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# SHORT BRIEFINGS ON LONG TERM THINKING – EPISODE 6

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## IS SPACE THE FINAL INVESTMENT FRONTIER?

MB – Malcolm Borthwick

LW – Luke Ward

MB Hello and welcome to *Short Briefings on Long Term Thinking*, thanks for joining us. I'm Malcolm Borthwick, managing editor of Intellectual Capital at Baillie Gifford.

It's 50 years since we first set foot on the moon. Since then, progress has been disappointing. A famous cover of MIT Technology Review summed it up with the words "You promised me Mars colonies. Instead, I got Facebook", alongside a picture of Buzz Aldrin, the second man who set foot on the Moon. But something significant is happening on the west coast of America. While funding at NASA has fallen, entrepreneurs Elon Musk and Jeff Bezos have stepped up spending.

To discuss this, I'm joined in our Edinburgh studio by Luke Ward – space enthusiast and deputy manager of Edinburgh Worldwide Investment Trust and the Global Discovery Fund. But before we start the conversation, some important information. Please remember that as with all investments, your capital is at risk.

Luke, we landed on the Moon in 1969, but what about putting people on Mars, is this the stuff of science fiction or could it be a reality in our lifetime?

LW I think it could be. I think the interesting thing is that if you ask people back in the 1960s whether they thought that was the case, there would be an emphatic yes. They thought, that within their lifetime, they would have holidays on the Moon, they'd be going to have colonies on Mars.

But the reality that played out over the subsequent 40 years was very, very, different to that. And it's always been a source of regret within the engineering community that it turned out that way. But I think it's important to consider why that is and why we think that might be changing now.

So, historically, the main driver for progress, here, has been spending by the government for military purposes. In the 1960s, you made so much progress because of the threat of Sputnik to the United States. They were keen to have an answer to that and provide a defence to it, effectively, with their own space programme.

As a function of that, they were willing to spend up to 4 per cent of the federal budget towards advances in rocketry. And with that kind of spending pressure and that kind of urgency, it's not too surprising that they made a lot of progress.



- MB What's spending, roughly, now?
- LW Under one per cent, way under one per cent. I think 0.5 per cent of tax revenue in the US goes to space spending or NASA. It's got about a \$20 billion budget.
- MB And who is spending money on space now?
- LW So, predominantly, it is still governments, but the interesting thing, which we've seen in the past ten years, is that a lot of entrepreneurs have stepped up their level of spending. To many people, I guess, this could appear to be an irrational exuberance. If you've got more money than sense, what do you do? You'd spend it on some sort of highfalutin dream of going to the stars.
- But I think the way in which they're approaching this is actually very rational, if you look beyond a ten-year timeframe. The way that they're structuring their ventures, very much as capital or commercial entities, [structuring] them such that they can create a sustainable business model around them, rather than it just being a case of [needing] to keep funnelling money into these ventures to keep them afloat.
- MB And who are the key entrepreneurs and companies that are in this sector?
- LW So, there's a couple of big ones. You mentioned earlier, Elon Musk and Jeff Bezos. But I think that does a disservice to the sheer number of companies and entrepreneurs, now, who are operating in this space. At last count, there were over a hundred companies designing rockets to put payloads into space.
- MB The key companies, Jeff Bezos, that's Blue Origin, isn't it? And SpaceX with Elon Musk.
- LW That's right.
- MB And are they approaching space investment slightly differently, or are they similar?
- LW So, Blue Origin has been a lot more private about the progress which they've been making. In terms of what we can tell from the outside, they haven't yet produced an orbital class launch vehicle, but they're very far along the way in terms of delivering reusability of the rocket which they already have.
- In contrast, SpaceX seems to have made a lot more progress over this timeframe. They do have an orbital class rocket. They are delivering payloads for NASA, for lots of commercial customers. But they have had a much more public approach to it as well. They've been willing to share progress with the public and, also, wear their failures on their sleeve as well. We've got several examples of rockets blowing up or not working correctly, but I think that's been for their benefit. It's because they've had a willingness to fail and do so publicly that they've been able to make the kind of advances that they have.
- MB And the difference between Tesla and SpaceX is one's public, the other's private. Does that make any difference for you from an investment perspective, in terms of how you look at SpaceX as an investment?
- LW Not in the way we go about analysing it. I think, operationally, it can make a difference to how these organisations go about their mission. If you have to be under the scrutiny of public investors with a shorter mindset, or shorter time horizon, then it makes it quite



difficult to [make] the kinds of investments you need in order to achieve a ten-year-plus vision. Whereas, if you can do that away from the public markets, you don't have that level of scrutiny and pressure to deliver on a quarterly basis or an annual basis. It gives you the flexibility to fail. And with that is the key to unlocking a longer-term technological development and a stronger business in the long term.

**MB** And you're deputy manager of Edinburgh Worldwide Investment Trust and, also, the Global Discovery Fund. Which of these investment vehicles do you hold SpaceX in, and is there a reason behind that?

**LW** So, the Edinburgh Worldwide Investment Trust is a closed-ended structure, whereas the Global Discovery Fund is an open-ended structure. With closed-ended structures, you don't have to buy or sell the individual securities within that, if a client wants to have their assets back or wants to increase asset exposure there. And so, as a function of that, it becomes much easier to hold private investments without liquidity constraints.

**MB** And you mentioned earlier that this isn't just aspirational, it is commercial. In the short, medium term, where do you think the money to be made in space is for Elon Musk and SpaceX?

**LW** In the immediate term, it's with providing existing capabilities, but [at] just a fraction of the cost with increased capability. So, there are still many, many, satellites which need to go into orbit and their vehicle is providing a much more efficient way of getting there.

If you look five, ten, years out, I think that the ability to launch satellite constellations is going to be a really interesting source of revenue for them – being able to disrupt the existing telecommunication infrastructure around the world, which has traditionally been provided on a local basis. Being able to provide that on a global basis is something quite unique.

**MB** And this is really exciting, this idea of an orbiting broadband system. Give me an idea about where we are with this and what the potential is; because Elon Musk has started, hasn't he, putting satellites into orbit?

**LW** They launched the first Starlink satellite constellation, or collection of satellites. So, there's 60 satellites on a single rocket. These were the first operating satellites for that network, which they expect to come to number in the hundreds or thousands of units, eventually.

It's early days still, there's a lot of testing which needs to go on; a lot of raising of orbits; a lot of establishing the ground infrastructure to support that, and, also, the ground receivers to connect people to those satellites. But the initial signs are very promising.

**MB** What kind of saturation are they trying to achieve, in terms of broadband and Wi-Fi? Is this on a global level and would we use it for our phones or electric cars, or other things?

**LW** I think the nature of the service they're delivering is going to have to be [targeted] towards homes and large assets like trucks or cars or planes. The size of the receiving antenna which you [would] need to use would be a little bit too large to put on your phone. It's about the size of pizza box.



But what we think is quite interesting about them is [that] they don't have to go for density of consumers in the same way that traditional infrastructure does. So, if you're building a traditional fibre optic network, you mainly want to provide that to a city, where the incremental cost of connection is very small to add another consumer onto that. If you've got a global satellite business, you don't really care where your incremental consumer comes from, because you still get the same incremental benefit from that. And so, I think, the plan here is actually to be able to put together a network from disparate users, but it still makes sense because you don't have to worry about that density of users.

**MB** I find space tourism very interesting because there's a lot of coverage about this, and we've seen this with various ventures from Richard Branson and, also, Elon Musk. Is it a serious money-spinner or is it a red herring?

**LW** I think it's somewhere in between. I think in the early stages, it's going to be quite an exclusive pursuit. I don't imagine you or I are going to be doing this within the next couple of years. But, I would hope, over the coming decades and, certainly, within our lifetimes that would be an affordable option for us.

It also depends on who you ask, or which person you choose to pay to take you there. Richard Branson's efforts with Virgin Galactic are a sub-orbital hop, which will give you a couple of minutes weightlessness. Whereas, Elon Musk has recently sold a ticket to a Japanese billionaire to travel around the Moon over a period of days and take several artists with him. Conceptually, that vehicle would also be able to land on the Moon. It could stay in orbit for several months. And so, it really depends on which method you use to get there, and which vehicle you have.

But I think there is going to be quite a big market for this. If you consider how many people try to climb Everest, and the level of risk, and the level of capital involved in that, [it's] very similar to the profile of human space flight, historically. Yet, I'd argue there's many more people who dream of becoming an astronaut, [who] have the means to do so by sitting in a chair for three minutes of lift-off, versus training for a long period of time and then summitting Everest in quite extreme conditions.

**MB** And how is space regulated?

**LW** So, that's an interesting question because no one quite knows the answer to it. Officially, because it's not within any countries, it follows the law of the sea. The Outer Space Treaty was agreed, I think, during the Cold War, around about the 1960s or 1970s. It's the same sort of legal conditions that govern Antarctica. People agree, or governments agree, to use it for peaceful purposes and not to exploit natural resources there.

However, it conveniently doesn't mention anything about corporations or individuals, mainly because people didn't think that would be an issue to consider over the timeframes we're talking about. But it poses an interesting question: is the future of our species, as we expand out into the solar system, one of corporate primacy, rather than governmental primacy?

**MB** And what, for you, has been the big breakthrough? We've seen things like reusable fuelling rockets and other things. What has been the big advance, for you, over the last two or three years?



LW I think you've touched on it there, it's that reusability. It's hard to understate just how significant that is. When you're going into orbit, traditionally, with an old-school rocket, you would just throw away the engines. They would crash into the ocean or they would burn up on re-entry. And those are some of the most complex things that humankind has ever made, and we just discard them like that. Now, being able to recover those and reuse them is hugely significant, in terms of cost and capability.

The physics of actually recovering those is extremely difficult. It's the equivalent of firing a pencil over the Empire State Building and getting it to land on a penny on the other side. It's not child's play, that's a really complex thing which people have been able to master, yet you're seeing this manifest in several companies now. That is going to be key to driving that cost continually down. If you can get operating leverage by just using the same rocket for tens or hundreds of launches, then you spread that cost over so many more customers than you had previously.

MB You touched there on the physics [and] the engineering. This is part of your background as well, Luke. What initially interested you about space?

LW So, when we were in engineering school – probably too long ago than I care to remember now – the people who stood out were the people who were pioneering these kinds of new industries. Elon Musk, at the time, was just experimenting with rockets. He'd had three failures and it looked like they were about to go bankrupt. Yet [he] was the poster child within the engineering school for people who were pushing the boundaries.

When you're brought up on a diet of Thunderbirds and Star Trek, and things like that, you expect the general community to be focusing on those sorts of efforts, and it's puzzling when people are focusing on much more commercially relevant things. Optimistically, we want to think 'yes, we're going to be out there exploring the stars', but there wasn't really anyone making that level of progress, apart from a few entrepreneurs, who no one had really heard of before, on the west coast.

Whereas, now you see that a lot of the investment and the struggles and the failures which they had to go through, now, are really paying off in terms of the capabilities they've developed ten years later.

MB There's a lot of talk about Mars, have we forgotten about the Moon? What's going on there?

LW Yes, so, because we've already been to the Moon, people see that as a bit of a box that we've ticked already, and that's less able to conjure the same level of enthusiasm, I think, as Mars, because that's the next step. People are always interested about the next big thing or where the frontier is, and [think] 'let's focus on that'.

But the Moon actually provides a really good testing base for a lot of the technologies which you would need to develop in order to have Mars colonies or move anywhere else in the solar system. That proximity to Earth, even though it seems a long way away, is highly beneficial, in terms of initially setting up colonies there or sending assets out there. That latency of communication is very low, so it provides an ideal testing ground.



If you want to get a bit more sci-fi about it, there's people who suggest that, because the solar wind is deposited on the Moon, Helium-3 is a really great source for fusion energy that can provide a clean energy source. The regolith on the Moon could be used to manufacture solar tiles. So, you could have a lot of your energy infrastructure there and beam it back to the Earth.

I've seen some people suggest that, maybe, we would have the Olympics on the Moon one day. What does the Olympics in a weightlessness or near-weightlessness environment look like?

MB It may help you with weightlifting.

LW It will. Certainly. Yes, I'll be much more likely to participate in that one I think.

MB And I think that's a great thought to leave our listeners with, Luke. Thanks very much for joining us and I hope you'll join us again soon on the podcast.

LW Thank you.

You can find our podcast *Short Briefings on Long Term Thinking* on Apple Podcasts, Spotify, and on our website at [baillieghifford.com/podcasts](http://baillieghifford.com/podcasts).

We hope you enjoyed it and please spread the word.

And in our next podcast, we'll be talking about Europe. Europe's economic growth is uninspiring, and its stock markets are stuffed with stagnant corporate dinosaurs. So, why would you want to invest there? We'll be answering this question.

And many thanks to Lord of the Isles for the music.

Until next time.

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