Question 1:

Dear Cheap Astronomy – Could war get us into space?

There's been a long-running dialogue here at Cheap Astronomy about what economic drivers might transform us into a proper spacefaring species with Moon bases, Mars bases and all that. And well, its been hard to think what economic drivers really might work. Space is hard and it's also darned expensive. Tourism could be a driver, after all there has been a bit of millionaire tourism happening, mostly just flights above the atmosphere. but there are plans to send tourists around the Moon in coming years. That is something, but until there's some economies of scale arising from much larger volumes of tourists it's hard to see tourism really leading the charge. Space is hard, expensive and also freaking dangerous. For all the same reasons that submarine tourism is unlikely to take off in a big way, space tourism also looks a bit doubtful. Of course there is space mining, but despite Cheap Astronomy's relentless advocacy for crashing $#!+ on the Moon, all that still seems no closer to reality.

So, is war an option? It does seem to be the case that the US-Soviet Union cold war in the 1950s and 60s got things moving and probably got Neil and Buzz on the Moon too. Ongoing international tensions have filled the skies with spy satellites and a range of space warfare strategies have been tested.

Ground to space attacks are fairly straightforward, started by the US destroying one of their ageing satellites in 1985 with a missile launched from an F15 fighter jet while in vertical ascent. The debris was tracked over the next 20 years, with the last big piece deorbiting in 2004. Russia, India and China have also targeted and destroyed their own satellites, though they were met with outraged complaints about putting space junk in Earth orbit.

Space to ground attacks are actually a lot more difficult. For example, you can't realistically drop a bomb from orbit since the satellite platform will be screaming over its target at 8km/sec and there's no way a passively-dropped bomb will stay on a planned trajectory, when it first has to survive re-entry and then fall through the full width of the atmosphere. So if you want to hit a specific target your only realistic option is some kind of precision guided missile, with some kind of robust heat shielding. In any case, as soon as your enemies know you've got a satellite weapons platform in orbit, they can just blow it out of the sky unless you burn a ton of fuel to constantly shift your orbit so as to evade any predictive targeting. So, in nearly all respects you are better off with a standard intercontinental ballistic missile, which can be launched stealthily from a stable surface platform that also has maintenance and upgrade capabilities.

A James Bond villain type laser weapon fired from orbit and which is able to cause significant damage on the ground would need an absolute &^%$ ton of electrical power, which you just can't get from solar panels and batteries – so forget that. You could build a giant solar reflector to torch your enemies with a heat ray, but again, as soon as someone realises what you're building they'll just blow it out of sky. In orbit, you are totally exposed.

Space to space warfare has also had its first small steps. The Soviets actually installed and test fired a space cannon mounted on Salyut 3. The cannon was essentially an oversized machine

gun intended to defend the station from the aggressive approach of another spacecraft. The Soviets also developed a hand-held laser pistol for cosmonauts, which would have been about as devastating as a laser pointer – but the idea was to burn out cameras and other optical devices on an aggressively approaching spacecraft. Trouble is, there never were any approaches by aggressive spacecraft, making it hard to justify any further developments in these areas.

Anyhow, war is unlikely to help get us into space. Wars are mostly about destroying infrastructure rather than building it – and in most respects Earth's orbit is a terrible place to mount an attack from. What history has shown us is that it's international tensions, suspicions and rivalry that really get things moving. War is a dish best served cold.

Question 2:

Dear Cheap Astronomy – What is new space?

You may have heard people talk about – old space and new space. Old space is like NASA pouring billions into the slow plodding development of huge one-off projects like the Space Launch System and the James Webb Space Telescope where they operate with extreme risk aversion, absolutely determined that absolutely nothing must go wrong. New space is like Space X, where they quickly launch prototypes and when those prototypes blow up they have the data to explain why so the next ones don't have that flaw and if they blow up then they get rid of those flaws as well, and so on. With a mature design now at its disposal Space X averaged about one launch a week in 2022 and it's managed 1.5 launches a week so far in 2023. These launches were mostly the tried and tested Falcon 9 with any rockets still blowing up being mostly Starship prototypes. Space X's reusable first stage design, along with other economies of scale it can achieve by doing things again and again at this frequency have made launches much more affordable, which hence drives more business and yet more economies and efficiencies.

Sounds great right – and with poor old NASA left blinking in the dust. But of course, without old space new space would never have happened - and any anyone working in old space would just say they're leaving the easy stuff to private enterprise while NASA is now doing things like the James Webb Space Telescope where you just can't be slapdash about accommodating the odd failure here and there. The launch of the Hubble Space Telescope was a bit slapdash since it was always intended to be upgradeable in orbit. But sending a space telescope out to Lagrange point 2 means it has to work straight up or it's game over. Similarly, if you're going to send people to the Moon or Mars you can't readily accommodate the odd failure here and there, because every time you fail, people die.

So, sure, new space is innovative and fast– but it's mostly innovative and fast about finding new ways to put thingsinto Earth orbit, which we've been doing since 1957. Indeed, most of the fast-paced launches we are seeing at the moment are about satellite constellations, which are multiple identical satellites that will establish global coverage of functions like internet

connectivity, aircraft surveillance and ground imagery – and you establish these constellations by launching pretty much the same thing over and over again. And if you are doing the same thing over and over again, you should be finding ways to do things faster and cheaper. It would be a worry if you didn't.

The majority of activity directed towards the Moon at the moment is governments doing old space, where failures are pretty catastrophic and aren't always followed by another mission with slightly improved features, although sometimes they are. There are also private enterprise missions to the Moon being funded by government grants, so this is activity by private contractors, who may well be undertaking fast and innovative solutions that meet the contract requirements, but it wouldn't have happened without the government money.

Anyway – our point is that if you hear anyone going on about old space and new space, it wouldn't be unreasonable to roll your eyes and maybe even scoff quietly. It's a very simplistic categorization of the growing diversity and breadth of space activities, all of which is a good thing, but if you think launching 100 starlink satellites in 6 months is more exciting than launching one James Webb Space Telescope in a decade, well OK. It's understandable that anyone would find it exciting to work in the space industry and also making money from it can't hurt either. And maybe this is the way things will always work, big slow government projects opening up new frontiers and then private industry moving in to make things faster, quicker and cheaper.