

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

9 July 2020

## Qubit control measurements commence

### Highlights

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- Archer has commenced development towards its first major technological milestone in the operation of its <sup>12</sup>CQ quantum computing chip.
  - Quantum control measurements on Archer's unique qubit components ("qubit") to be performed at world-class institutes in Sydney.
  - The successful completion of the control measurements would be major validation of the commercial viability of the <sup>12</sup>CQ chip.
  - Chip build is advancing, with control measurements to be performed over the next 6 months as part of the overall fabrication process roadmap.
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Archer Materials Limited ("Archer", the "Company", "[ASX: AXE](#)") is pleased to announce the Company has commenced a significant phase in its technology development as part of its commercial roadmap to build the <sup>12</sup>CQ room-temperature quantum computing qubit processor ("chip"). Archer is one of very few companies globally that provides investors a direct, on-market opportunity to invest in quantum computing technology.

**Commenting on the Company's <sup>12</sup>CQ chip fabrication, Archer CEO Dr Mohammad Choucair said:** "Achieving control of single and few qubits in our <sup>12</sup>CQ chip design components would mark our first major technology development milestone in chip operation and a paradigm shift in the wider quantum computing economy that thrives on and values such disruptive advances.

"The Company's recent successful and oversubscribed share purchase plan means we have been able to accelerate Archer's <sup>12</sup>CQ work programs to significantly reduce the time previously allocated for *control fabrication*, from 12 months to around 6 months, and has provided the opportunity to rapidly derisk chip development, which we have now commenced".

### Qubit control is an integral part of the <sup>12</sup>CQ chip operation

Qubit control componentry fabrication, prototyping, measurements, and quantum materials characterisation ("control measurements") has begun. The control measurements on qubit components ("qubits") are being led and carried out by Archer staff together with world-renowned experts in the field of quantum computing in Australia.

The control measurements involve accessing and processing quantum information residing on individual and few qubits, which is directly linked to chip operation, unlike previous 'measurements' of single qubit conductivity (ASX Ann. [15 Jun 2020](#)) which were successfully performed and are directly linked to device integration. The control measurements are an integral part of the chip operation, and prototyping the control componentry is an important part of the overall chip fabrication process.

The measurements are being performed across a number of world-class institutes, laboratories, and semiconductor foundry facilities in Sydney. The speciality qubit control instrumentation have now been received from suppliers in the US, configured, and integrated into the measurement systems which have been custom designed, and purpose built for this work, together with qubit control software for the instrumentation which has been developed and tested.



**Image 1.** Archer staff inside the semiconductor foundry facility in Sydney where the Company builds the  $^{12}\text{CQ}$  chip and related control componentry and testbed devices. All the materials necessary for the measurements are available, including the qubit material which can be easily prepared on site, and all the silicon substrates, wafers, metals, ceramics, and specialty materials for nanofabrication.

### **Achieving single qubit control in $^{12}\text{CQ}$ would represent a major technical milestone**

The  $^{12}\text{CQ}$  chip design requires the isolation of a few to single qubit components for the chip to successfully operate. This will involve fabricating testbed devices (see ASX Ann. [15 Jun 2020](#)). Controlling quantum information residing on individual qubits (“control”) is a key componentry requirement for a working quantum computing qubit processor; another being *readout*. Control must be performed prior to readout, as these subsequent steps represent a logical series in the  $^{12}\text{CQ}$  quantum computing chip function.

The control measurements related to the  $^{12}\text{CQ}$  chip fabrication are a world-first, in particular related to solid-state, non-optical quantum computing systems. The successful completion of the control measurements is a major factor in validating the commercial viability of the  $^{12}\text{CQ}$  chip technology<sup>†</sup> as qubit control is what allows for operation, function, utility and performance.

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<sup>†</sup> <https://www.bcg.com/en-au/publications/2019/quantum-computers-create-value-when.aspx>

## Archer's <sup>12</sup>CQ chip technology and related intellectual property

<sup>12</sup>CQ is a world-first technology that Archer aims to build for quantum computing operation at room-temperature and integration onboard modern electronic devices. For more information about Archer's quantum computing technology, please view the Company's [most recent technical presentation](#).

Archer maintains an exclusive licence to all the intellectual property rights related to the <sup>12</sup>CQ chip technology, including [trade secrets](#) resulting from the control measurements, and [patent applications](#) filed under the Patent Cooperation Treaty ("PCT") to protect and commercialise intellectual property in Australia, China, Japan, South Korea, Hong Kong, European Union, and the United States. The international PCT application continues to progress in all jurisdictions at various stages of the patent granting procedure. <sup>12</sup>CQ® is a registered trademark of Archer Materials Limited.

## Next steps in the <sup>12</sup>CQ fabrication roadmap

The Company's technology development is currently focused on achieving quantum control of a single qubit, that is essential for quantum information processing. Over the next 6 months Archer will perform quantum measurements and materials characterisation at different laboratory facilities to achieve quantum control, and key measurements will be released to ASX. The control measurements will be performed in parallel to other technology development work packages, intellectual property prosecution, and commercialisation.

Further reading with much deeper technical details on what is generally and fundamentally involved in [performing quantum measurements](#) on [a single qubit](#) is available online.

## About Archer

A materials technology company developing materials in quantum computing, biotechnology, and lithium-ion batteries, and exploring for minerals in Australia. The Company has strong intellectual property, broad-scope mineral tenements, world-class in-house expertise, a unique materials inventory, and access to over \$300 million of technology development infrastructure.

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

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