SIF Alpha Round 2 Project Registration

Date of Submission

Nov 2023

Project Reference Number

CAD_SIF0004

Initial Project Details

Project Title

Digital Inspector Alpha R2

Project Contact

Innovation@Cadentgas.com

Challenge Area

Improving energy system resilience and robustness

Strategy Theme

Data and digitalisation

Lead Sector

Gas Distribution

Other Related Sectors

Gas Distribution

Gas Transmission

Project Start Date

01/09/2023

Project Duration (Months)

6

Lead Funding Licensee

Cadent

National Grid - Gas Transmission (GB wide)

Funding Licensee(s)

Cadent

Funding Mechanism

SIF Alpha - Round 2

Collaborating Networks

Cadent

National Gas Transmission PLC

Technology Areas

Gas Distribution Networks

Project Summary

The project continues to meet the primary innovation challenge with its core aim to increase productivity through a reduction in construction costs, production defects, project delays and carbon footprint directly linked to welding and its associated activities. This is to be achieved by lowering the risk of deviations or errors during the welding process, which is a critical path activity, through better practice and quality management. Increasing system robustness and traceability through digitisation of welding process and supply chain gas assets. The project continues to provide value to gas consumers by lowering the costs on a regulated asset by refining the user needs into clear outputs that must be met these are:

a) The elimination of double and triple handling of data

b) Reducing the number of staff needed to cover projects

c) Reducing the amount of travelling needed by staff

d) Live error correction through production transparency via a shared portal

e) Open ended design ready for future upgrades

f) Able to provide Live metrics, KPI's and remote monitoring of projects day to day

The project continues to look to the future by considering emerging technology such as satellite internet, artificial intelligence integrations and blockchain data security and how these contrasting systems may integrate into the solution in 10 to 20 years' time by asking the question "how would we use these technologies if they were ready today?" to provide significant resiliency to the gas network for upgrades and rebuilds.

Throughout the discovery phase the project developed as predicted apart from three core factors, IT communication, technology standardisation and accessibility. The partners have learnt that these three factors had a higher significance to the success of the project than originally thought.

Strong IT communication was known to be needed and whilst the original idea conceptualised wireless and 5G connectivity, through observation of how unreliable these can be on sites with poor access to phone masts (due to their remote locations) the project has included a radio mesh system for site side system resilience over long 'field' distances and satellite internet for site to office communication in lieu of phone mast connectivity.

Technology standardisation was partially considered originally; the project partners original focus looked only at macro technological solutions such as equipment and integration with other software systems through using Application Programming Interfaces (API's) however during discovery the partners realised that there is a need to ensure future systems and technologies understand what a weld 'looks' like in the digital space at the micro level, as this would future proof the creation of new API's and

new equipment outside of this project.

The project partners believe this will be best met by producing a new International Standards Organisation (ISO) standard to depict what a digital weld is amongst the business community. Fortunately, two of the project partners United Living and TWI have presence on international committee's and experience creating and modifying international standards; this may result in a separate project alongside Digital Inspector.

Whilst an accessible system to both customer and contractor is still part of the project objectives, greater consideration has been applied to the physical site side users. Whilst the new generation of user are technology savvy current incumbents are largely technology shy so the user interface being considered is planned to be simple and logical that requires minimal training thus the design of a simple Site App will be produced with possible consultation from a human factors engineer.

Add Preceding Project(s)

CAD_SIF0003 - Digital Inspector

Add Third Party Collaborator(s)

The Welding Institute

Triton Electronics Ltd

United Living Group

Project Budget

£343,809.00

SIF Funding

£309,790.00

Project Approaches and Desired Outcomes

Problem statement

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Innovation justification

Digital Inspector represents a strategic shift in energy network installation and management. It is an essential solution that heralds a new era of digitalisation within the energy sector, fostering efficiency, cost-effectiveness, and risk mitigation. The project will

enable a step-change in welding management and monitoring across disparate locations, integrating real-time weld data acquisition with approval databases for procedures and welders. This solution is not only revolutionary in its current form, but also offers scalability for future inclusion of Non-Destructive Testing (NDT) digital data.

We are applying against the Improving energy system resilience and robustness innovation challenge with a focus on both technological innovation and digitalisation within energy networks. Our project addresses the area "strengthening the UK's energy system robustness to support efficient roll out of new infrastructure". We will build on our findings from the Discovery phase during which close collaboration of the partners has identified the critical interdependencies between the different partner roles as well as the needs of other stakeholders. Frequent requirement-gathering meetings and rigorous R&D initiatives have substantiated the project's viability, directing us towards an innovative, cost-effective, and transformative solution. Under the leadership of Cadent Gas Limited, our collaborative team, including TWI (The Welding Institute), National Gas Transmission PLC, Triton Electronic Limited, and United Living Group Limited, in the alpha phase we will build prototypes and experiment with different solutions based on our findings from the discovery phase. Assumptions will be rigorously tested and validated to advance the TRL from TRL 3 to TRL 7.

The crux of Digital Inspector's innovation lies in its central dashboard system being developed by Triton Electronics. This ground breaking platform will enable live project tracking and instantaneous collaboration with principal contractors like Cadent/National Grid, and subcontractors such as United Living performing the welding. The aim is to transform conventional welding plants into IoT-enabled entities, offering real-time data on fabrication across numerous sites, ensuring live compliance to specifications and codes, and facilitating remote digital inspection. A key feature of Digital Inspector is its capacity to seamlessly integrate with modified software packages from TWI Ltd, such as Welding Coordinator and Welding Qualifier. This will enable uploading and utilisation of pre-project planning phase data and documentation. Upon completion of welding, data is reintegrated back into TWI's software for long-term retention and subsequent analysis according to industry standards.

The size and scale of the Digital Inspector Alpha Phase concept has been meticulously defined to achieve suitable TRL, IRL and CRL such that by completion of the experimental development there is sufficient demonstrated capability to move to demonstration and network roll out by United Living in the Beta phase. This scalability will catalyse wider adoption and wield a profound influence on energy networks, optimising operations and triggering substantial cost savings.

The implementation of this novel concept necessitates the collaborative expertise of the project partners. SIF funding is the key enabler in supporting the project partners to collaborate and ensure that priority is given to innovation as opposed to focusing on 'business as usual'. The absence of funding would lead to a substantial delay in bringing Digital Inspector to market, preventing the realisation of a transformative digital solution that promises a safer, more efficient, and cost-effective energy network. The potential risks of delaying are substantial, with both direct and indirect implications on operational efficiency, cost savings, and overall market readiness. By not proceeding in a timely manner, we risk falling behind in the industry's digital revolution, resulting in a potential loss of competitive advantage. Hence, securing funding and moving forward promptly is of utmost importance.

Impact and benefits (not scored)

Financial - future reductions in the cost of operating the network

Environmental - carbon reduction – direct CO2 savings per annum

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Revenues - creation of new revenue streams

New to market – processes

Impacts and benefits description

Digital inspector will improve the control of welded pipeline construction. By increasing the visibility of construction progress, problems can be identified earlier, such as defect welds which can then be repaired sooner in the cycle. There are also benefits from reduced paperwork induced defects and identifying potential pinch points so resources can be best directed.

We have estimated these benefits in themselves are significant, but just as importantly offering the visibility helps to increase trust and reduce both the risk of overruns, and so the insurance costs associated with late delivery or substandard quality. These are outlined in the Project Management Book.

A key metric is an estimated 65% reduction in weld repair costs. This is achieved by linking the quality assurance early in the cycle -- making sure welders are qualified, pipe certificates are available, correct welding procedures are selected. After each weld, quality assurance documents will be instantly available, so weld repairs are done while the crew is still in situ with minimum project disruption.

Currently issues with assets are only found once there is a failure and this frequently occurs once the asset has been reburied and everyone has left site, with the use of Digital Inspector we will be able to flag any issues with welds before the point of failure. This will mean that the use of excavators would not be needed to re-excavate the ground and cut the faulty pipe out to fix the issue. This further reduces the amount of liquid fuels that we would use annually and reduces the carbon emissions produced directly.

Reducing weld repairs and reducing the impact of any repairs that are still necessary, leads directly to reduced insurance costs. It is estimated adopting Digital Inspector will reduce project insurance by 30%.

Improved quality and a readily available database of project information reduces ongoing maintenance. Digital Inspector saves both in construction and in ongoing maintenance, and therefore future reductions in the cost of operating the network.

United Living estimates that Digital Inspector will give a 30% saving in tCO2e. From 5,101 tCO2e to 3,571 tCO2e per annum.

Indirect carbon dioxide savings would be the reduction of scope 2 and 3 areas, this is the reduction in the main contractor mobilisation, such as Cadent. This refers to the deliveries and equipment used on site that would produce additional CO2. The indirect reduction of CO2 production would be reduced with the implementation of Digital Inspector by decreasing the callouts to site for supply chain and hiring of equipment. This would be decreased by preventing damaged pipework from being buried and found to be faulty later down the line where equipment and suppliers would have to travel back to site to unearth the asset to fix it.

This would reduce the amount of emissions from our gaseous fuels and grey fleet from 287 tCO2e by 20% to 231 tCO2e per annum, as well as reducing carbon dioxide production in other scope 2 and 3 aspects.

Both TWI and Triton Electronics aim to offer new products and bring in new income streams. TWI already produces weld management software. However, new options and specific criteria are necessary for this application. Digital Inspector will allow TWI to offer a tailored land pipeline construction solution.

Triton produces welding monitors. Digital Inspector will require an increased number of monitors on a site. However, the monitors will be simpler than the current range of products, relying on the Digital Inspector dashboard to provide the connection and intelligence. Implementing an industry 4.0 approach to keep site welding connected to a highly functional quality database.

Teams and resources

During the Alpha phase of the Digital Inspector project, the following project partners will be involved:

Cadent: Cadent is the network project partner and provides project management resources, network knowledge and access to their engineering team for consulting and advice in the design of the solution. They also offer access to their sites for testing purposes. Their involvement ensures that the project aligns with industry standards and best practices.

National Gas: National Gas plays an advisory role in the project during the Alpha phase. They provide industry expertise and guidance to ensure the project meets the requirements and regulations of the gas industry. They also provide access to their sites for testing and validation purposes.

TWI: TWI is responsible for welding management and coordination software. They bring their existing software expertise and are developing new software to integrate with the Digital Inspector platform. TWI also provides expert knowledge on welding standards and other industry expertise. They take the lead in standardising aspects of the Digital Inspector platform, including the definition of a weld in the digital space.

Triton Electronics: Triton Electronics is a software and hardware development company with 25 years of experience manufacturing welding monitors. They are leading the development of a new low-cost, innovative monitor, as well as the software interface for the Digital Inspector platform. Their expertise ensures the seamless integration of hardware and software components.

United Living Infrastructure Services: United Living Infrastructure Services, part of the United Living Group, is a large contractor involved in pipeline welding in the UK. They provide project management support and access to inspectors, industry knowledge, and processes. They also contribute to the design and definition of the software, as they will be the primary users of the Digital

Inspector system.

Regarding resource requirements for the Alpha phase, Triton Electronics and TWI have in-house resources for software and hardware development. Access to welding activities and inspectors is facilitated through United Living Infrastructure Services' headquarters. When ready for site and field tests, Cadent sites will be utilised to perform real tests and collect usage data.

Based on the provided information, no additional external parties are identified as vital for the successful completion of the Alpha phase. The existing project partners, along with their respective roles, skills, and expertise, are well-positioned to deliver their assigned parts of the Digital Inspector project.

In summary, the Alpha phase of the Digital Inspector project involves the project partners mentioned above, each contributing their specialised knowledge and resources. The collaboration between these partners enables the development of software, hardware, welding expertise, and industry knowledge necessary to create a new ecosystem for managing welding inspections at pipeline welding sites.

Project Plans and Milestones

Project management and delivery

To effectively manage the Digital Inspector project, Agile Scrum methodologies will be utilised. Agile Scrum is an iterative and incremental project management framework that emphasises collaboration, adaptability, and continuous improvement. It involves breaking down the project into smaller, manageable tasks called "user stories" and organising them into short iterations called "sprints." During each sprint, the team focuses on delivering a set of user stories, ensuring regular feedback and flexibility throughout the project.

To support the project management process, the team will utilise Jira project management software. Jira is a widely used tool for software development projects, providing features for task tracking, team collaboration, and project monitoring. It enables efficient task assignment, progress tracking, and facilitates communication and transparency among team members.

Regarding milestones and dependencies, a Gantt chart has been provided to visualise the project timeline and interdependencies. While there are minor links and dependencies between milestones, the project team will ensure that these are carefully managed and addressed to maintain project progress and minimise any impact on the overall timeline.

For risk management, a robust strategy will be implemented. A risk register has been created and will be maintained as a living document. It will undergo frequent reviews, at least once per month to assess the current status of identified risks, any changes, and the introduction of new risks. The project partners will continue their weekly review meetings, fostering open communication and collaboration to mitigate risks and address any potential overruns or delays. Risk management will be an ongoing iterative process, integrated into the wider project management framework.

A proposed stage gate is identified early in the project, dependent on Triton Electronics developing a functional prototype device that can integrate with the inspector's tablet. This stage gate is crucial to progress into the Alpha phase. Although the risk of not achieving this milestone is low, its non-attainment could potentially impact the schedule for the remainder of the Alpha phase and the overall success of the project. Thus, close attention will be given to monitoring and supporting the progress of this milestone.

There are no planned or potential supply interruptions during the Alpha phase. Field tests will be conducted on pipelines under construction, without affecting the energy supply. They will run alongside existing processes to avoid delays in ongoing construction. Furthermore, at the Alpha phase, there will be no direct impact on consumers' access to energy services, and no direct interaction with energy customers is anticipated. However, in the future, the Digital Inspector project aims to indirectly impact customers by providing a more robust infrastructure and enabling a lower-cost rollout of net-zero fuel to the UK, contributing to the broader energy landscape.

By employing Agile Scrum methodologies, utilising Jira project management software, addressing minor milestone dependencies, implementing a robust risk management strategy, and ensuring no disruptions to energy supply or consumer access, the Digital Inspector project aims to manage the project effectively, deliver innovative outcomes, and achieve its long-term objectives.

Key outputs and dissemination

By the end of the Alpha Phase, the Digital Inspector project aims to achieve several key outputs. These are:

a. Development of a functional prototype device, inspector app and software dashboard interface.

b. Successful integration of the hardware and software components with TWI's welding software packages.

c. Completion of field tests and validation of the Digital Inspector platform with end users.

d. Identification and resolution of any technical issues or performance improvements required for the Beta Phase.

e. Compilation of data and insights gathered from the field tests and user feedback.

Within the project team, specific roles will be assigned responsibility for each key output and planned dissemination activity. These are:

Triton Electronics will be responsible for delivering the functional prototype device and software interface.

The integration of hardware and software components will be coordinated by a joint effort between Triton Electronics and TWI.

Field tests and validation will involve collaboration between United Living Infrastructure Services, Cadent, and National Gas, with Triton supplying prototypes and TWI ensuring functionality of their software integrations.

Data analysis and insights generation will be a collective effort involving all project partners.

The Digital Inspector project recognises the importance of sharing its key outputs and lessons learned with relevant stakeholders, industry professionals, and interested parties. The dissemination plan includes the following elements:

Technical Reports: Detailed technical reports will be prepared, documenting the development process and findings. These reports will provide comprehensive insights into the project's outcomes, including the functionality and performance of the Digital Inspector platform.

Industry Bodies: We will seek to demonstrate the innovations taking place as part of the Digital Inspector platform through engagement with industry bodies, such as Institute of Gas Engineers and Managers (IGEM), Institute of Civil Engineers (ICE), Institute of Mechanical Engineers (IMECHE) and The Welding Institute. These opportunities will allow for direct engagement with experts, potential collaborators, and industry stakeholders.

Standardisation: TWI are leading on developing a new standard for a Digital Weld. This will, once developed, be shared more widely with experts, industry stakeholders and research organisations. The definition of a digital weld will improve future collaboration, development and innovation between network providers, business and other organisations wishing to innovate in welding.

Stakeholder Engagement: Communication channels will be established with stakeholders, including network providers, regulatory bodies, and standards organisations. These engagements will ensure that the project's outcomes and lessons learned are shared with those who can influence policy and practice.

Collaboration and Partnerships: The project team will actively seek opportunities to collaborate with other relevant projects, organisations, and researchers. This will facilitate knowledge sharing, cross-learning, and the dissemination of best practices within the industry.

The Digital Inspector project will ensure that the dissemination activities are carried out in a manner that encourages collaboration, supports market growth, and promotes fair competition. This will be achieved by sharing technical information, research insights, and lessons learned in a transparent and inclusive manner, fostering an environment conducive to innovation, collaboration, and industry advancement.

Through a comprehensive approach to dissemination, the Digital Inspector project aims to maximise the impact of its key outputs, foster knowledge exchange, contribute to industry development, and support the achievement of broader energy sector goals.

Commercials

Intellectual property rights, procurement and contracting (not scored)

Intellectual Property Rights, procurement and contractingThe project partners have carried out patent and other internet searches and have found no barriers to the planned project developments.

In general, the principles described in Section 7 of the SIF Project Agreement for the Discovery Phase (dated 03/05/23) apply to the Alpha Phase.

Background IP

The project Partners have the following Background IP relating to the Digital Inspector Project :

Triton Electronics Ltd:

Arc Welding Monitors and controlling firmware and software.

TWI Ltd:

Welding Qualifier commercial-off-the-shelf (COTS) software for creating and managing the qualification of welders and welding procedures.

Welding Coordinator COTS software

Clause 9.14 of the SIF Governance Document applies to Commercial Products.

United Living:

Project Tracking documentation.

Licensing of Background IP

Background IP will be provided at 50% of normal licence fees for project partners.

Foreground IP

During the project, the partners will generate the following IP:

Triton Electronics Ltd

New monitor hardware and firmware

New charging hardware

The Digital Inspector Dashboard

TWI Ltd

Customised Welding Qualifier software to include BS 4515 code rules

Customised Welding Coordinator software to include functions to generate and manage Project Tracker documents and communicate with The Digital Inspector Dashboard

The specification of a Digital Weld to facilitate communication between digitised welding system components

Licensing of Foreground IP

It is envisaged that the ownership of all IP identified above will remain with the partner who generates the IP and it is not foreseen that any IP will be 'shared' (as described in the SIF Governance Document 9.7).

In line with clause 9.14 of the Governance Document, foreground IP within Commercial Products is not deemed 'Relevant foreground IP' and is subject to normal commercial licensing for other licensees.

Both TWI and Triton Electronics have existing licensing and marketing activities. These will also be used to disseminate the foreground IP from the project to organisations outside the project.

Any shared IP will be identified during the Alpha phase development.

Commercialisation, route to market and business as usual

The commercialisation plan for Digital Inspector entails establishing it as best practice within the network provider's pipeline projects, with the aim of widespread adoption across other industries. To achieve this, the project partners have developed a comprehensive strategy that encompasses the following elements:

a. Integration into Project Monitoring and Management Processes: United Living as the contractor will integrate Digital Inspector into their production processes and use it with their own inspectors and set it as a requirement for their third party inspectors. Cadent, as the network provider, will initially integrate Digital Inspector into their pipeline project monitoring and management processes. This will serve as a pilot phase to demonstrate the value and effectiveness of the solution within their operations.

b. Transferability to Other Industries: Digital Inspector's applicability extends beyond the energy sector. The project partners envision its utilisation in industries such as manufacturing, nuclear, and aerospace. The solution's adaptability and scalability make it well-suited for diverse welding-intensive processes. As part of this project we are building Digital Inspector for oil and gas, however, once it is established in that industry we believe with further research and development it could be transferred and marketed in other industries and countries.

c. Leveraging Project Partners' Customer Base: Triton and TWI, with their extensive customer bases worldwide, will play a pivotal role in commercialising Digital Inspector. Once proven and adopted within the pipeline welding and energy sectors, the project partners will leverage their existing relationships and networks to promote the solution across other industries.

The route to market for Digital Inspector involves a phased approach that focuses on building credibility, demonstrating value, and expanding adoption. The key steps include:

a. Pilot and Validation Phase: Digital Inspector will undergo rigorous testing and validation within the pipeline welding projects of Cadent. This phase will gather real-world data and feedback to refine the solution's functionality and performance.

b. Adoption within Network Provider Projects: Upon successful validation, Digital Inspector will be positioned as best practice within United Living and Cadent's pipeline projects. This endorsement by a network provider will generate credibility and facilitate its adoption as a standard solution.

c. Expansion to Other Industries: Leveraging Triton and TWI's customer base and industry connections, Digital Inspector will be introduced to other industries that rely on welding processes. As part of this project we are building Digital Inspector specifically for the oil and gas sector, however, we believe once Digital Inspector is established for oil and gas, with further development and research, it could be easily promoted in other industries.

The project partners, Triton and TWI, are commercially ready to exploit the completed Digital Inspector product once it is market-ready. They have the necessary expertise, industry relationships, and customer bases to facilitate widespread deployment. Additionally, Triton has engaged UKRI Edge, an organisation providing support in commercialisation and growth, to further enhance their capacity for scaling Digital Inspector and exploring market opportunities.

Cadent, as the lead partner and network provider, plays a crucial role in driving the adoption of Digital Inspector. Their senior sponsorship and involvement throughout the project demonstrate their commitment to innovation and supporting the successful commercialisation of the solution. Their endorsement and collaboration will be instrumental in achieving business as usual deployment within their network and potentially across other networks.

The Digital Inspector project focuses on ensuring that the project does not undermine the development of competitive markets. The strategy emphasises collaboration, scalability, and the transferability of the solution across multiple industries, while also leveraging the project partners' commercial readiness, partnerships, and engagement with external organisations to support successful commercialisation and wide-scale deployment of Digital Inspector.

Policy, standards and regulations (not scored)

The project does not foresee any requirement to work outside of existing regulations or standards. The principal regulations relating to the project are Pipeline Safety Regulations 1996, Pressure System Safety Regulations 2000, Pressure Equipment (Safety) Regulations 2016, Dangerous Substances and Explosive Atmospheres Regulations 2000 and Provision and Use of Work Equipment Regulations 1998.

As the project is relating to the way that data is collected and used, we do not require any changes to how the inspection techniques and risk to people are managed.

Value for money

The total alpha project budget will be £343,809 with SIF funding sought for £309,790, which is split into 11 work packages. The project partners will meet the compulsory 10% contribution from their own R&D budgets.

We have identified that ease of use of the system is imperative to the successful deployment of Digital Inspector, therefore bringing in a subcontractor that is a "Human Factors Specialist" was key to ensuring the project partners deliver easy to use systems. The reason for outsourcing this is because it's a niche skill and none of the project partners have this speciality in house. We believe that the subcontractor costs sought for the project are value for money due to the important nature of getting the human interaction with a new process right, while ensuring that the existing processes are expertly transferred into the digital space.

Digital Inspector represents excellent value for money. We believe that the cost savings that Digital Inspector can generate over the lifetime of the project will be in the tens of millions, due to a reduction in construction delays, a reduction in the amount of construction repairs and more efficient site operations. These improvements in construction, reduction in errors and corrective works will also lead to a saving in insurance. These costs are all ultimately passed on to the Network and therefore the consumer. Digital Inspector will provide savings in all of these areas.

These savings will filter to the consumer as a benefit through a more efficient gas network, which has cost less to maintain and upgrade. This will mean the gas network operators can stretch their budget further or reduce their budget and pass on the savings to the consumer as a reduction in their bill.

We also see an indirect benefit to consumers being offered through the reduction in carbon due to fewer trips to site being necessary, fewer heavy plant hours due to the need for repairs taking place, and fewer journeys conducted by HGV's, fleet and other vehicles to and from sites.

United Living will provide access to some pre-existing welding assets and facilities, for which they are making some contributions in kind to the project. These assets will be critical for certain work packages when the project has progressed to field test phases. They will contribute from their R&D fund.

Triton Electronics will be developing the web dashboard, inspector app and the new monitoring hardware. They have internal software and hardware development expertise and will be utilising their existing staff resources for the purposes of the new development required to build digital inspector. They are contributing to the project through their own R&D budget.

TWI will be conducting work on their existing software products to make them compatible with the new software being developed by Triton, but also to add new features to their new software to make it compatible with the welding codes and standards used by United Living and Cadent. They will be making use of their own internal resources in order to complete this work, while making a contribution to the project from their own R&D.

Cadent will be providing engineering oversight and project management resources to the project. National Gas Transmission will be providing engineering expertise and oversight of the design and field tests of the Digital Inspector platform.

Associated Innovation Projects

- ○ Yes (Please remember to upload all required documentation)
- ◉ No

Supporting documents

File Upload

Show and Tell Alpha.pptx - 23.2 MB
SIF Alpha Round 2 Project Registration 2023-11-28 2_38 - 79.4 KB

Documents uploaded where applicable?

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