PETRAS National Centre of Excellence for IoT Systems Cybersecurity: 2nd Strategic Research Fund (SRF) Call for Intent to Bid

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Summary

The PETRAS National Centre of Excellence for IoT Systems Cybersecurity invites proposals from eligible UK higher education institutions (HEIs) for collaborative research projects in the *cybersecurity of devices and networks at the edge of the internet, including behavioural, social and policy aspects of such devices and networks* to be undertaken jointly with user partners. Through this call, the Centre is making funds available of up to £4.5 M to support a maximum of 20 new collaborative research projects (18 months max. duration).

Funded by UK Research and Innovation (UKRI) through Engineering and Physical Sciences Research Council (EPSRC), PETRAS is a consortium of 16 research institutions and the world's largest socio-technical research centre focused on the future implementation of the IoT (https://petras-iot.org). As the National Centre of Excellence for research within UKRI's Security of Digital Technologies at the Periphery (SDTaP) programme[1], PETRAS exists to ensure that technological advances in the Internet of Things (IoT) are developed and applied in consumer and business contexts, safely and securely. We do this by considering social and technical issues relating to the cybersecurity of IoT devices, systems and networks. PETRAS works in collaboration with academia, industry and government partners to ensure our research can be directly applied to benefit society, business and the economy.

In its current phase, the PETRAS programme aims to strengthen an already established and successful platform (i.e., the PETRAS Hub[2]) which, since 2016, coordinated and convened 11 universities and 110 industrial and government User Partners in cross-disciplinary collaboration. PETRAS has created a dynamic shared research agenda that incorporates social and physical science challenges in equal measure and has worked across a broad range of Technology Readiness Levels. In this current phase, the Centre's ambition is to make a step change in scope, enabling trustworthy Artificial Intelligence (AI) and other emerging technologies embedded in IoT networks to deliver safe, functional, usable, and ethical solutions. This will then provide even more opportunities for interdisciplinary teams and the inclusion of new perspectives from the social and behavioural scientists.

This call facilitates the Centre to continue building upon this foundation to further strengthen and expand the inclusive PETRAS National Centre of Excellence open to all and to identify and execute the best and the most transformative and impactful projects in this area. In return, this will enable PETRAS to continue actively engaging with the user community and effectively responding to the Internet of Things (IoT) developments.

In addition to receiving funding to deliver their proposed research project, the successful applicants will also become a member of PETRAS, enabling them to connect with the Centre's large network of academic and user partner members. Other benefits of PETRAS membership include, but are not limited to, access to other funding opportunities, online resources, business development specialists, our monthly newsletter etc. (please see our website for further details: https://petras-iot.org/collaborate/).

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[1] https://www.ukri.org/news/keeping-our-smart-technology-safe/
[2] https://epsrc.ukri.org/newsevents/news/iotresearchhub/

Background

The PETRAS (privacy, ethics, trust, reliability, acceptability, and security) Centre aims to continue building the UK national capacity needed to create a comprehensive and systematic understanding of the opportunities and threats that arise when edge computing nodes are deployed, and when AI and Machine Learning (ML) technologies are migrated to the periphery of the internet and into local IoT networks. These challenges are socio-technical, and the Centre organisation is designed to accommodate transdisciplinary research. Personal perceptions of risk and trustworthiness as a result of machine agency, which interact with regulation, standards and policy on the one hand and design and engineering on the other, span the physical and behavioural sciences.

PETRAS strives to be an inclusive Centre that can attract and closely connect experts and organisations, together forming a strategic national research capability in the cybersecurity of devices and networks at the edge of the internet. Hence, the Centre is designed to provide flexible and responsive national capacity in the area of security and the connected world. In its current phase, the Centre has 16 academic partners working on 22 projects[3] in collaboration with user partners from industry, government, and public sector, providing instances linking four challenge-based *Lenses* and six application-focussed *Sectors* (Table 1). This analytical framework helps us investigate how to practically mitigate potential threats and take advantage of the huge benefits that the application of IoT, AI, and ML technologies can bring.

The Centre's academic and user partner numbers as well as research focus coverage will be further expanded through the open *2nd Strategic Research Fund* (SRF) Call, which is the focus of this document. The outcomes of the 1st SRF call can be found via https://petras-iot.org/update/petras-announces-seven-new-research-projects/.

PETRAS is particularly keen to see new academic applicants from disciplines that are often not represented in traditional discussions of IoT systems cybersecurity, such as Creative & Performing Arts, Digital humanities, Economics, Education, History, Human geography, Law & legal studies, Literature, Management & business studies, Philosophy and ethics, Political Science International Studies, Psychology, Social anthropology, Social policy, Social statistics, and Sociology. New User Partner applicants are welcomed from any sector, including commercial businesses, charities, trade and advocacy groups, local and central government, law enforcement, and other government agencies.

PETRAS Lenses and Sectors

PETRAS projects are organised within a matrix of 'Sectors' and 'Lenses' that help to define research challenges in a real-world context. The Centre's Lenses are research challenge domains: Securing the Edge, Useful, Usable Decentralisation, Law and Economics at the Edge, and Building Public Value at the Edge. The Sectors have specific application-focussed contexts in terms of technology, regulation, economics, interventions, and innovation: Ambient Environments, Supply Chains and Control Systems, Infrastructure, Health and Wellbeing, Agritech, and Transport and Mobility.

The Lenses and Sectors are units of synthesis of findings, points of contact for accessing the Centre's programme and expertise, as well as special interest groups. Please refer to https://petras-iot.org/sectors/ for detailed descriptions of PETRAS's research-challenge Lenses and application-focussed Sectors.

Hence, each proposal must be associated with at least one challenge and apply its findings in at least one sector.

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[3] Please see https://petras-iot.org/about-us/ & https://petras-iot.org/projects/ for further details.

Table 1 – PETRAS Projects by Lens (horizontals) and Sector (verticals)

	Ambient Environments	Supply Chains and Control Systems	Infrastructure	Health and Wellbeing	Agritech	Transport and Mobility
Securing the Edge D De Roure/Oxford	ReCoPs **RACE TEAM**	IAM NUSBIoT **ICE** IoT-Depends **MASS ELLIOTT CRatE**	ALIoTT BlockIT BotThings CRACS IoT in Control RSIOT **SPIoTSH SECRIS SecCNIoT IoT Tram RETCON RIoTE**	AACIoT SeNTH+ SeNTH	CyFoo	B-IoT GEOSEC **MAGIC**
Useful, Useable Decentralisation E Luger/Edinburgh	aRIoT IoT4Kids HTIoT Dice UDAIoT DePrIoT IoT in the Park IoT in the Home DiSSC ReTiPS STiPS **REAPPEAR ICE-AI**		Cyberhygiene HEALTH-I **CEDE** IoT Observatory **TanSec UnCanAI** PEDASI	DASH PEIESI		P-CARS
Law and Economics at the Edge M Carr/UCL	Things d'Art G-IoT Art Connect MASBI **MaCs**	EBIS EBIS+ **Logistics 4.0**	CSI CSI+ HANCODE IoT-MSP NIPC **GISt**			DDIP-IoT TMDA
Building Public Value at the Edge W Hall/Southampton	SeMIoT VPD **PPIEM**	EVIoT **Sec-QBS**	BTS P2P-IoET	**CP-SOCIAM**		RoadMaPP **AIKEMA**

C Morisset/Newcastle — P Burnap/Cardiff — T Watson/Warwick, D McAuley/Nottingham — R Cooper/Lancaster — A Rashid/Bristol — C Maple/Warwick

PETRAS Hub: Completed projects 2016 - 2019
PETRAS National Centre of Excellence: Current projects as of June 2020

Funding

The total PETRAS funding available for the 2nd SRF call is £4.5 M Full Economic Cost (fEC), or £3.6 M @ 80% fEC. We expect to fund approximately 15-20 projects. This is roughly based on an 18-month project employing a post doctorate research associate (PDRA) fulltime with associated Principal Investigator (PI) costs, consumables and travel. Equipment over £10,000 in value (incl. VAT) is not available through this call. Smaller items of equipment (up to 10% of the value of the grant, or under £10,000 (incl. VAT), whichever is the lesser), are allowable.

Duration: Up to 18 months (whilst PETRAS will not mandate the precise duration of projects, it is anticipated that projects will have an approximate duration of 18 months, as 18 months is the **maximum duration** permitted).

Applicants: Each project should involve at least one, ideally two or more, new or existing User Partner(s)[4] from industry and/or public sector with strong background in the Centre's research programme. Proposals must be co-created with the User Partner(s) and be convincing in the depth of the partner commitment. Whilst matched contributions (cash and/or in-kind) from user partner(s) are not required, they are highly desirable. Although the Letters of Support from user partners are not required in Stage 1 (Intent to Bid submissions), all applicants will be asked to provide these in the next Stages (please refer to Overall Submission and Assessment Process section for further details). Projects must be led by a PI from an EPSRC eligible UK research institution. They will be responsible for the development and delivery of the project, and for reporting on the outcomes and budget.

Award:
All applicants should cost their projects using the same process as they would cost an EPSRC grant. Successful proposals will receive 80% fEC of their budget from PETRAS. It must be recognised that an application to this call requires a commitment to provide the remaining 20% of fEC from their own resources. All costs should be inclusive of VAT and/or any other applicable

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[4] https://petras-iot.org/collaborate/

tax. A guide of fEC and the EPSRC's position on its payment is available at: https://epsrc.ukri.org/funding/applicationprocess/fundingguide/ and https://www.ukri.org/funding/information-for-award-holders/grant-terms-and-conditions/.

If successful, the applicants' institutions will be expected to provide complimentary FTE of investigator time (PI & CoI time) to match the FTE PETRAS is providing as part of this call (please see the Eligible costs section below for further details).

Eligible costs: Costs under a new project may include UK-based staff time for PIs and Co-Investigators (CoIs) (see below for further details) and PDRAs, associated indirect and estates costs, travel and subsistence, and consumables and equipment for the project, all subject to EPSRC rules and requirements. Smaller items of equipment (up to 10% of the value of the grant, or under £10,000 (incl. VAT), whichever is the lesser), are allowable.
Resources to fund User Partners are not allowable (this includes sub-contracting to a User Partner).
Under normal circumstances PETRAS will cover up to 0.1 FTE equivalent combined staff time for PIs and CoIs as part of a project with mainly technical or social focus. The applicants will be allowed to apply up to 0.3 FTE equivalent combined staff time for PIs and CoIs, for projects with collaborative socio-technical focus to enable joint inputs from suitable PI/CoIs as necessary. In either case, if successful, the applicants' institutions will be expected to provide complimentary FTE of investigator time (PI & CoI time) to match the FTE PETRAS is providing.

Grant Management: Details on how to access funding will be provided to those departments that have received awards. Awardees will be expected to manage the accounts as per normal EPSRC rules.

Themes for the 2nd SRF Call

Proposals are encouraged which include themes that address IoT systems research challenges at the intersection of any two (or more) PETRAS Centre 'Lens' and 'Sector' descriptors (see below), and which include emerging technologies (e.g., AI and ML) that support IoT deployed at the 'edge' of the internet. PETRAS embodies a socio-technical approach to cross-cutting challenges, so (without exclusivity), proposals are welcomed that take a cross-disciplinary viewpoint. However, those that address purely technical or social dimensions are also strongly encouraged. Without losing sight of strong technical requirements that underpin IoT and Edge security, PETRAS would like to capitalise on the range of social science contributions that clearly need to be made in this space. In all cases, proposals should embody a cybersecurity perspective.

'Lenses' – cross-cutting, policy orientation:
- Securing the Edge;
- Useful, Useable Decentralisation;
- Law and Economics at the Edge;
- Public Value at the Edge.

'Sectors':
- Ambient (Built Environment / Homes / Cities / Public Spaces);
- Supply Chains and Control Systems (Industrial / Buildings / Utilities);
- Infrastructure (including Digital);
- Health and Wellbeing (Critical care to leisure wearables);
- Agritech;
- Transport and Mobility.

The call themes listed above are indicative, and not exclusive. The Centre will consider other themes relating to proposers' research interests or those of user partners, where these pertain to themes not covered in the existing suite of PETRAS Centre and Hub projects[5].

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[5] Please see https://petras-iot.org/projects/ for further details.

Review and Selection Process

As part of a suite of demand management measures, to help alleviate pressure on all involved with our review process, applicants may only apply once, either as a PI or CoI.

Overall Submission and Assessment Process
Applications will be considered and assessed via a three-stage process:

- Stage 1 - the Intent to Bid (ItB) Stage;
- Stage 2 - the Outline Proposal Stage; and
- Stage 3 - Full Proposal Stage.

The review process is a paper exercise based solely on the completed application form and will not involve interviews. The review process will be led by the PETRAS Leadership Team, and each stage will have its specific review mechanisms such as peer reviewing and panel selection processes, which will include a mixture of expert reviewers drawn from academia, industry and public sector within and beyond the PETRAS network. This document mainly focuses on detailing the submission and assessment processes of the Stage 1. Further details on Stages 2 and 3 will be made available in due course as detailed below in Table 2.

Activity	Date
Stage 1 of the 2nd SRF Call launched	15 Jun. 2020
Deadline for questions and queries (Stage 1)	3 Sep. 2020
Closing date for ItB submissions (Stage 1)	9 Sep. 2020 (09.00 UK time)
Stage 1 applicants invited to progress to Stage 2 of the 2nd SRF call	11 Sep. 2020
Stage 2 of the 2nd SRF Call launched	11 Sep. 2020
Deadline for questions and queries (Stage 2)	3 Nov. 2020
Closing date for Outline Proposal submissions (Stage 2)	10 Nov. 2020, 09.00 UK time
Outline proposals reviewed	Nov. – early Dec. 2020
Applicants notified of their Outline Proposal application outcomes - progression to full stage for shortlisted Outline Proposals	Early Dec. 2020
Stage 3 of the 2nd SRF Call launched	7 Dec. 2020
Deadline for questions and queries (Stage 3)	19 Jan. 2021
Closing date for Full Proposal submissions (Stage 3)	26 Jan. 2021, 09.00 UK time
Full proposals reviewed	Late Jan. – Mar. 2021
Stage 3 applicants notified of outcome	Late Mar. 2021
Expected start of awarded projects	Jul. – Sept. 2021

Table 2 – 2nd SRF Call for Proposals timetable (timelines for Stages 2 and 3 are indicative, and may be subject to change)

Stage 1 - Intent to Bid submission process
- ItBs may be submitted by eligible researchers only, with proposed contributions from a single institution or a consortium (see the eligibility section);
- Proposal summaries provided through ItBs must be novel. In Stages 2 and 3 of this call, applicants will be asked to provide details of all support currently being sought from any other source where funding has been requested bearing any relation to the objective(s) of the proposed project;
- The ItB submissions will need to conform to the information requested in the ItB submission form (https://submit.link/ygWeg) and respond to the call's requirements as specified in this document.

The ItBs received will serve as a mechanism to enable applicants to proceed to the Stage 2 of the call. **The ItB submissions will not be assessed and can be modified by applicants at the Stage 2**. **It must be noted that it is mandatory to submit an ItB on or before the closing date for ItB submissions for any applicant to be able to progress to the Stage 2 of this call for proposals.**

Next Steps
All eligible ItBs will be invited to the Stage 2 of this call to submit outline proposals. Guidance on outline proposals will be provided upon invitation at the next stage.

Grant conditions
Successful applicants not already party to the PETRAS Centre Collaboration Agreement will join by accessioning to the PETRAS Centre Agreement, which imposes EPSRC/UKRI conditions on the consortium. They will be expected to participate in Centre activities and duties, including reporting, dissemination and communication activities.

Deliverables, Reporting and Quality Assurance
While the projects funded through this call will deliver individual and novel outcomes, they will also be expected to be collaborative with, have clear relation to, and be synergistic with work ongoing in the PETRAS Centre. Each project partner will be expected to participate in coordination and dissemination meetings/events and to report regularly to the PETRAS Centre Management Team. In Stages 2 and 3 of this call, applicants will be provided with further details on deliverables, quality assurance and the reporting processes they would need to adhere to if their proposals are selected for PETRAS funding.

Under normal circumstances, all deliverables from successful activities will be expected to be in the public domain, and published and disseminated through the normal academic and other publication channels. In addition, applicants are encouraged to present their work at conferences, workshops, networks, and other dissemination events, and costs associated with doing so may be budgeted in the proposal.

Equality, Diversity and Inclusion
The long-term strength of the UK research base depends on harnessing all the available talent and the Research Councils together developed the ambitious UKRI Equality, Diversity and Inclusion Action Plan (https://www.ukri.org/files/legacy/skills/action-plan-edi-2016/).

In line with the UKRI's policies on equality, diversity and inclusion (https://www.ukri.org/about-us/policies-and-standards/equality-diversity-and-inclusion/) and our main funder EPSRC's expectations, PETRAS expects that equality, diversity, and inclusion are embedded at all levels and in all aspects of applicants' research proposals.

We are committed to supporting the research community in the diverse ways a research career can be built. This includes career breaks, support for people with caring responsibilities, flexible working and alternative working patterns. With this in mind, we welcome applications from researchers who job share, have a part-time contract, need flexible working arrangements or those currently committed to other longer, large existing grants. Please see EPSRC's Equality, Diversity and Inclusion webpages at https://epsrc.ukri.org/funding/equalitydiversity/ for further information.

Further Information
- You can download a PDF version of the 2ⁿᵈ SRF call guidance here;
- You can download a PDF version of the ItB submission questions here;
- You can download a PDF version of the call FAQs (will be updated) here;
- For any enquiries not covered in the FAQ document, please email: petras-proposals@ucl.ac.uk;

How to Apply
All applications to be submitted electronically via the following submission system by the call deadline (9ᵗʰ September 2020, 09.00 UK time): https://submit.link/ygWeg

Note: Applicants must seek approval from their organisation prior to submission.

Eligibility

Applicants may only apply once as a PI **or** CoI (i.e. an individual may not be involved in more than one proposal) and must demonstrate they meet the following requirements:

1. Projects must be led by a PI eligible to hold an EPSRC grant. For collaborative projects, where proposed CoIs are also requesting PETRAS funding through this call, both PI and CoIs need to be eligible to hold EPSRC grants. The PI will be responsible for the delivery of the project work and required reporting requirements. For information on the eligibility of organisations and individuals to receive EPSRC funding, see the EPSRC Funding Guide: https://epsrc.ukri.org/funding/applicationprocess/fundingguide/ .

2. Projects must be novel, address intellectually inspiring challenges in the cybersecurity of devices and networks at the edge of the internet, including behavioural, social and policy aspects of such devices and networks, and provide improvements upon the state of the art (see Call Themes section above for further details).

3. Projects must be co-created with and involve, user partners.

4. Projects must be able to demonstrate how beneficiaries will be engaged and describe how they will make a real difference to IoT security at the periphery.

In addition, it is highly desirable for project proposals to demonstrate the following:

- Complementarity to existing PETRAS Centre projects (https://petras-iot.org/projects/?_sft_status=current) and Hub projects (https://petras-iot.org/projects/?_sft_status=complete);

- Have potential to be developed to a higher Technology Readiness Level (TRL) or be applied, including linkage with the SDTaP programme's[6] Innovate UK Demonstrators

    (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/823359/Competition_Results_-_Demonstrators_Addressing_Cyber_Security_Challenges_in_the_Internet_of_Things.pdf and

    https://apply-for-innovation-funding.service.gov.uk/competition/544/overview);

- Involve AI and/or ML;

- Substantial support from user partners (including the details of leveraging and additional funding), as well as collaboration and engagement with innovative businesses including SMEs; and

- Transformative contributions to the state of the art on social, physical and interdisciplinary aspects.

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[6] https://epsrc.ukri.org/newsevents/news/uk-launches-national-centre-of-excellence-for-iot-systems-cybersecurity/