

ASX Announcement ([ASX: AXE](#))

21 January 2022

Second Quarter Activities Report

For the three months ending 31 December 2021

Significant Activities

- The Company is well capitalised with approximately \$29 million cash and no debt.
 - ¹²CQ chip development advances with the validation of qubit robustness, having important links to integration with practical chip devices.
 - Archer collaborates with the Australian Institute for Machine Learning with a 5-year MOU signed with the University of Adelaide.
 - Significant technological progress was made in Archer's biochip development by assembling nanosized components inside hair-thin microfluidic channels.
 - Archer develops its first biochemical reactions for applications in its biochip technology and files an Australian provisional patent application during the Quarter.
 - Successful distribution of shares and ASX listing of iTech Minerals Ltd and receipt of the final tranche of ChemX Materials Ltd shares which completed the divestment of the mineral exploration business.
 - Company GICS code changed to "Semiconductors" with Archer added to the S&P/ASX All Technology Index.
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Archer Materials Limited ("Archer", the "Company", "[ASX: AXE](#)") is pleased to report on its activities for the three months ending 31 December 2021 ("Quarter").

Commenting on second quarter activities, Greg English, Executive Chairman of Archer, said, "The in-specie distribution of the iTech Minerals Ltd shares, change of GICS code to semiconductor and Archer's admission to the S&P/ASX All Technology Index was completed during the Quarter. Archer is now recognised as a pure deep tech-focused company.

"During the Quarter, we were able to show that the ¹²CQ qubits quantum coherence properties are preserved under an inert atmosphere at room temperature. The fact that this work was done using qubits that had experienced a shelf-life of many years highlights the robustness of the fundamental components of the ¹²CQ quantum computer chip.

"During the Quarter, Dr Choucair and his team successfully fabricated microfluidic channels required for the biochip and integrated sensor components and other features within them on a silicon wafer.

"The share purchase plan and share placement completed during the Quarter raised \$25 million (before expenses) and the Company is now well funded. The funds raised will allow the Company to continue the development of the ¹²CQ quantum computer chip and the biochip."

Quarterly Activities to 31 December 2021

Archer is a technology company that operates within the semiconductor industry. The Company is developing advanced semiconductor devices, including chips relevant to quantum computing and medical diagnostics. The Company is progressing the development of its ^{12}CQ quantum computing qubit processor chip (" ^{12}CQ chip") and 'lab-on-a-chip' biochip technology ("biochip").

Technology development and commercialisation activities

^{12}CQ Chip

Archer's ^{12}CQ chip is a world-first qubit processor technology the Company is developing that would allow for mobile quantum computing powered devices. During the Quarter, the Company for the first time validated that the qubits' quantum coherence properties¹ are preserved under an inert atmosphere (ASX ann. 14 Oct 2021) (Image 1).

Archer also found that the quantum properties of the bulk qubit material could be recovered even after the qubit material experienced shelf-lives exceeding years, and when placed under extreme exposure to high temperatures for at least several weeks (i.e. the qubit material withstood exceptional degradation conditions that are possible in chip-based environments).

Quantum coherence is the fundamental requirement for quantum logic operations that are the basis of *any* qubit processor hardware. For potential integration and use of qubit materials in practical chip devices, it is significant to demonstrate and validate qubit robustness at room temperature and under atmospheric environments other than that of air or vacuum.

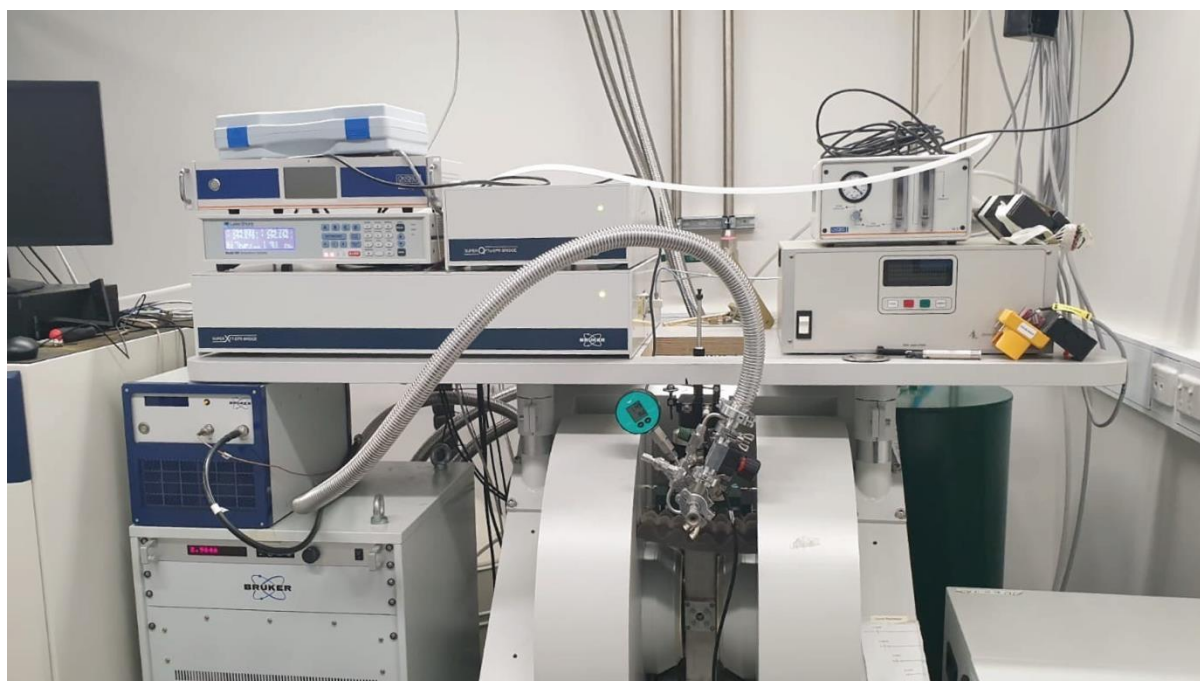


Image 1. Electron spin resonance setup to validate qubit robustness.

¹ <https://www.nature.com/articles/ncomms12232>

Exhibit 1. Description of Archer's technology patents and patent applications

Filing Date	Technology Summary																				
3 Dec 2015	<p> A quantum electronic device. Quantum electronic devices for processing qubits represented by an electron spin on a new type of carbon nanomaterial and methods for using this material in quantum computing.</p> <table> <tr> <th>Stage & Coverage</th><th>Patent/Application Number</th></tr> <tr> <td>Granted</td><td></td></tr> <tr> <td>Japan</td><td>6809670</td></tr> <tr> <td>South Korea</td><td>10-2288974</td></tr> <tr> <td>China</td><td>4606612</td></tr> <tr> <td>United States of America</td><td>11126925</td></tr> <tr> <td>Pending</td><td></td></tr> <tr> <td>Australia</td><td>2016363118</td></tr> <tr> <td>Hong Kong</td><td>18115770.4</td></tr> <tr> <td>Europe</td><td>3383792</td></tr> </table>	Stage & Coverage	Patent/Application Number	Granted		Japan	6809670	South Korea	10-2288974	China	4606612	United States of America	11126925	Pending		Australia	2016363118	Hong Kong	18115770.4	Europe	3383792
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15 Feb 2019	<p> Graphene complexes and compositions thereof. Complexes comprising graphene compositions, methods of synthesising these complexes and compositions, and the use of these complexes and compositions in biomolecular sensing.</p> <table> <tr> <th>Stage & Coverage</th><th>Patent/Application Number</th></tr> <tr> <td>Pending</td><td></td></tr> <tr> <td>Australia</td><td>2020220236</td></tr> <tr> <td>United States of America</td><td>17429442</td></tr> </table>	Stage & Coverage	Patent/Application Number	Pending		Australia	2020220236	United States of America	17429442												
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Australia	2020220236																				
United States of America	17429442																				
1 Dec 2021	<p> Detection and quantification of nucleic acids.</p> <table> <tr> <th>Stage & Coverage</th><th>Patent/Application Number</th></tr> <tr> <td>Provisional Patent</td><td></td></tr> <tr> <td>Australia</td><td>2021903898</td></tr> </table>	Stage & Coverage	Patent/Application Number	Provisional Patent		Australia	2021903898														
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Australia	2021903898																				
<p>Patent Family</p> <p> ¹²CQ chip  Biochip</p>																					

Advanced materials, AI, and quantum technologies are all listed and identified as critical technologies of national interest by the Australian Government². During the Quarter, the Company signed a non-binding memorandum of understanding ("MOU") with The University of Adelaide (ASX ann. 26 Nov 2021). By signing the MOU the Company has entered into a strategic relationship with the Australian Institute for Machine Learning ("[AIML](#)") that will focus on advanced materials development, device fabrication and characterisation, and the development of quantum semiconductors relevant to Archer's ¹²CQ chip technology. Cooperation between Archer and AIML is intended to last 5 years.

² <https://www.pmc.gov.au/resource-centre/domestic-policy/list-critical-technologies-national-interest>

During the Quarter Archer and Artificial Intelligence and Machine Learning consulting firm, [Max Kelsen](#), continued to work on developing quantum algorithms towards a use-case with verifiable quantum advantage. Both Archer and Max Kelsen are members of the global IBM Quantum Network.

This first collaborative project between Archer and Max Kelsen is focused on advancements in the area of quantum neural networks. The project is on track and near completion, and during the Quarter, jointly developed code was implemented using IBM's Qiskit quantum programming language and submitted to IBM for integration into the globally available Qiskit repository.

During the Quarter, the Company continued to work through the ¹²CQ chip technology patent application procedures in Europe and Australia after having the US, Chinese, and South Korean patents granted in Q1 (Exhibit 1).

Archer's Biochip

Archer's biochip is a unique graphene-based technology that the Company is building to enable the complex detection of some of the world's most deadly communicable diseases. The Company is currently focused on micro- and nano-fabrication of the biochip device components and combining these components with biologically relevant chemical reactions to detect diseases.

The biochip requires the advanced fabrication of features like hair-thin microfluidic channels that allow sample processing such as mixing, chemical or physical reactions. These channels also allow the transportation of samples to smaller built-in sensors for analysing biochemical targets, for example, of viruses or bacteria.

During the Quarter, the Company successfully fabricated microfluidic channels required for the biochip and integrated sensor components and other features within them on a silicon wafer (ASX ann. 4 Nov 2021), demonstrating for first time the fabrication, miniaturisation, and integration of critical biochip components (Image 2). This significant early-stage development at the micro- and nano-scale demonstrates the potential for increased compatibility with functions required for lab-on-a-chip biosensing, including for Archer's biochip.

The Company, in parallel to its nanofabrication progress, also successfully developed its first biochemical reactions for the detection and quantification of nucleic acid sequences (both DNA and RNA), for potential use and application at room temperature in its biochip technology (ASX ann. 1 Dec 2021). The nucleic acid sequences of interest could potentially be of viral, bacterial, or other microbial origin, which would allow for the development of Archer's biochip towards tailored on-chip pathogen detection.

Nucleic acid markers are useful for monitoring various states of health and disease; for the identification of pathogens and their strains; and the diagnosis of many diseases. Commonly known techniques to analyse biological samples for known nucleic acids include polymerase chain reaction (PCR). The techniques developed by Archer could potentially apply in conjunction with, or without, the use of PCR.

Archer owns 100% of the biochip technology intellectual property, and during the Quarter the Company filed an Australian provisional patent application (No. 2021903898) related to its biochip technology (Exhibit 1).

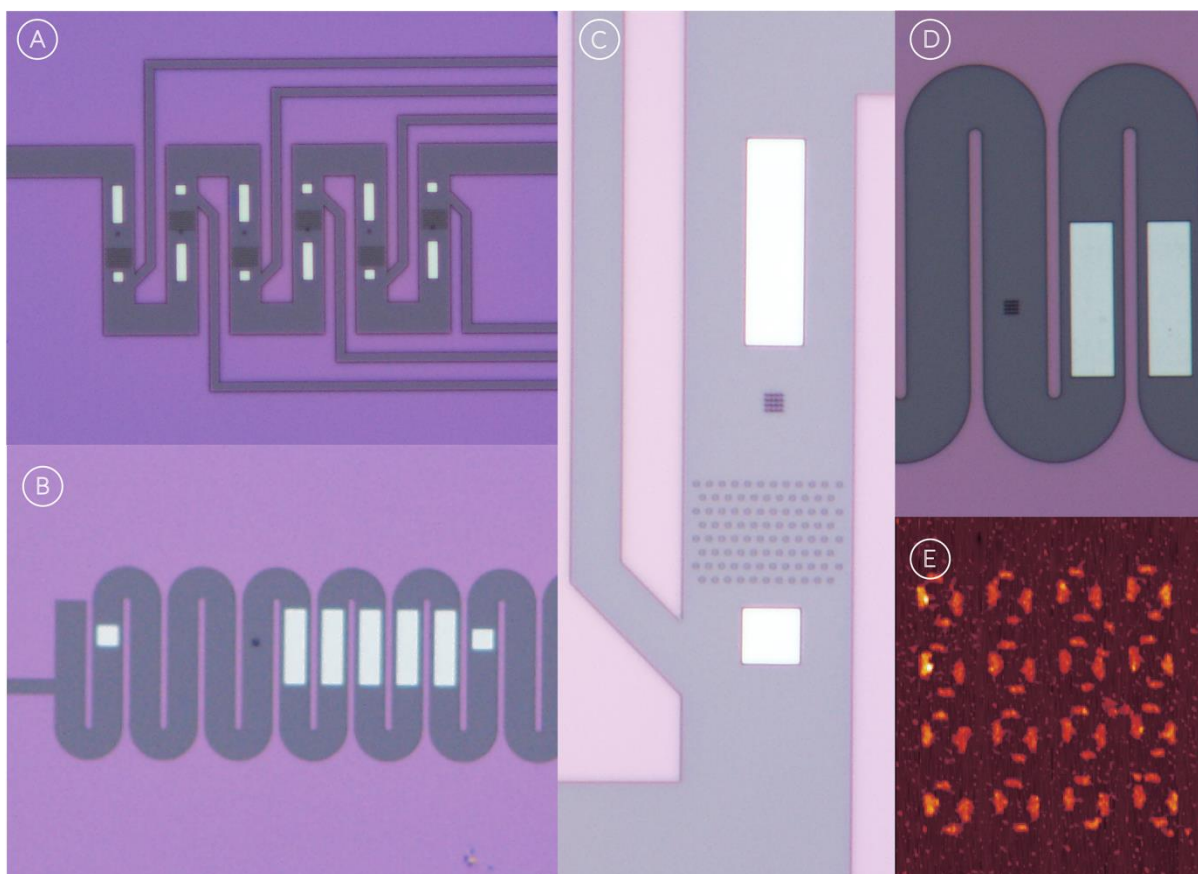


Image 2. Early-stage biochip assembly. **A** and **B** are images of two different fabricated patterns of on-chip microfluidic channels shown in the darker shaded regions on the purple background. The microfluidic channels are approx. 3 times thinner than a human hair. Additionally, features of **B** which are magnified and shown as the tight continuous curves in **D** and the magnified region of **A** showing small nanometre square arrays of pillars (approx. 500 nanometres in height) present above the white square region magnified in **C**, would allow for mixing of sample. The white squares and rectangle areas in **A** and **B** are pre- and post-sensing mixing stations and storage wells for chemical reactions. The pattern assemblies shown in **A** and **B** integrate electrode routing for 96 biosensing areas and are an unoptimised proof of concept. The image in **E** shows a highly magnified area of the nanosized biosensing electrodes (approx. 100 nanometres in size) that can be seen in **C** and **D** as a 4 x 4 electrode array, which would allow for biosensing and are nanofabricated using various metals. Archer's biochip development involves designing the sensing components in **E** to incorporate graphene materials.

Financial update

The Company's cash balance at the end of the Quarter was \$29,080,000.

During the Quarter, the Company raised \$25 million (before expenses) via an institutional placement (\$15 million) and share purchase plan (\$10 million). Under the placement and share purchase plan, shares were issued at \$1.45 per new share.

During the Quarter, the Company received \$459,368 from the ATO in respect of Archer's R&D tax incentive for the year ended 30 June 2021.

At the end of the Quarter, the Company held 6,535,775 shares in Canadian Stock Exchange listed Volatus Capital Corp (CSE:VC) and 11,571,119 shares in ASX listed ChemX Materials Ltd (ASX:CMX) ("CMX Shares"). The CMX Shares have been classified by ASX as restricted securities and must be held in escrow for 24 months from the date of ChemX listing on the ASX.

Archer's accompanying Appendix 5B (Quarterly Cashflow Report) includes amounts in item 6.1, which were executive and non-executive director fees paid as salaries and wages. The Company does not hold any mineral tenements and did not spend any funds on exploration activities.

Corporate

Change of GICS code

Archer has changed its GICS code from 'Materials - Diversified Metals & Mining' to 'Information Technology - Semiconductors'. The Company was added to the S&P/ASX All Technology Index effective before the opening of trading on December 20, 2021 (ASX ann. 3 Dec 2021).

Issued Capital

Date	Shares	Options
Start of Quarter	227,706,546	14,318,277
New issues during Quarter	17,242,384 ^{(1) (2)}	24,050,000 ⁽³⁾
Options Exercised/forfeited during Quarter	2,618,277 ^{(4) (5)}	2,618,277 ^{(4) (5)}
End of Quarter	247,567,207	35,750,000
Date of this Report	247,567,207	35,750,000

- (1) 10,344,828 fully paid ordinary shares at an issue price of \$1.45 per share were issued on 8 October 2021, pursuant to a share placement to professional and sophisticated investors.
- (2) 6,897,556 fully paid ordinary shares at an issue price of \$1.45 per share were issued on 27 October 2021, pursuant to a share purchase plan dated 7 October 2021.
- (3) 24,050,000 unlisted options were issued to directors and employees following shareholder approval at the Company's Annual General Meeting held on 24 November 2021.
- (4) The exercise of 1,418,277 unlisted options, exercisable at \$0.1511 by 31 March 2023.
- (5) The exercise of 1,200,000 unlisted options, exercisable at \$0.1929 by 31 March 2023.

Annual General Meeting

The Company's Annual General Meeting was held in Adelaide on 24 November 2021. All resolutions put to the meeting were passed on a poll.

Appointment of Non-Executive Director

During the Quarter the Company announced the appointment of Bernadette Harkin as a Non-executive Director of the Company (ASX ann. 6 Oct 2021). Bernadette joins Archer as an independent director and a member of the Audit and Risk Committee. Bernadette's appointment to the Board was confirmed by shareholders at the Annual General Meeting.

Bernadette has over 20 years of experience working as a business technologist across strategy, sales, marketing, operations, and delivery for multinational Information Technology companies including IBM, Avanade, and CGI. This includes 3 years at IBM where Bernadette served as a board member for IBM Philippines. Bernadette's experience covers technology areas of Cloud, Analytics, Mobility, AI and Security.

Divestment of remaining mineral tenements

During the Quarter the Company completed the sale of its remaining mineral exploration business to iTech Minerals Ltd ("iTech") (ASX ann. 14 Oct 2021), and advised shareholders that the Australian Taxation Office had published a Class Ruling ([CR 2021/98](#)) (the "Ruling") relating to the in-specie distribution of iTech shares ("Capital Return") (ASX ann. 16 Dec 2021).

Stakeholder events and outreach

During the Quarter, Archer attended the in-person [Q2B 2021 Conference](#) on Practical Quantum Computing held in Silicon Valley, USA, 7-9 December 2021, which hosted leading quantum computing experts and companies from around the world. Archer's attendance to Q2B 2021 was a productive time to meet with colleagues from IBM, and to explore opportunities for strategic business relationships with US organisations. Archer's CEO was in attendance and shared [key insights](#) from the 3-day event.

The Company electronically distributed a number of Newsletters and Commentary to shareholders during the Quarter, including:

- + [Newsletter: US Patent Granted For 12CQ Chip Technology](#)
- + [Newsletter: Archer Enters A New Era Of Growth As A Pure-Play Deep Tech](#)
- + [Newsletter: Biochip Tech Advances, Archer In Silicon Valley](#)
- + [CEO Commentary: Australian Government Commits To Quantum Technology](#)
- + [CEO Commentary: Ensuring Online Security In A Quantum Future](#)

Archer CEO, Dr Mohammad Choucair, gave media interviews, and other online webinars to shareholders and investors:

- + [Interview with The Market Herald](#)
- + [Stocks Down Under's Third Annual Semiconductor Conference](#)
- + [Q2B 2021 Conference](#)
- + [A behind-the-scenes look at quantum computing company Archer Materials](#)
- + [Lot Fourteen's Job's of Tomorrow \(news.com.au\)](#)
- + [Digital Nation interview with IBM and Archer](#)
- + [ASX Investor - Archer Materials' Quantum Computing Journey](#)

About Archer

Archer is a technology company that operates within the semiconductor industry. The Company is developing and commercialising advanced semiconductor devices, including chips relevant to quantum computing and medical diagnostics.

The Board of Archer authorised this announcement to be given to ASX.

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