

s 47E(d)

Technical Advisory Group (TAG) – Technology Due Diligence (TDD) Report 28 September 2023

Key judgements

s 47C, s 47G

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• s 47C, s 47G

- Based on updated data provided by the company in the context of non-binding negotiations, the TAG assessed that the company:
 - appears to demonstrate the capability to continue to progress along their technology roadmap. This is based on having achieved or progressed towards several previously identified technological milestones;
 - has demonstrated a high level of competency in identifying and resolving technological barriers, and that this approach is a positive indication that the company will continue to achieve against their technology roadmap; and
- However, the TAG considered that it had not yet had the benefit of sufficient clarity or technical detail from s 47E(d) to assess the veracity or significance of all of s 47E(d) claimed achievements.
- On this basis, should the Commonwealth decide to proceed with an investment, the TAG assessed it would be beneficial for the Commonwealth to progress further verification of s 47E(d) ability to demonstrate its claimed capabilities, including by undertaking a site visit of s 47E(d) US operations and ongoing technical due diligence for the duration of the project.

1. Technical due diligence methodology

The Taskforce established a Technical Advisory Group to provide oversight of the technical elements of the project, including technical due diligence. TAG members are:

- Anthony McGregor, TAG Chair and Head of Division, Technology Investment Taskforce (TITF), Department of Industry, Science & Resources (DISR),
- Dr Cathy Foley, Australia's Chief Scientist
- Dr David Kershaw, Chief, Science Strategic Planning & Engagement, Defence Science and Technology Group (DSTG),
- Prof Elanor Huntington, Executive Director, Digital, National Facilities & Collections, CSIRO

- David Webster, First Assistant Secretary, Commercial Investments Division, Department of Finance

The Taskforce also established a technical due diligence (TDD) working group to undertake TDD activities:

- a. s 22(1)(a)(ii) Quantum Information Science Program, Defence Science and Technology Group (DSTG);
- b. s 22(1)(a)(ii) Research Scientist, Standards for Time and Frequency, National Measurement Institute (NMI); and
- c. s 22(1)(a)(ii) Research Scientist, Manufacturing, Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The TDD working group was tasked to:

- Review the existing TDD.
- Consider any progress and further information available from s 47E(d) since the DSTG Technology Risk Indicator (TRI) report that was completed in April 2023.
- Identify additional information required from s 47E(d) to perform further due diligence.
- Undertake an assessment of the information provided to inform advice to government on technology risk.
- Consider whether further technology due diligence might be desirable post September 2023 should the project progress.

To achieve this, the TDD working group has:

- Obtained further data and information from s 47E(d) through requests for information submitted as part of the non-binding negotiation process.
- Reviewed public data and reports.
- Participated in a technical briefing with Professor Andrew White.
- Engaged with the project's Technical Advisory Group (TAG) (consisting of Dr Cathy Foley (Australia's Chief Scientist), Dr Elanor Huntington (CSIRO's Executive Director) and Dr David Kershaw (DSTG) on 1 September 2023 to discuss technology issues and challenges.
- In consultation with the TAG, refined a list of technical questions that were subsequently provided to s 47E(d) executive and technical staff before face-to-face Canberra meetings in the week of 4 September 2023. Meetings were held with:
 - s 22(1)(a)(ii), Chief Scientific Officer,
 - s 22(1)(a)(ii), Senior Quantum Researcher
 - s 22(1)(a)(ii), Director, R&D Engineering
 - s 22(1)(a)(ii), Chief Commercial Officer
- Submitted a further set of technical questions to s 47E(d) seeking additional information.
- Discussed and scoped activities for a proposed site visit to s 47E(d) facilities to support the TDD process.
- Prepared this report as a record of TDD undertaken in order to inform advice to Government. This report was endorsed by the TAG on 22 September 2023.

2. Outcomes of technical due diligence

s 47C, s 47G

Based on the assessment of material available at the time of writing, the TAG assessed that:

- s 47E(d) demonstrates the capability to continue to progress along its technology roadmap, based on achievement of having made substantial progress towards several previously identified technological milestones. Attachment B provides a detailed technology update relative to the DSTG TRI report from May 2023.
- s 47E(d) demonstrates a high level of competency in identifying and resolving technological barriers.
- Further information from s 47E(d) would provide greater ability to assess risks in the technical development path and associated systems integration. This includes information relating to s 47(1)(b), s 47C . Information provided to date is insufficient to provide a full technical assessment.

There were some inconsistencies and gaps in information provided by s 47E(d) in response to requests for information. Further information should continue to be sought where it will inform assessment of technology risks.

s 47(1)(b), s 47C

s 47C, s 47G

3. Suggested next steps

The TAG considered that the following actions would further support assessment of risks relating to the s 47E(d) proposal:

- A site visit by suitably qualified technical experts to conduct on-site technical assessments of specific capabilities.
s 47(1)(b), s 47C

In response to these findings, that Taskforce is currently liaising with s 47E(d) to organise a site visit.

The site visit (see Attachment D) will aim to:

s 47(1)(b), s 47C

s 47(1)(b), s 47C

If the government were to proceed with an investment to support ^{s 47C, s 47G}

Attachments

Attachment A Summary of Technology Risk Indicator

Attachment B Technology progress update summary

Attachment C Suggested activities for a site visit to US based ^{s 47E(d)} facilities

Attachment A

s 47(1)(b), s 47C

s 45, s 47(1)(b), s 47C

Technology progress update summary

s 45, s 47(1)(b)

Attachment C

s 47(1)(b), s 47C

PsiQuantum US site visit

Executive summary

Between 10 and 12 October 2023, two experts from the Technology Due Diligence (TDD) working group conducted a site visit of PsiQuantum's facilities in the United States to gain further insight into the company's technical roadmap and address gaps identified through the TDD process. The visit sought to increase confidence in the assessment of PsiQuantum's project proposal and the associated technical, systems and integration risks by verifying these issues firsthand and answering questions from the Technical Advisory Group.

The assessors, ^{s 22(1)(a)(ii)} (Defence Science and Technology Group) and ^{s 22(1)(a)(ii)} (National Measurement Institute), evaluated the staff levels, facilities and infrastructure at PsiQuantum's headquarters in Palo Alto, ^{s 45, s 47(1)(b)} and, via video call, their cryogenic testing facility in Daresbury, UK. While onsite, the assessor's itinerary included inspecting laboratory facilities, discussions with key technical personnel and live demonstrations of measurement processes associated with key technology risk areas.

The assessors judged that:

- PsiQuantum demonstrated the necessary capacity, technical expertise and established facilities and systems to pursue its technology roadmap, taking into consideration the ambitious and high-risk nature of the project.
 - Development steps for technology risk areas were well planned and provide a logical and risk-mitigated pathway towards realising a Fault-Tolerant Quantum Computer.
- Onsite team members were willing to provide information with a high degree transparency.
- Team members demonstrated extensive experience and considerable capability, with senior technical members being experts in their fields.
- Based on the onsite demonstration of tests and data analysis, the assessors were able to verify and validate claims made by PsiQuantum on achievements to date.

PsiQuantum provided evidence to respond to key questions on specific technology, systems and integration risks raised by the Technical Advisory Group (TAG) during the TDD process, including with respect to:

- The demonstration of mature development processes that enable rapid technological advancement. ^{s 45, s 47(1)(b)}
- ^{s 45, s 47(1)(b)} ^{s 45, s 47(1)(b)} PsiQuantum has a clear development path, rigorous process pipeline, the facilities and expertise to meet its milestones; and current processes are sufficient to reach ^{s 45, s 47(1)(b)}
- ^{s 45, s 47(1)(b)}

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- s 45, s 47(1)(b)
-
-

Overall, PsiQuantum's progress and capabilities in most technology risk areas exceeded expectations, s 45, s 47(1)(b)

- s 45, s 47(1)(b)
-

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s 45, s 47(1)(b)

s 45, s 47(1)(b)

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Site visit schedule

Day 1:	Tuesday 10 October
9.00am	s 45, s 47(1)(b)
10.30am	Break – 30 mins
11.00am	s 45, s 47(1)(b)
11:45am	s 45, s 47(1)(b)
12.30pm	Lunch – 60 mins
1.30pm	s 45, s 47(1)(b)
3:00pm	Break 15 min
3.15pm	s 45, s 47(1)(b)
5:15pm	Day 1 end
Day 2:	Wednesday 11 October
9.00am	s 45, s 47(1)(b)
9:30 am	Break – 15 mins
	s 45, s 47(1)(b)

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1.00pm	Lunch – 60 mins
2.00pm	s 45, s 47(1)(b)
3:30pm	Break – 30 mins
4:00pm	s 45, s 47(1)(b)
5:00pm	Day 2 end
Day 3:	Thursday 12 October
9.00am	s 45, s 47(1)(b) <i>Break as needed</i>
12:00pm	Lunch – 60 mins
1.00pm	s 45, s 47(1)(b)
3.00pm	Break – 30 mins
3.30pm	Wrap up and follow up on Canberra discussions- s 22(1)(a)(ii)
4.30pm	Day 3 end

Figure 1. Onsite visit itinerary

PsiQuantum personnel

The table below is a non-exhaustive list of PsiQuantum staff with whom the assessors interacted during the site visit, including key personnel that presented or responded to questions and their roles within the company. As some staff were introduced by first name only, some staff surnames are unknown to the assessors.

Name	Role	Home Location
s 22(1)(a)(ii)	s 45, s 47(1)(b)	UK
		AUS
		US
		US
		UK
		UK
		US
		US

s 22(1)(a)(ii)	s 45, s 47(1)(b)	US
		UK
		UK
		US
		Europe
US		
US		
US		

Facility details and staff levels

Interactions with senior technical staff revealed their expertise to be at a world-leading level within their respective fields. Discussions and demonstrations by junior laboratory staff indicated they were highly competent and at the level of senior PhD students and post-doctoral researchers.

The company has six key sections:

- s 45, s 47(1)(b)
-
-
-
-
-

The total number of employees is close to 250 with staff divided evenly across all sections.

Palo Alto – PsiQuantum Headquarters

The visit to PsiQuantum’s headquarters in Palo Alto substantiated the company’s claims, revealing staff levels and facilities commensurate with their achievements and plans for developing a fault tolerant quantum computer (FTQC). s 45, s 47(1)(b)

s 45, s 47(1)(b)

Daresbury – UK operations cryogenics development

A live video-call tour was conducted from the Daresbury cryoplant facility, allowing the assessors a firsthand view of:

- s 45, s 47(1)(b)
-

The Daresbury facility is a major research facility of the Science and Technology Facilities Council, with infrastructure to support nuclear physics and supercomputing research and employing approximately 300 staff.

s 45, s 47(1)(b)

Expression of Interest (EOI): Develop an onshore commercial-scale universal fault tolerant quantum computer

Evaluation Report

Evaluation Report

Evaluation Assessment Panel

As per the EOI Plan, the EOI Assessment Panel (EAP) comprised:

Position on the EAP	Name	Title	Section, department
Chairperson	Dianna Gaetjens	Deputy Head	Department of Industry, Science and Resources
Member	s 22(1)(a)(ii)		Department of Finance
Member	s 22(1)(a)(ii)		Department of Defence

EOI participants and responses received

Name of suppliers who signed a non-disclosure agreement and were provided with the EOI pack	Response submitted (yes/ no)
---------------------------------------------------------------------------------------------	------------------------------

s 45, s 47(1)(b)

s 45, s 47(1)(b) requested changes to the non-disclosure agreement (NDA). In order to ensure a fair and balanced process in accordance with the EOI plan, s 45, s 47(1) was informed that some of their proposed modifications to the NDA could not be accepted. Subsequently s 45, s 47(1) did not submit an acceptable NDA and did not receive the EOI information pack.

One company, s 45, s 47(1)(b) received the EOI pack but chose not to provide a submission.

Findings

The panel considers that none of the submissions received are highly competitive.

The panel considers that none of the proposals received are competitive.

The panel considers that the following proposals are borderline.

s 47C, s 47G

The panel considers that the following proposals are not competitive.

s 47C, s 47G

s 45, s 47(1)(b) was excluded from further assessment. Additional information is included in the Probity - Process Issues and Management section.

Individual assessments for each proposal are listed in Attachment A.

Authorisation

EOI Assessment Panel Signatures

The undersigned members of the EOI Assessment Panel agree with the findings, requirements and obligations of this Evaluation Report and attachments.

s 22(1)(a)(ii)

s 22(1)(a)(ii)

s 22(1)(a)(ii)

Dianna Gaetjens (DISR)

s 22(1)(a)(ii)

Department of
Finance)

s 22(1)(a)(ii)

DSTG)

25/9/2023

25/09/2023

25/SEP/2023

Summary

The market testing process was conducted through a confidential Expression of Interest (EOI) informed by the Public Governance, Performance and Accountability Act 2013 (PGPA), the Commonwealth Investment Framework (CIF), the Commonwealth Grants Rules and Guidelines (CGRGs) and the Commonwealth Procurement Rules (CPRs).

The Australian Government, represented by the Department of Industry, Science and Resources (DISR), sought information from a range of companies about their interest and capability in developing, building and operating a commercial-scale universal fault tolerant quantum computer (FTQC) in Australia (ideally by 2030 and preferably earlier), and delivering a range of related benefits to strengthen Australia's quantum sector and contribute to the national interest.

The EOI process sought responses from interested parties to achieve the following objectives:

1. To accelerate the development of world-leading quantum computing capabilities in Australia, including delivering on the Government's ambition to build the world's first commercial-scale, universal FTQC in Australia.
2. To strengthen Australia's quantum sector, including through enabling potential translation and commercialisation paths for Australian-based research and development.
3. To support initiatives that enhance domestic and international links with strategic partners in the national interest.

Respondents were asked to provide information demonstrating their capability to deliver against these objectives by responding to the criteria set out at Attachment B. Respondents were also asked to indicatively or provisionally cost their proposals, as well as provide information about the types of financing or support required.

The list of potential respondents invited to participate in the process is at Attachment C. This list was compiled on the basis of expert advice (see the Evaluation Plan for more detail) and endorsed by the TAG on 11 August 2023.

Potential respondents were approached via email on 14 August 2023 and invited to participate. Of those offered the opportunity to participate, six companies s 45, s 47(1)(b) completed a Deed of Confidentiality and were subsequently provided the EOI pack for further

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consideration. Five companies^{s 45, s 47(1)(b)} provided submissions by the closing time of 9:00am Monday 11 September 2023.

Evaluation Process

An Evaluation Plan was developed to guide the assessment of responses to the market testing process.

EOI responses were distributed to all EAP members on Monday 11 September following the deadline for submissions.

The EAP assessed responses strictly against the five categories in the requirements table (Attachment B) with reference to:

1. how well each response addressed the relevant Category (including completeness); and
2. the degree to which the respondent's assertions and claims were demonstrated or supported, and the merit of any supporting information provided.

Each EAP member reviewed the responses individually. The EAP met as a panel on the following occasions to discuss the evaluation:

- Tuesday 12 September 2023
- Wednesday 13 September 2023
- Friday 15 September 2023
- Monday 18 September 2023

A draft report was circulated for consideration on Monday 18 September and finalised on Wednesday 20 September 2023.

The EAP was assisted by the following expert advisors:
^{s 22(1)(a)(ii)}

In addition, on 18 September, the EAP sought further advice from the Technical Advisory Group consisting of:

- Dr Cathy Foley, Australia's Chief Scientist
- Professor Elanor Huntington, Executive Director, CSIRO – Digital, National Facilities and Collections
- Dr Nigel McGinty, Chief Technology Officer - Science Strategy, Communications and International Engagement, Defence Science and Technology Group (acting as the delegate for Dr David Kershaw, Chief - Science Strategic Planning and Engagement, Defence Science and Technology Group.)

As per the Evaluation Plan, this Evaluation Report includes:

- background to the process (see Summary section);
- assessment of the responses, including identifying strengths and weaknesses (see Attachment A);
- value for money considerations if determinable at this stage (see Attachment A);
- identification of any risks if determinable at this stage (see Attachment A);
- identification of any issues which should be resolved by discussion with the respondent; and
- an overall assessment of each response according to one of four categories (highly competitive, competitive, borderline, and not competitive) (see Findings section above).

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For the purposes of the evaluation, the evaluation categories were defined as:

- Highly competitive: demonstrated an excellent understanding of the criterion and provided a considered and comprehensive response supported by evidence (where possible) that indicated a highly credible pathway for meeting the requirement.
- Competitive: demonstrated a reasonable to good understanding of the criterion and provided a credible response supported by some evidence (where possible) that indicated a reasonable ability to meet the requirement.
- Borderline: demonstrated an acceptable understanding of the criterion and provided a response demonstrating consideration of a pathway to meet the requirement but with significant gaps, insufficient detail or unsupported by evidence.
- Not competitive: either did not address the criterion; or did not demonstrate sufficient understanding of the criterion; or did not provide a pathway to meet the criterion.

Probity – Process, Issues and Management

The Expression of Interest (EOI) process was undertaken consistent with an approved Probity Plan which is in place for the broader Technology Investment Taskforce activities, including this EOI process. This was monitored and guided by s 22(1)(a)(ii) Managing Director - Sententia, the probity adviser to the process. All EAP participants had access to that Probity Plan.

Prior to release of the Request for EOI (REOI), the probity adviser was able to review the list of invited respondents (including understanding how that list was developed), the initial correspondence to invited respondents requesting confidentiality commitments, the NDA which was used, the REOI document and the EOI Evaluation Plan. Any material amendments to each of these suggested by s 22(1)(a)(ii) were undertaken. Following that, s 22(1)(a)(ii) confirmed that the invitation documentation and process was established in a way to support effective management of probity in order to bring probity risk down to a reasonable level.

While in the market, an organisation who was not invited to participate in the EOI process inquired as to whether it could participate. Following consideration of the entity and seeking to understand how information about the EOI process had been accessed, the organisation was advised that it would not be able to participate in order to uphold the probity of the process.

s 22(1)(a)(ii) attended all meetings of the EAP to ensure deliberations were conducted in accordance with the probity principles governing the EOI process.

Panel members, project officers and technical advisers completed confidentiality deeds and conflict of interest declarations as per the Evaluation Plan. Panel members, project officers and technical advisers received a probity briefing in advance of considering the EOI responses.

Members of the Technical Advisory Group also completed confidentiality deeds and conflict of interest declarations. This includes Dr McGinty, who was Dr David Kershaw's delegate.

Through the conflict-of-interest declaration process, some sources of potential or perceived conflict of interest were identified. These related primarily to known professional engagements within the sector. There were no 'red flag' issues relating to actual conflicts based on the information provided by participants in this process. The sector within Australia is relatively small, and it is known that many business and academic associations exist between individuals in the sector.

Some professional connections were identified between:

- CSIRO and the EOI participants,
- TAG members and the EOI participants,
- Technical advisers and the EOI participants, and
- EAP members and the EOI participants.

Noting that quantum physics sector is a small and close community,^{s 22(1)(a)(ii)} and the Chair of EAP assessed that some risks were unavoidable. However, it was considered that these connections did not give rise to current, actual conflicts and could be managed.

Processes put in place to manage these potential or perceived conflicts included:

- The Chair of the EAP having no disclosable conflicts of interest with regard to the respondents to the REOI, allowing her to be entirely objective in her management of the process.
- While one member of the EAP had a "potential perceived" conflict of interest, it was only "potential perceived", and by virtue of their role was considered reliable in terms of their contribution. (The EAP Chair agreed that a risk of utilising that member brought some risk, but it was determined that the risk was both unavoidable, and reasonably low.)
- Transparency of all relationships that may create potential or perceived conflicts of interest, allowing the EAP Chair and EAP members (as well as the probity adviser) to monitor all contributions for indication of bias or lack of objectivity. The EAP Chair and EAP members all considered any contribution in light of the potential for bias by virtue of a pre-existing relationship, and utilised their input with a view of being circumspect in relying on advice received.
- If there were outliers or inconsistencies in advice that may be influenced by pre-existing relationships, then this would not be utilised. (No such instances occurred during the evaluation.)
- Each EAP member and each EAP adviser formally confirmed at the completion of the evaluation that their input was not in any way impacted by the relationships that existed.

It was recognised and disclosed that there is some residual risk associated with the complex accumulation of relationships impacting the evaluation, however, with the aforementioned controls, the Chair of the EAP (following advice from the probity adviser) determined that it was managed as low as practicable, and to a level that supported the process providing reliable and relevant advice to Government.

One Respondent Excluded

A breach of the deed of confidentiality by one of the respondents^{s 45, s 47(1)(b)} was identified through the content of the EOI submission, as well as following feedback from CSIRO.
s 45, s 47(1)(b)

The breach was perceived by the panel as significant. The following decisions were made to manage this issue:

- s 45, s 47(1)(b) submission would not be considered for any future funding opportunities or procurements that may arise out of this process.
- s 45, s 47(1)(b) submission might still be viewed as a source of market intelligence regarding the sector.

The panel determined that there was no action that could be taken to mitigate the loss of control of knowledge of the EOI process.

Attachment A – Detailed assessments

s 45, s 47(1)(b)

expression of interest (EOI): Develop an onshore commercial-scale universal fault tolerant quantum computer

s 45, s 47(1)(b)

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s 45, s 47(1)(b)

Expression of Interest (EOI): Develop an onshore commercial-scale universal fault tolerant quantum computer

EOI Requirements

Category	Requirement	Description of Requirement
Technology, IP and readiness to scale	Maturity and feasibility of the technological approach	Reasonable prospect that technology can achieve a commercial-scale universal FTQC, ideally by 2030, and preferably earlier, including through evidence of milestones already met and upcoming milestones.
	Capability	Demonstrate capability by: <ol style="list-style-type: none"> a) Identifying a problem of commercial value (demonstrate the implication and possible magnitude of the value) and the current classical best practice attempt to solve it. b) Estimating the run time that can be achieved by the commercial-scale universal FTQC that can be deployed ideally by 2030 and the comparative speed up that will be achieved compared to the classical approach to quantify the expected quantum advantage.
	FTQC prediction date	Demonstrate justification for predicted date of achieving the commercial-scale universal FTQC (i.e. when is respondent forecasting successful production and operation of first FTQC and what are the assumptions underpinning this outcome?).
	Roadmap and processes for achieving FTQC	Demonstrate the processes, pathways and investments respondent is making to meet the prediction date.
	Ownership and commercial certainty over IP	Ownership of, access to, or ability to develop the IP required to deliver and operate the FTQC. Ability to use IP in Australia.
	Component availability / supply chains	Indicate how components will be sourced and whether pathways exist to scale production.
	Direct benefits to Australian economy	Build in Australia
Support for local industry ecosystem		Indicate what flow-on effects could be expected for Australia's quantum sector from the manufacture and production of the FTQC.
R&D ecosystem		Indicate any intent to support university and research institutions in Australia.

	Supply-chain use	Degree of potential involvement of Australian industry in the FTQC supply chain, including in project and post project phases.
	Potential to attract further investment to Australia	Indication of any potential to attract further investment to Australia.
Broader benefits to Australian economy	Willingness to partner with Government to deliver strategic objectives	Outline whether the FTQC build might contribute to Australian Government strategic objectives.
	Additional benefits	Potential for R&D, industry ecosystem formation, and induced job creation in Australian industry.
Required investment and support	Support required	The expected duration, quantum and nature of Government support that would be required.
Company capability	Corporate capability	Outline balance sheet and capital raising plans to implement delivery.

DRAFT

Companies invited to participate

s 45, s 47(1)(b)

