19 December 2023

Disruption Bytes

Building the future: AI, drones, LEOs, quantum, and nuclear

Free to View
Disruptive Technologies - Global

- **AI:** The race to build AI infrastructure continues and we track the rise of AI prompt engineers
- **Drones and LEOs:** Will delivery drones be flying in the UK and Italy soon? eVTOL European regulators and latest from space
- **Quantum and SMRs:** Will Q-Day arrive in 2029 and is small modular reactor (SMR) tech too costly, or inevitable?

In this free to view update, we look at some recent developments within HSBC's Disruptive Technology theme and any potential implications investors should note.

Building the AI future… The race to build artificial intelligence continues with the leader of a major AI start-up who may have started fundraising for new hardware to become more independent and control costs. However, we look at a number of challenges that remain a stumbling block to going solo. We also highlight why it might be a good time to be an AI engineer, as demand for them since 2015 has risen 5x.

Building drones and electric vertical take-off and landing (eVTOL) aircraft… A large tech company is looking to launch trial drone delivery services in the UK and Italy. Having rolled out two such trials in the US previously, it has experience; however, it has not always been plain sailing and it has taken time to build a customer base. Plus, the company announces a new drone.

Building LEOs… A leading American space company launched its biggest rocket for the second time and whilst progress was made, the mission did not reach its objective. And it could take months for the Federal Aviation Administration (FAA) to investigate and issue a new launch licence. Meanwhile a tech giant has signed a deal with this rocket launcher to send its LEOs (Low Earth Orbit Satellites)] into space in 2025.

Building quantum computers… We look at a big tech player that released its first ever modular quantum computer, the world's first 1,000 qubit quantum chip, and a new product roadmap to 2033. Meanwhile another large tech player has withdrawn from the quantum sector for now…

Building small modular reactors (SMR)… Small modular reactors might be part of the future of data centres and other power needs; however, a US start-up has cancelled one of its US projects; its projects in Romania and South Korea are still going ahead and the US government has recently backed SMRs as being key to the energy transition. We also look at who might be winning the UK SMR contracts…

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Building artificial intelligence

A new entry into the AI chip market?

The OpenAI saga…

November 2023 saw the departure and re-hiring of Sam Altman by artificial intelligence start-up OpenAI. During this saga, Bloomberg reported that Altman had been seeking funding for a new chip venture to rival Nvidia. According to the report, this was called project Tigris and had the aim of developing a start-up to build TPUs (Tensor Processing Units) designed to handle large AI workloads[1].

And the need to build more AI computing capacity

However, any venture into chip manufacturing would not be without significant upfront costs. The Financial Times reported that Altman had aimed to raise up to USD100bn to build a chip company and the report said "USD100bn may not go very far". For instance, it will take TSMC-more than three years to open its Arizona production facility despite having decades of experience in opening such plants and it is estimated the company is spending USD40bn on the plant[2].

Challenges include expertise, machinery waiting lists, and patents

Other potential difficulties with starting a new chip company include skill shortages in the expertise required to build and maintain facilities, waiting years as long as two years for critical machinery, and patents. For instance, TSMC has over 52,000 patents related to chip making. This would make any venture from Altman time consuming and it is likely OpenAI would not see the benefits until the medium to long term[3].

Demand for AI experts rising

The rise of prompt engineers…

It has been a year since ChatGPT launched and demand for AI experts is soaring, particularly for prompt engineers. According to LinkedIn's Future of Work Report (November 2023) conversations around AI have risen 70% (from December 2022 to September 2023) and 74% of executives believe generative AI will benefit their employees[4]. Prompt engineering roles pay over USD335,000 per year[5] with the job comprising tailoring AI systems to produce improved results as well as helping organisations train their employees on these novel AI systems[6].

And pay is soaring…

According to a November 2023 article in Bloomberg, AI engineers earn 8-12.5% more than their non-AI counterparts. OpenAI's most common salary range for engineers is USD200,000-370,000 and for specialised roles, that rises to USD300,000-450,000[7]. An Oxford University report found that between 2015 and 2022, there had been a fivefold increase in demand for AI skills as a percentage of US jobs[8].

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[1] Altman Sought Billions For Chip Venture Before OpenAI Ouster, Bloomberg, 19 November 2023
[2] AI chip contenders face daunting 'moats', Financial Times, 28 November 2023
[3] AI chip contenders face daunting 'moats', Financial Times, 28 November 2023
[4] Future of Work Report, LinkedIn, November 2023
[5] $335,000 Pay for 'AI Whisperer' Jobs Appears in Red-Hot Market, Bloomberg, 29 March 2023
[6] A Year After ChatGPT, Everybody Still Wants Prompt Engineers, Bloomberg, 30 November 2023
[7] OpenAI Engineers Earning $800,000 a Year Turn Rare Skillset Into Leverage, Bloomberg, 22 November 2023
[8] Expert Comment: AI demand is booming for the right skills and for the technology 'glue-guys', Oxford University, 9 October 2023

Drones and eVTOLs

eVTOL start-ups working with aviation incumbents

Lilium and Lufthansa partnership and are looking for further collaboration

In December 2023, Lilium and Lufthansa Group signed a memorandum of understanding (MOU) for a strategic partnership. The partnership will also look at further collaboration with third parties such as airports and regional partners with a view to developing vertiports, airspace integration, and operational procedures for eVTOLs. According to Lilium, there will be 9,200 Lilium Jets across Europe by 2035[9].

Lilium making strides with regulators. To begin operations in 2026?

The MOU covers flight operations, aircraft maintenance, and crew with Lilium's six-passenger eVTOL and builds on a 2020 agreement for Lufthansa to train and qualify pilots for Lilium's eVTOL[10]. Lilium has begun production of its eVTOL with a view to having seven available for flight testing in late 2024 in order to gain EASA type certification and eventually full approval and commercial services operating by 2026[11]. In November 2023, Lilium received Design Organisation Approval from the EASA (EU Aviation Safety Agency), which means it is now authorised to hold a type certificate for eVTOLs[12].

Drone delivery expands into new sectors and new geographies

Amazon aims to roll out a delivery drone service in the UK and Italy in 2024

In October 2023, Amazon revealed its plans for drone delivery in the UK, Italy, and a US city (yet to be announced). It aims to begin autonomous drone delivery in late 2024 as it builds towards its goal of 500m packages via drone per year by 2030[13]. As we mentioned in *Drone Disruption: Transforming industries (15 June 2023*), Amazon previously launched drone delivery trial programmes in California and Texas, which were hindered by layoffs and by May 2023, the program had only made just over 100 deliveries despite having an internal target of 10,000 deliveries in 2023. However, according to the company, thousands of deliveries have since occurred for thousands of customers[14].

New iteration of drone…

In October 2023, Amazon also unveiled its latest MK30 Drone, which will launch in 2024. It reduces noise by 50% and is lighter and smaller than the current MK27 model. According to Amazon, the MK30 can also fly twice as far (12km) and is capable of operating in tougher weather conditions (eg. light rain and wind)[15]. Amazon also announced that customers in College Station, Texas would be able to get prescriptions delivered via the drone delivery service within 60 minutes of ordering including over 500 types of medications[16].

[9] Lufthansa Group and Lilium sign Memorandum of Understanding for strategic partnership, 7 December 2023
[10] Lufthansa in Electric Air Taxi Deal With Germany's Lilium, Bloomberg, 7 December 2023
[11] Lilium Starts eVTOL Final Assembly and Partners with Lufthansa, FutureFlight, 7 December 2023
[12] Lilium Receives EASA Design Organization Approval, Lilium, 27 November 2023
[13] Amazon unveils plan to deliver packages by drone in UK and Italy, The Guardian, 18 October 2023
[14] Amazon unveils plan to deliver packages by drone in UK and Italy, The Guardian, 18 October 2023
[15] Amazon announces 8 innovations to better deliver for customers, support employees, and give back to communities around the world, Amazon, 18 October 2023
[16] Get medications faster with drone delivery from Amazon Pharmacy, Amazon, 18 October 2023

The space race continues…

Starship's second launch

Starship lifted off for a second time but significant challenges remain

In November 2023, SpaceX launched its Starship rocket for the second time. The Super Heavy booster and the Starship rocket achieved stage separation, all 33 of the Raptor engines fired, and Starship hit an altitude of 93 miles above the earth[17]. However, shortly after detaching, the Super Heavy booster exploded over the Gulf of Mexico. The Starship continued but minutes later SpaceX lost contact after the automated flight termination system was triggered. It is not yet known why it was triggered[18].

The FAA will investigate the launch, which could take months

The FAA (Federal Aviation Administration) will now conduct an investigation into the test flight and SpaceX will have to submit a plan of how to resolve the failings. Shortly after the launch, Elon Musk claimed the Starship could be ready to launch again in 3-4 weeks; however, SpaceX will first have to secure a launch licence from the FAA. Previously at the inaugural Starship launch in April, Mr Musk had claimed the next launch could happen in 6-8 weeks but in reality, it took nearly six months for the FAA to grant the respective launch licence[19].

Worker safety

SpaceX is succeeding at launches but law makers' safety concerns arise

Reuters reported in November 2023 that SpaceX had over 600 unreported workplace injuries since 2014, some of which resulted in amputations and crushed limbs, and even one death. This is a much higher injury rate than the space industry average according to Reuters[20]. Some SpaceX sites began publishing injury reports to US regulators in 2021 and at several SpaceX sites the injury rate far exceeded the industry average of 0.8 injuries per 100 workers, with one site, Brownsville, reaching 4.8. SpaceX has only published the injury rate once at the Kennedy Space Centre site in 2016 and it was 21.5-27 times the average[21].

More competition in the space sector

Amazon has signed up for SpaceX launches in 2025

In December 2023, it was announced that Amazon had signed a deal with SpaceX for three launches of its Kuiper satellites. Falcon 9 rockets will be used as Amazon seeks to launch at least half of its 3,236 constellation by July 2026 as per FCC (Federal Communications Commission) licence rules.

The launches are set for 2025[22]. Amazon already has 94 launches booked with Blue Origin (12 and an option for 15 more), United Launch Alliance (47), Arianespace (18), and ABL (2)[23]. However, SpaceX is by some margin the market leader in space launches and dependability. According to Amazon, full-scale deployment of the constellation will begin in H1 2024 and a sufficient number of satellites should be launched by H2 2024 to begin pilot schemes for some customers[24].

[17] The most powerful rocket ever built just went farther than it had ever gone, then was lost, CNN, 18 November 2023
[18] SpaceX Starship launch failed minutes after reaching space, Reuters, 18 November 2023
[19] SpaceX's Starship should be ready to fly again before Christmas, Elon Musk says, Space.com, 20 November 2023
[20] US lawmakers urge scrutiny of SpaceX worker injuries after Reuters report, Reuters, 18 November 2023
[21] At SpaceX, worker injuries soar in Elon Musk's rush to Mars, Reuters, 10 November 2023
[22] Amazon awards launches to SpaceX, its main internet satellite rival, The Washington Post, 1 December 2023
[23] Investing in Space: Why Amazon bought rocket launches from rival SpaceX, CNBC, 7 December 2023
[24] Amazon to use Falcon 9 rockets of SpaceX for Project Kuiper, Reuters, 1 December 2023

Quantum Computing

Quantum roadmap and a quantum exit

IBM has rolled out its first modular quantum computer…

In December 2023, IBM revealed its Quantum System Two – the company's first modular quantum computer (QC). It uses three Heron chips each with 133 qubits and is built in New York. Heron is available to IBM clients via the cloud and has a 5x improvement in error rates over the IBM Eagle[25].

What are qubits?

A "classical computer", which operates using electronic signals to represent bits of information, either a 0 or a 1. QCs operate using quantum bits called qubits. These can be simultaneously 0 and 1, otherwise known as a superposition of all possible states. There are two key properties of QCs and qubits – entanglement and superposition. These principles can be a bit mind-bending for non-experts, and we attempt an explanation, but the essential point is that these properties enable QCs to do things significantly faster than traditional computers we use today.

…and has launched the world's first 1000 qubit chip

IBM has also released the first ever 1,000 qubit quantum chip. IBM has been roughly doubling the number of qubits each year and the Condor has 1,121 qubits, up from the 433 qubit Osprey[26]. IBM has also released an updated quantum roadmap that stretches to 2033 and goes into detail on hardware, software, and enabling technology needed to deliver quantum advantage. To date IBM has not missed a target on the quantum roadmap[27] and the new roadmap shows IBM aims to reach an error corrected QC by 2029.

In November 2023, Alibaba announced it was shutting down its QC research lab and will donate its equipment to Zhejiang University[28]. Alibaba's DAMO Academy, the company's in-house research hub, will now focus on generative AI[29].

Quantum data protection

Is Q-day closer to reality?

In December 2023, it was announced that HSBC was trialling a new quantum protection method on a EUR30m foreign exchange transaction. The tool is provided by a partnership between Toshiba, BT, and Amazon Web Services, Inc. (AWS) and uses QKD (quantum key distribution), which uses particles of light to deliver secret keys to the parties involved in a transaction[30]. The global foreign exchange market trades USD7.5trn per day[31] and with IBM targeting 2029 for error corrected QCs, it is important for companies to begin exploring cybersecurity options for Q-Day (ie. when QCs are powerful enough to break modern day encryption techniques).

[25] IBM Debuts Next-Generation Quantum Processor & IBM Quantum System Two, Extends Roadmap to Advance Era of Quantum Utility, IBM, 4 December 2023
[26] IBM releases first-ever 1,000-qubit quantum chip, Nature, 4 December 2023
[27] IBM Launches Quantum System Two And A Roadmap To Quantum Advantage, Forbes, 4 December 2023
[28] Alibaba Shuts Quantum Computing Lab in Sign of Broader Cutback, Bloomberg, 27 November 2023
[29] Alibaba shuts quantum computing lab amid cutbacks, Data Centre Dynamics, 29 November 2023
[30] 'World-first': HSBC trials tool to deter quantum-powered cyber attacks, Interesting Engineering, 7 December 2023
[31] HSBC tests protecting FX trading from quantum computer attacks, Reuters, 6 December 2023

Small modular reactors

Are SMRs too expensive?

NuScale cancellation but other plans remain…

In our report *Disruption Bytes: Metaverse evolution, powering AI, and LEOs latest (1 November 2023*), we highlighted that NuScale Power was the first company to have its SMR design certified by the US NRC (Nuclear Regulatory Commission). However, since then NuScale has cancelled one of its plans to build an SMR in the United States because there was insufficient interest in purchasing electricity from the facility from power utilities after the price surged by over 50%[32]. However, projects in Romania and South Korea are going ahead, as are plans to provide Standard Power with 2GW of power for its data centres in Pennsylvania and Ohio[33].

> **"You can do it if you've got an order for ten. You can't do this if you've got an order for one[34]**
>
> **Tony Roulstone, Cambridge University nuclear energy professor**

US government still believes SMRs will be key to meeting COP28 goals…

Despite the setback, US Energy Secretary Jennifer Granholm said in December 2023 that the US is not going to be able to meet the COP28 goal of tripling nuclear power by 2030 without small modular reactors[35].

The race for UK SMR contract

Is Westinghouse set for SMRs in the UK?

In December 2023, it was reported that Westinghouse Electric was close to a deal to build four SMRs near Hartlepool in the UK. The four reactors are expected to cost less than GBP10bn and generate 1.2GW of power, with the funding coming from the private sector[36].

However, the bigger prize is still to be grabbed as six companies are shortlisted

A number of companies have been shortlisted in the UK government's SMR competition, including: Westinghouse, EDF, GE-Hitachi, Holtec Britain, NuScale Power, and Rolls Royce. In spring 2024 the UK government will announce which of these it will support and contracts will begin to be awarded in summer 2024[37]. Rolls Royce is the only one of the six whose SMR is currently undergoing assessment from the Office for Nuclear Regulation and the Environment Agency which Rolls Royce claims puts the company two years ahead of its competition[38].

Rolls Royce believes it is in pole position

Up to GBP20bn worth of contracts awaits the winners of the competition and Rolls Royce's CEO recently made comments that he would be "very surprised" if Rolls Royce did not get selected. The Rolls Royce SMR is a version of the reactors used in the Royal Navy's nuclear submarines, which have been in use for decades[39].

[32] US nuclear start-ups battle funding challenge in race to curb emissions, Financial Times, 12 December 2023
[33] NuScale CEO defends modular nuclear plants after project cancellation, Reuters, 14 November 2023
[34] Concern for Rolls-Royce, other developers after US mini nuclear setback, Proactive Investors, 30 November 2023
[35] US energy secretary says new small nuclear reactors must be built to meet global climate pledge, Chattanooga Times Free Press, 5 December 2023
[36] Ben Houchen to strike deal with US company to develop mini-nukes in the North East, The Telegraph, 1 December 2023
[37] Six companies through to next stage of nuclear technology competition, GOV.UK, 2 October 2023
[38] UK's first small nuclear reactor deal 'poised' for signing but not with Rolls-Royce, Proactive Investors, 1 December 2023
[39] Rolls-Royce boss: we expect to win nuclear SMR race, The Times, 3 December 2023

Disclosure appendix

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