LONG TERM INVESTMENTS AND CREATING AN EVERSHRINKING WORLD

Paul Gillespie, MD Deep Tech had the pleasure to meet Mark Thomas, CEO of Reaction Engines. They discussed how the company is helping to make the world feel even smaller by developing the technology that will enable hypersonic travel. Using truly barrier-breaking techniques, their quest will eventually enable us to fly anywhere in the world in less than three hours.

Mark Thomas

Mark, tell us what Reaction Engines is trying to achieve?

We're looking to make that breakthrough in hypersonic flight which will lead to a revolution in space access, so that space travel becomes a routine, everyday event - more commercial aircraft-like in manner. To do this we're using the attributes of the propulsion systems of jet and rocket engines and developing avant-garde technology, which will enable us to travel at more than one mile a second.

Can you explain the definition of 'hypersonic'?

More than five times the speed of sound, or Mach 5. Up to that point you're supersonic. Decades ago, the SR-71 Blackbird spy plane achieved the fastest ever jet-powered flight at 3.3 times the speed of sound. That was a huge achievement in aviation and no piloted air-breathing aircraft has ever gone beyond that. As you go faster, the temperature of the air impacts the vehicle exponentially. So, at Mach 3.3, you are over 400 ◦ C, but at Mach 5, you are approaching 1,000 ◦ C - the temperature of molten lava.

To counteract this, you need technology and materials that can generate sufficient propulsion and withstand extreme heat. With our proprietary cooling technology this enormous amount of heat is dissipated immediately so the engine is effectively taking in air at ambient conditions. This pre-cooling of air before it goes into an engine has been attempted before, but never successfully, so we've made a real breakthrough in technology.

Are you in competition with other companies to achieve this?

Hypersonics as a concept and domain has been studied for some 70 years. Really only now are we seeing the race begin in anger, particularly in terms of the strategic imperative around hypersonics, which centres on defence platforms and particularly missiles.

We've all heard the recent clamour around high-speed commercial aircraft and supersonic business jets, and vehicles that will go even faster than supersonic. Boeing, for instance, announced a hypersonic cruiser and Virgin Galactic revealed a pivot towards high-speed flight opportunities, in addition to their space tourism activities.

Reaction Engines advantage is having an A-list of investors. Are they just financial investors or are they technology partners working with you to achieve your goal?

A bit of both. The company has evolved from one that was founded and principally built on the back of private investment, which then led us to the world of financial institutions and patient capital funds and more recently, it's been strategic investment from industry, with the intent to get our technology into applications that is being developed for their customers. Rolls Royce has just become one such investor, and strategic partnership is a key element of this relationship.

When do you think the SABRE engine will eventually be deployed?

It's been a very long journey on the SABRE front and the efforts in the early years were especially pioneering. Many of the subsystem technologies required for a SABRE engine are in test now, and we're looking to bring a representative engine demonstrator together soon, which will be a huge step forward. Having said that, we don't expect to see a responsive, reusable, aircraft-like space plane operating until the 2030s. The hypersonics opportunity is earlier, and we would expect to see applications for the technology within this decade.

Obviously, getting SABRE to market is the ultimate goal but can you monetise the technology now?

What we had to do was establish long-term, strategic programmes with the right investors and industry partners and get those on track. It's only in the last few years that we've built a separate division within the Company to explore, develop and grow the commercial part of the business, and it's been really successful. We have all the IP within the business. It has tremendous value, so inhouse commercialisation is the ideal place to start.

Can you give an example of a market application for the technology?

Well, there's the automotive sector. The SABRE style precooler, with its ability to provide rapid heat transfer, can be scaled to a size that would happily fit into a Formula 1 race car to improve its performance. And we've also developed unique technology solutions for cooling electric vehicles.

The beauty of this business is it can move with real pace. We have ingenuity in spades, and we are not burdened with a heavy amount of infrastructure or bureaucracy. We can make decisions very, very quickly and people like working with us for that reason.

I'm very keen to remind people that it's not just about the technology. It's about proof of product - getting it in the hands of real customers who are going to use it. We need that kind of experience and feedback to enable us to step into even larger commitments and opportunities. Industrialisation of certain aspects of our business – process, operations - is the next step on our maturity journey.

What has been the biggest challenge?

Well, the technology is, in itself, extraordinarily demanding, but we're not fazed by that. The biggest hurdle has been finding the right partners that can work at our pace without becoming a constraint or financial burden. We need process and discipline that supports innovation and the ability to partner at all levels, but we can't become a bureaucratic and heavy organisation, so I just need to be careful we don't trip into that place without realising it.

What are the milestones in the coming years?

I think we are on a path to being commercially viable within the next three to four years. There will be programmes that run significantly beyond that, in terms of research and development efforts and demonstration of strategic capability. It's a big challenge, especially at this time of global uncertainty, but eminently doable.

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The technology has great appeal and is transformational across multiple sectors. We have, as already mentioned, strong backers and great support from the British government but, increasingly, we're getting interest from the US and other parts of the world. So, it is all to play for. The decisions we take in the next six months will be critical.

I imagine the reason you're gaining more attention is because what once might have seemed impossible is now becoming a reality.

That's exactly right. We have to be able to prove how we will be delivering the dream in a way that stands up to intense scrutiny and will not fall at the first hurdle. Let me give you an example of how we've already done this. There were leading government agencies in the US who wanted to see our technology cool air from Mach 5 levels of 1,000 ◦ C to ambient in less than the blink of an eye, at full scale. The only way we could have done that was to fly the technology at hypersonic speeds – something that was years out and a huge cost. So, we decided to build a unique test facility in the US to simulate those conditions on the ground. We achieved that entire programme from standing start to completion of a full test campaign, which fully met the criteria within about 18 months, for less than $10m. It was truly incredible, and a world first.

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One final question, Mark. Do you have this little dream at the back of your mind of being onboard that hypersonic vehicle?

Yes! I saw the last ever Concorde flight when it flew into Filton, standing at side of the runway and when I lived in South Wales as a youngster, I enjoyed seeing that iconic aircraft fly directly overhead every day and transition to supersonic as it left the coast. I was also fortunate at Rolls-Royce to be the Chief Engineer for the engines for fast jets like the Tornado and Typhoon, but I regret never getting to fly supersonic - so I would absolutely love to experience hypersonic flight!