

# MY PLAN TO **SAVE THE WORLD**



Meet Elon Musk, unassuming inventor of internet success story PayPal, Toyota's new partner in the world of electric vehicles and maybe, just maybe, the man who will save the human race

**IF ELON MUSK WERE THE HERO OF A HOLLYWOOD BLOCKBUSTER, YOU'D THINK HIS LIFE STORY WAS TOO FAR-FETCHED TO BE BELIEVABLE.** By the age of just 31, he had made two separate multi-million-dollar fortunes in the dot-com boom, one of them in 2002 by selling his PayPal online banking system to eBay for \$1.5 billion.

Then, armed with more cash than he could ever reasonably get around to spending on himself, Musk sat down to think about how he could use his vast wealth to change the world. He decided the three biggest issues facing humankind over the coming years would be the rise of the internet, the urgent need to find alternatives to fossil fuels, and the longer-term need to start exploring space properly – just in case the human race one day needs to make a sharp exit from Planet Earth.

Having already 'done' the internet, he took the decision to devote himself to the other two issues. Musk's contribution to the renewable energy problem has been to found both SolarCity, a firm that develops high-efficiency solar panels, and, most famously Tesla, the electric sports car firm whose flagship £100,000 Roadster model will outdrag a Ferrari to 60mph.

Musk's ambitions in outer space are even bigger – nothing less than the establishment of a future human colony on Mars. But he realised early on that the biggest obstacle to the human race getting there was the cost of launching into orbit. So he founded his private rocket company SpaceX (Space Exploration Technologies) to develop low-cost, partially reusable rockets that will revolutionise the economics of space travel.

And he doesn't just bankroll all this work. Despite making his fortune in the fields of software and banking, Musk is a trained physicist – which means that as well as being CEO at both Tesla and SpaceX, he also designs the cars and rockets. Musk also holds the titles of Product Architect at Tesla and Chief Technology Officer at SpaceX.

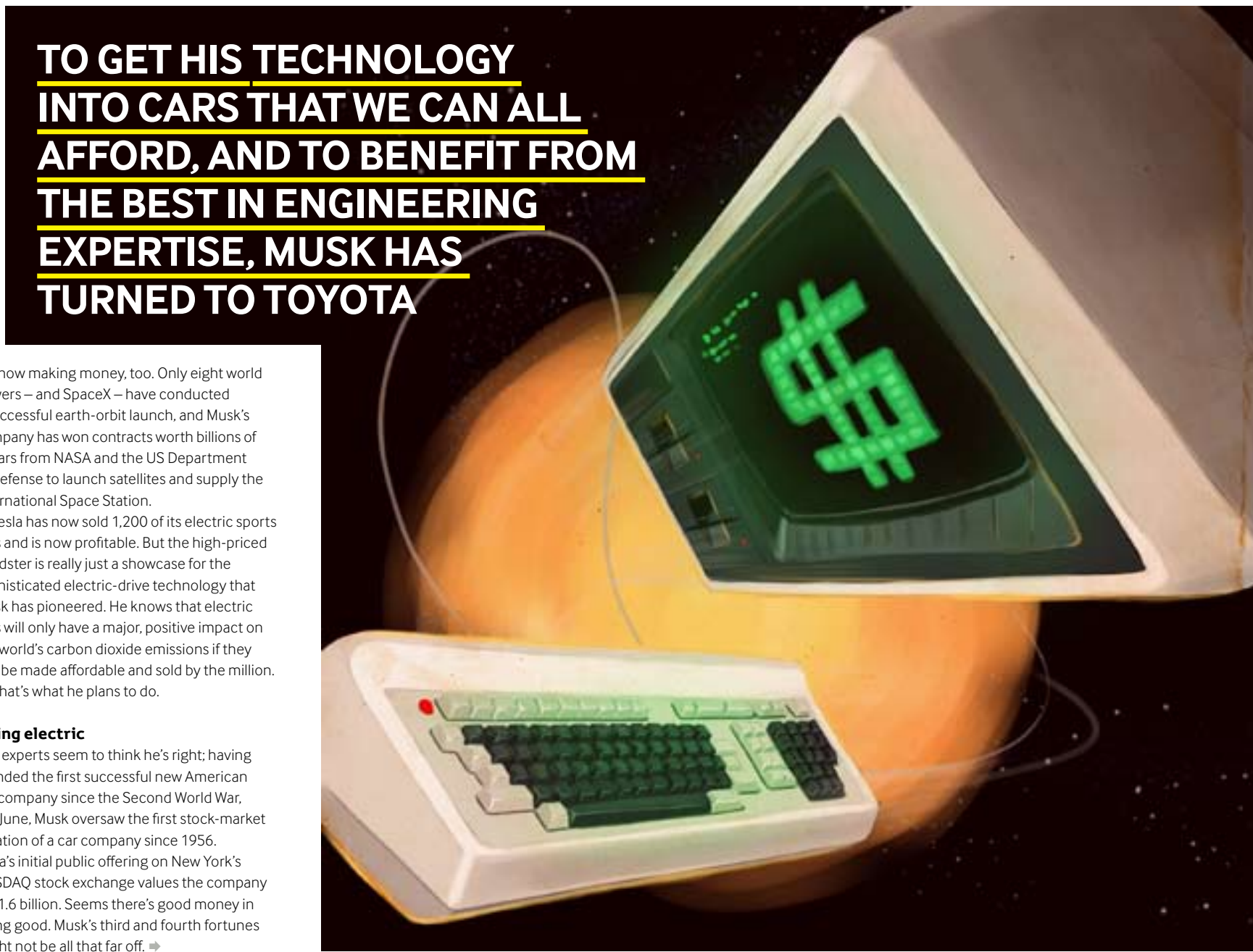
He may have set out to save the world, but SpaceX and Tesla are proving successful and

are now making money, too. Only eight world powers – and SpaceX – have conducted a successful earth-orbit launch, and Musk's company has won contracts worth billions of dollars from NASA and the US Department of Defense to launch satellites and supply the International Space Station.

Tesla has now sold 1,200 of its electric sports cars and is now profitable. But the high-priced Roadster is really just a showcase for the sophisticated electric-drive technology that Musk has pioneered. He knows that electric cars will only have a major, positive impact on the world's carbon dioxide emissions if they can be made affordable and sold by the million. So that's what he plans to do.

**Going electric**

The experts seem to think he's right; having founded the first successful new American car company since the Second World War, last June, Musk oversaw the first stock-market flotation of a car company since 1956. Tesla's initial public offering on New York's NASDAQ stock exchange values the company at \$1.6 billion. Seems there's good money in doing good. Musk's third and fourth fortunes might not be all that far off. ➔



**TO GET HIS TECHNOLOGY INTO CARS THAT WE CAN ALL AFFORD, AND TO BENEFIT FROM THE BEST IN ENGINEERING EXPERTISE, MUSK HAS TURNED TO TOYOTA**

World-changing idea #1

**PayPal**

**Take one online electronic payment system and turn it into a goldmine**

Despite training as a physicist and making his first fortune (a mere \$307 million, aged 28) with an online publishing business, Musk turned his mental firepower to a totally different field next: online banking. He acquired an online financial services business, but spotted the huge potential of one of its then less-popular products, which allowed for instant online payments between individuals. Musk marketed PayPal brilliantly and made it easy to use; soon it was by far the most popular means of payment on eBay, and the money changing hands through PayPal dwarfed the sums handled by the rival online payments services started by the banks or big, established online players such as Yahoo. Ebay offered Musk and his partners \$1.5 billion for PayPal in 2002. But should they have accepted? Since then, PayPal has put most of its serious rivals out of business. It handles around \$80 billion of transactions each year and the majority of its transactions now have nothing to do with eBay; it has simply become a simple, cheap and trusted method of moving money around the world. Did Musk sell too soon? It's not up to us to say; we're just grateful for a really clever, simple idea that benefits everyone.

**Destination Mars**  
Elon Musk's road to the Red Planet

- 1971** Born in South Africa
- 1981** Buys first computer
- 1983** Sells his first software – a space game called Blaster – for \$500
- 1989** Moves to Canada and takes on some grim manual labour jobs
- 1992** Wins Physics scholarship to University of Pennsylvania and gets Economics degree
- 1995** Starts post-grad programme at Stanford University, but drops out after two days to start an online publishing business Zip2
- 1999** Sells Zip2 to Compaq for \$307 million; founds PayPal



To get his electric technology into cars that we can all afford, and to learn and benefit from the best in engineering, manufacturing, and production expertise, Musk has turned to Toyota.

Tesla's next car will be the seven-seat Model S electric saloon, likely to cost around £50,000 when it arrives in Europe in 2012. Toyota has taken a £50 million stake in Tesla, and as part of their co-operation deal, the new Model S will be built in a former Toyota plant in San Francisco, and Musk plans to copy Toyota's high-quality mass-production techniques. But to really drive down the cost of electric cars, the two firms will co-operate on an electric version of the Toyota RAV4, which will be offered in the UK in the second half of this decade. This has the potential to be a truly game-changing step in the evolution of the car, and one that will have the joint DNA of Toyota and Musk's Tesla coursing through its veins.

**Hard graft**

When you meet him in the flesh, Musk is surprisingly calm and relaxed for someone who fits so much into a day. Born in South Africa, he emigrated to Canada at 17 and his accent is neutral and unplaceable. He conducts his personal life with the same efficiency as his business; his five children with his former wife, novelist Justine Musk, were born as twins and triplets.

Of course, doing all this isn't easy. Musk only got his *Falcon 1* rocket into orbit in late 2008, at the fourth attempt. And trying to establish a new car maker in the midst of a deep recession, and using a radical new form of propulsion, isn't rocket science – it's much harder than that.

'I'm working about 100 hours a week,' he says. 'People often ask, "Are you having fun?" I say I should be, but it wouldn't be true to say that I am. But I'm not asking people to feel sorry for me.'

Musk's difficulties at SpaceX have been 'almost purely engineering'. Tesla's teething troubles were more varied. Many car makers viewed electric cars as a dead end because they couldn't be driven as far as petrol- or diesel-powered cars,

World-changing idea #2

# An electric RAV4

Build affordable, all-electric version of RAV4 SUV

**Motor:** Tesla's electric motors are small, light and powerful. Their current unit weighs just 50kg yet produces an incredible 288bhp at 14,000rpm. Electric cars drive very differently, too: not only are they silent, but you don't have to wait for the revs to rise before you get full power. It's all available from standstill, making them not just green, but a hoot to drive.

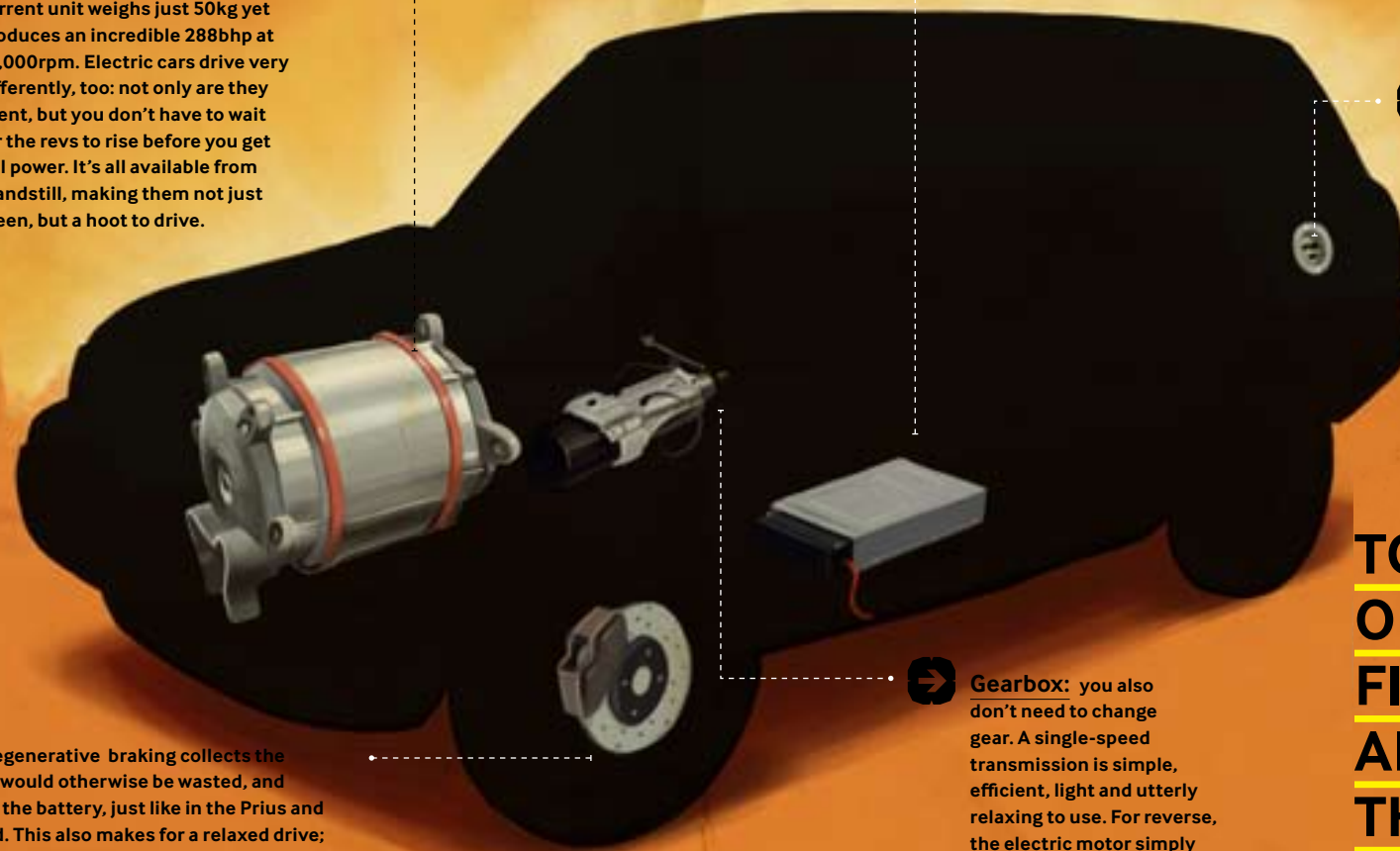
**Battery:** The individual cells used in the battery pack are just like those in your laptop, except there a lot more of them. Their lithium-ion chemistry means they pack the maximum possible charge into the minimum possible space and weight. The Tesla battery uses an amazing 6,831 cells, but Toyota can fine-tune the size of the battery pack to give the optimal balance of cost and range.

**Power Exchange Module:** The really clever bit, the PEM makes sure all those cells charge and discharge evenly, stay cool and work together to provide that addictive rush of acceleration when the driver demands.

**Charging:** An on-board charging unit means you can plug your electric car in anywhere there's a plug. A fast-charge station installed in your home will give a full charge in four hours, and, as electric cars become more popular, on-street charge points will become more numerous; it's already easy to find one in central London.

**Gearbox:** you also don't need to change gear. A single-speed transmission is simple, efficient, light and utterly relaxing to use. For reverse, the electric motor simply spins back the other way.

**Brakes:** Regenerative braking collects the energy that would otherwise be wasted, and returns it to the battery, just like in the Prius and Auris Hybrid. This also makes for a relaxed drive; the car slows gently when you lift your foot off the throttle, so you often don't need to brake at all.

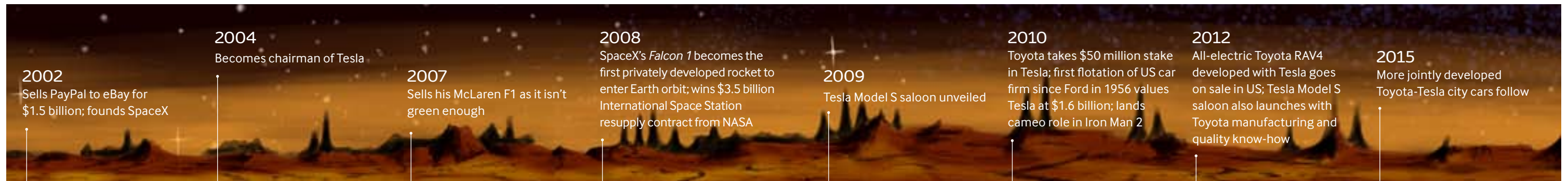


## TO DRIVE DOWN THE COST OF ELECTRIC CARS, THE TWO FIRMS WILL CO-OPERATE ON AN ELECTRIC VERSION OF THE RAV4, PLANNED FOR THE SECOND HALF OF THE DECADE

or be made as cheaply. Tesla's stroke of genius was to take a very Silicon Valley approach to the price problem. Musk realised that electric cars didn't have to compete with conventional cars – at least, not at first. Instead, Tesla's first electric car would be like other new high-end electronic gadgets: desirable, expensive and rare. As with every other new gadget, Tesla plans to make its electric cars less expensive with time and volume, with those first customers subsidising their development. If it can make them cheap enough for us all to afford, we'll have much cheaper motoring and the world will be a much cleaner place. And that's where the link-up with Toyota comes in.

But its birth was still traumatic. Late in 2008, Musk admitted that Tesla was down to its last \$9 million; he had to lay off 80 staff, shut its Detroit engineering centre and stump up half of two further \$40 million financing rounds. 'It's been quite the soap opera,' he says. 'It certainly got very hairy there for a while.'

But it seems Musk's instincts have been proven right. Last June, Tesla announced that the Roadster would start making a profit. And, in the same month, the US Department of Energy announced that Tesla would be one of the first three firms to receive a slice of the federal government's \$25 billion fund to encourage green cars. It's only ➔



open to companies the US government considers 'financially viable'; GM and Chrysler could not apply while still in bankruptcy.

Musk is a genuine car enthusiast, who had an amazing collection of supercars. But after founding his own green car company, he felt he had to sell them. 'It was an environmental decision,' he says. 'My McLaren F1 was a great car. It was a work of art, really, but it's not good for the environment and I didn't want people always writing that I have a high-performance gasoline sports car, so I decided to sell it.'

**Mere mortal?**

Although it seems like he can't help but make money, the 100-hour weeks Musk puts in are for everyone's benefit. 'It's worth knowing that I'm a volunteer,' he says. 'If Tesla, SpaceX and SolarCity are successful, it doesn't change my lifestyle one iota. I already have everything I could want from a personal-consumption standpoint; it's not like there's a bigger jet that I want to get [he does have a private plane], and I don't really like yachts.'

'And if I was purely trying to optimise my net worth, I wouldn't have picked these as ventures. I'd be in real estate or finance or, frankly, in the oil business; I'm not trying to paint myself as some sort of saint. I'm just making the point that the success of the company doesn't change my life. These are the problems that I think are important and need to be solved, and I'm trying to help solve them.'

And as it turns out, Musk is, indirectly, the hero of a Hollywood blockbuster after all. When Robert Downey Jr and Jon Favreau, the star and the director of the *Iron Man* films, needed inspiration for their main character – the industrialist and engineer Tony Stark, who becomes superhero Iron Man – they went to see Musk. He even gets a cameo role in *Iron Man 2*. And if his plans for electric cars and affordable space travel work out, he'll be a real-life superhero, too. ●

World-changing idea #3

# SpaceX

## Build your own rockets and take the human race to Mars

It sounds like madness, but he's deadly serious. Elon Musk is convinced that we ought to start looking seriously at colonising other planets, just in case the Earth is one day uninhabitable. He had his eye on Mars, until he realised that the cost of getting the few miles off Earth and into orbit was the single biggest barrier to space exploration, and the reason it has – until now – been the sole preserve of superpowers. So, with \$100 million of his own money and 1,000 brilliant staff based at the firm's headquarters on Rocket Road in Los Angeles, Musk has designed and successfully launched two partially reusable rockets – *Falcon 1* and *Falcon 9* – that can get cargo into orbit for around a tenth of the current cost. He's also working on the 'human-rated' Dragon module, which sits atop the *Falcon 9* and can carry astronauts – and don't bet against Musk being among the first to test-drive it. Its low costs mean the firm has already won vast orders to launch satellites and resupply the International Space Station, but Musk won't be distracted, and the income and experience SpaceX's commercial operations generate will be used to further his ultimate aim of settling on the Red Planet.



**2020**

Musk launches himself into earth orbit, aboard the *Falcon 9* rocket, which he designed himself

**2025**

Aged 54, Musk finally makes it to Mars. During the four-month trip, he invents a teleporter to send himself home instantly, but decides to stay

