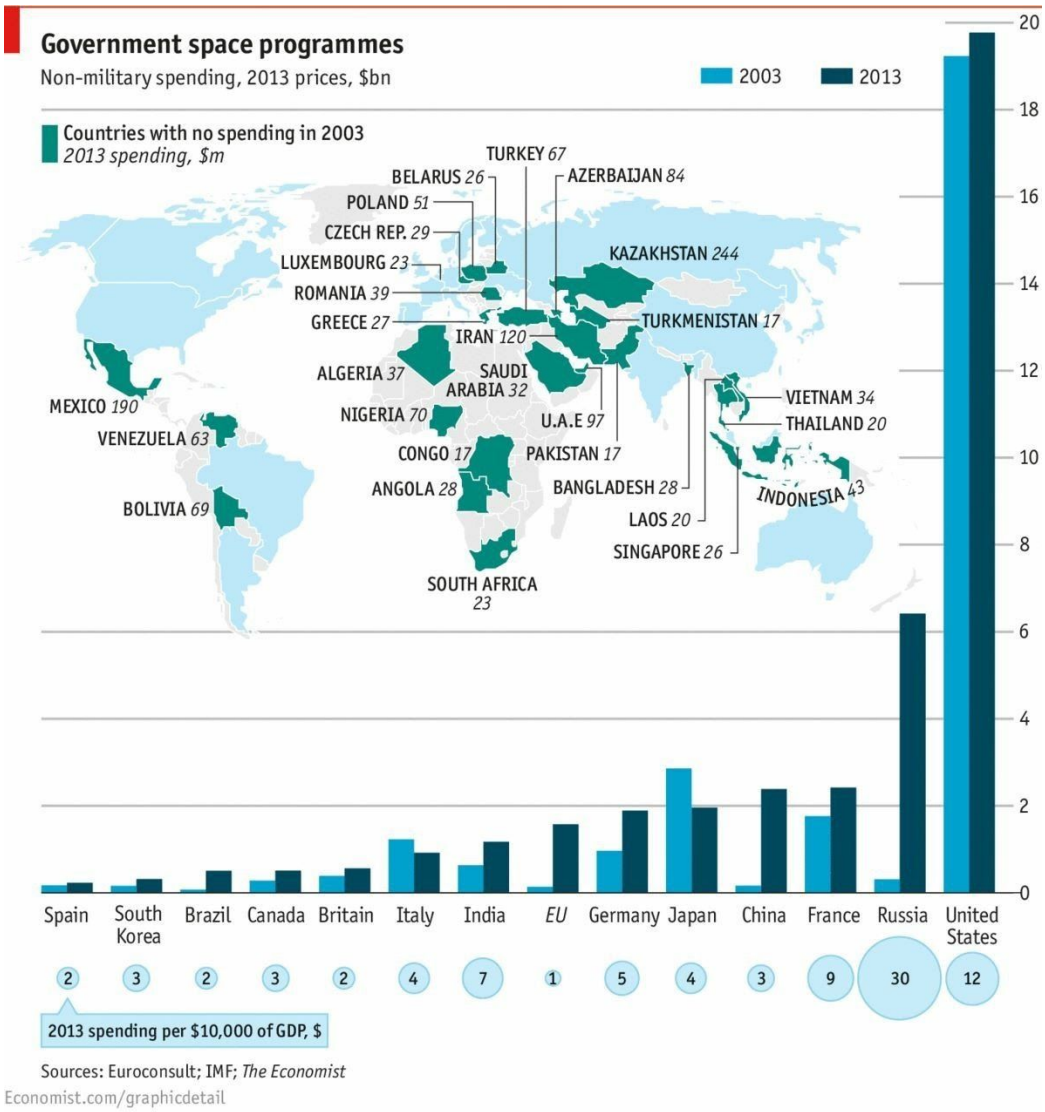
Cryogenic propellent

SpaceX loves to use Cryogenic propellent and Cryogenic fuel. According to wikipedia Rocket engines need high mass flow rates of both oxidizer and fuel to generate useful thrust. Oxygen, the simplest and most common oxidizer, is in the gas phase at standard temperature and pressure, as is the simplest fuel hydrogen. While it is possible to store propellants as pressurized gases, this would require large, heavy tanks that would make achieving orbital spaceflight difficult if not impossible. On the other hand, if the propellants are cooled sufficiently, they exist in the liquid phase at higher density and lower pressure, simplifying tankage. These cryogenic temperatures vary depending on the propellant, with liquid oxygen existing below −183 °C [90 K] and liquid hydrogen below −253 °C [20 K]. Since one or more of the propellants is in the liquid phase, all cryogenic rocket engines are by definition either liquid-propellant rocket engines or hybrid rocket engines.[2]

Various cryogenic fuel-oxidizer combinations have been tried, but the combination of liquid hydrogen (LH2) fuel and the liquid oxygen (LOX) oxidizer is one of the most widely used.[1][3] Both components are easily and cheaply available, and when burned have one of the highest enthalpy releases in combustion,[4] producing a specific impulse of up to 450 s at an effective exhaust velocity of 4.4 km/s. According to frontline.thehindu.com **Cryogenic** propellants are preferred as **rocket** propellants when

rockets have to carry payloads of high mass because they have the greatest efficiency in terms of thrust generated. This efficiency is measured by what is called “specific impulse”.

This statistic (below) shows that the USA is dominating with government space programs.



My thoughts

I think that the space industry is growing a lot. I personally like cryogenic propellent because they contain the highest magnitude of energy. Thank you everyone for reading this, you can join my AI companies research organization on Github.