**HEIF Research Collaboration Stimulus Fund 2015/16**

**PROJECT PROPOSAL GUIDANCE**

Please complete the project proposal form below and submit to Sue Smith at [s.b.smith@soton.ac.uk](mailto:s.b.smith@soton.ac.uk) by **Tuesday 1 September 2015.** All projects should meet the criteria set out. Awards will be made by **1 October 2015**.  
  
  
**Scheme Outline**

SMMI has been granted £100,000 Research Collaboration Stimulus Fund by UEG for 2015/16. This is funded from the Higher Education Innovation Fund (HEIF) allocated to the University by HEFCE, to stimulate interactions with business and other users of University research.

This fund aims to stimulate and pump prime interdisciplinary research activity across Faculties that will ultimately lead to collaborations and the development of full research grants or contract proposals with non-academic partners. Projects arising will be externally-funded either directly or the collaboration with the non-academic partner(s) will be leveraged through public funding sources, either national or international.It is anticipated that each £10k invested by this scheme will lead to ~£500k of grant proposal.

This fund encourages interdisciplinary applications with the stated intent of collecting preliminary data for grant applications.  The projects will exclude established, low risk, exercises and we encourage Early Career Researcher participation.  Collaborations between SMMI members from different academic units and faculties will be a prerequisite, as is the enterprise component.  This Fund will further develop the philosophy of interdisciplinary research sponsored by the University and advocated by SMMI.

Once the decisions on funding have been made, successful applicants and their respective finance teams will receive guidance on how to set up and manage these awards from an administrative perspective. Successful projects will be awarded funding within a range of £5K to £20K.

**Project Proposals**

SMMI Members are invited to submit applications to the scheme set out below. Members may participate in more than one application. Applications should contain the following:

* Investigators and Academic Unit/Faculty affiliation.
* Short CV’s of investigators (max 2 pages)
* Research proposal (max 750 words, with references in an appendix)
* Statement of interdisciplinary ‘cross-faculty’ nature (max 250 words)
* Statement of industrial collaboration (max 250 words)
* Funding plans with successful completion of this project
* Approximate timeline for completion and spend out by 31 July 2016
* Budget request and justification (NB Faculty Finance Office can provide actual costing)

**Selection Procedure**

Applications will be peer-reviewed by committees chaired by the SMMI Deputy Director for Research. Projects will be short listed and the final awards made subject to fit with the SMMI strategy.

Peer review will examine:

* Quality of science
* Fit with the HEIF criteria to facilitate research collaborations with industry
* Interdisciplinary nature of the project
* Impact and future funding potential
* Student/ECR involvement
* Value for money
* Sensible spending plan
* Receipt of previous HEIF or similar funds from SMMI or other Institute/Faculty
* Successful delivery of outputs from previous applications

**Project Conditions and Reporting**

Awardees will be required to:

* Produce a **mid-term report** for the SMMI Deputy Director **by 22 February 2016.** This report must include a review of the budget spent to date and, in accordance with University Executive Group (UEG) requirements, a **four page outline grant proposal.**
* Produce a **final report**, including projection for the final grant submission, for the SMMI Deputy Director **by** **22 July 2016.** This report must include a review of impact of the pilot project and, in accordance with UEG requirements, **a mature grant proposal.**
* Spend all allocated funds by 31 July 2016.
* Include an acknowledgment of SMMI support on all publications and posters resulting from this funding.

**Eligible costs:**

Awards can be any size up to a maximum of £20k for exceptional projects and will cover:

* Salary costs
* Consultancy costs
* Consumables
* Travel costs
* Small items of equipment up to £3000 (computers are not eligible)
* Indirect costs or PI time are not eligible

**SMMI Research Collaboration Stimulus Fund 2015   
Project Proposal Form**

**Due by 1 September 2015**

**PI Details:**

|  |  |
| --- | --- |
| Principal Investigator\*\*: | András Sóbester |
| Academic Unit & Faculty: | AACE/FEE |
| Email: | a.sobester@soton.ac.uk |
| Additional Colleague(s)\*\*: | Alexander Phillips, Eleanor Frajka-Williams,  Alberto Naveira Garabato, James Scanlan, Mark Pickering |
| Academic Unit & Faculty: | MARS(NOC)&FSI(FEE), OES, OES, Planet Ocean Ltd |
| Email: | [abp@noc.ac.uk](mailto:abp@noc.ac.uk), [e.frajka-williams@soton.ac.uk](mailto:e.frajka-williams@soton.ac.uk), [acng@noc.soton.ac.uk](mailto:acng@noc.soton.ac.uk), mark@planet-ocean.co.uk |

**\*\*** Please include short CV’s (max 2 pages)

**Project Details:**

|  |  |
| --- | --- |
| Project Title: | Oceanography and Polar Science through Agile Robotic Systems (OPSARS) |
| Project start date: | 1 October 2015 (or as soon after as possible) |
| Project end date: | 1 March 2016 |

|  |
| --- |
| Research proposal (max 750 words, figures and references can be included in an appendix) |
| We propose to investigate the feasibility of a disruptive technology for the rapid deployment of oceanographic and polar science instruments through an unmanned system comprising aerial and marine vehicles. This offers a significant step change in range and speed of deployment over current capabilities of comparable costs. Based on the outcomes of this design and operational analysis study, OPSARS will be developed into a large scale bid (~£750k) for the development of the proposed system and trial deployment of the prototype as part of a science campaign.  A generic OPSARS system will consist of a long range Unmanned Air Vehicle (UAV), which delivers a light Autonomous Underwater Vehicle (AUV) to a precisely determined location, where the AUV is deployed (the UAV performs the deployment in-flight). This enables the rapid long-range deployment of the AUV to remote or inaccessible locations, including to cracks in the Arctic ice. Upon deployment the UAV returns to base, performs a broad aerial survey or holds on station above the deployment area, acting as a communications relay platform, while the AUV conducts an underwater survey or intervention.  The University of Southampton (UoS) is uniquely placed to deliver such a system. On the one hand, a suitable aircraft – the long-range maritime surveillance platform SPOTTER (Figure A1)– has already been developed and, uniquely in the UK, the University plans extended line of sight operations with this vehicle by mid-September. At the same time, the MARS group at the NOC is collaborating with Planet Ocean Ltd and the University to develop a small semi-disposable AUVs (Figure A2) fitted with miniaturised sensors which can be deployed in shoals for enhanced temporal and spatial resolution of oceanographic variables.  While some of the building blocks are in place, the feasibility of OPSARS is, as yet, unclear, and we seek funding to overcome some major conceptual design hurdles. As with any very low technology readiness level disruptive system, there are significant risks too and the proposed research programme aims to bring those to a level where a large-scale bid for full development will have a good chance. Research questions include:   * targeting and release/deployment – avionics, guidance, mechanics, safety, reliability, dependability * concept of operations – integrating with other traffic in maritime environments – establishing those geographical regions where deployment will be feasible * collaborative operation – previous experience with unmanned systems at the National Oceanography Centre (NOC) has demonstrated that significant scientific benefits can be achieved by using different platforms synergistically, for example the discovery of the world’s deepest undersea vents (<http://news.bbc.co.uk/1/hi/sci/tech/8611771.stm>) and the largest deployment of marine unmanned surface and underwater platforms in British Waters (<http://www.bbc.co.uk/news/science-environment-29464273>). For the OPSARS system the synergies need to be established. For example the size and low cost of the AUV platforms prohibits the use of many established exteroceptive sensors; consequently it may be desirable for the UAV to perform an initial aerial survey off the locality to enhance the local map to be used by the AUV. This is of particular importance if the target location is a polynya (the edges of such unfrozen areas may not be known *a priori*) * environmental impact – for operations when the AUV is not recovered the environmental impact of the unit must be considered and mitigating actions taken in the design where the effects are not acceptable * legal implications * scientific potential – an understanding of the range of science questions OPSARS may address (developed in collaboration with OES).   The planned activities to be undertaken by the ECR employed on the OPSARS feasibility have also been designed to explore the engineering, scientific and societal angles and, correspondingly, include three major work packages:    1. Mission design – analysis of possible science missions using UAV/AUV parametric performance models. Detailed analysis of 1a) observing the interaction between meso-scale eddies and known seabed topography and 2a) Deployment under Arctic ice.\*  2. Engineering – conceptual design of the deployment process and auxiliary equipment, including the mechanism for AUV targeting.  3. Enterprise, society, regulations, including a clear path towards commercialisation.  The effectiveness of a concept like OPSARS is determined by how closely aligned the engineering goals are with a clearly defined science need. Indeed, therein lies the core challenge that we are proposing to address here. The engineering building blocks are either in place or in the process of being developed – this feasibility study is centred on the *integration* of these components in a way that will best address the identified science needs. This is a multi-disciplinary challenge, involving a two-way interaction between the science stake-holder and the engineers.  \*This work package will be augmented by an undergraduate student project offered at OES. |

|  |
| --- |
| Statement of interdisciplinary ‘cross-faculty’ nature (max 250 words): |
| We propose to achieve the challenge defined above through an iterative approach, wherein a gradual refinement of the engineering solution – the combined UAV/AUV autonomous system – is intertwined with a fine-tuning of the corresponding science mission.  This deviates from much common practice, wherein a science objective is formulated and is ‘thrown over the wall’ to an engineering team, who then develop the final product. The result is likely to be suboptimal, because the formulation of the science objective is often already prejudiced by the existence of a notional presumed engineering solution and the engineering team will have no choice but to closely follow the resulting design brief. Equally, in such processes engineering choices are often made without regard to science needs.  The proposed approach within OPSARS is a much more organic interweaving of the two processes, made possible by the multi-disciplinary composition of its team of investigators – it is thus hoped that the exact science mission and the autonomous system can evolve together.  This partnership combines expertise in aeronautics in AACE (FEE), marine autonomous systems in the MARS group at the NOC, with observational oceanography needs from Ocean and Earth Sciences. It is a unique synergy between these centres of excellence in Southampton and ideally aligned with the aims of SMMI.  Combining unmanned aerial and underwater vehicles, as driven by a clear science (and societal) need is adventurous and ambitious and it is only possible through the exploitation of these synergies. |

|  |
| --- |
| Statement of industrial collaboration (max 250 words): |
| This work will be conducted with in-kind support from Planet Ocean (PO) Ltd (http://planet-ocean.co.uk/). PO are a UK based SME providing expertise in oceanographic sensors and platforms, as well as cross sector marine end user requirements.  They are already engaged in the production of the light AUV platforms as lead partner for the Innovate UK CRD Grant (“Launch & Recovery of Multiple AUVs from an USV” along with NOC, UoS and ASV Ltd) developing, commercialising and providing a route to market for the platforms over the next 2 years. For the Innovate UK project they are embedding two engineers and a program manager in the NOC’s new MARS Innovation Centre (MARSIC). The PO Engineers form part of a mixed organization collaborative design team with MARS personnel under the direction of Dr Phillips. UoS work packages in the FEE, led by Dr Sally Bennett, also feeding into the project are exploring the use of rapid prototyping techniques for the marine environment using new tow tank facilities at the Southampton Boldrewood Innovation Campus.    The deliverables of the OSPARS system provide new capabilities not already funded by existing projects. For the initial feasibility study PO will provide end user, scientific and engineering guidance into work packages 1 and 2 respectively, and will also investigate/propose a route to commercialisation for the OSPARS system as part of work package 3.    For the full proposal UoS/NOC/PO would explore avenues to leverage expertise from PO to add value to the proposal as well as providing a route to commercialisation for elements of the system.  Dr Mark Pickering, MARSIC based Planet Ocean Ltd Science and Technology Program Manager, commented:  “At Planet Ocean we are very supportive of this proposal both in the SMMI and the subsequent full grant application phases. There is a very good fit between the Innovate UK project to deploy the AUV autonomously from a surface vessel and the objective here of deploying from an autonomous aerial platform. The resulting system would address novel and unique scientific applications and is likely to be transferable to other marine sectors. As with the Innovate UK project, cutting edge emerging technology projects such as this enabling new science are not always commercially justifiable without the support of funders such as SMMI and public sector Research Council funds.” |

|  |
| --- |
| Funding plans following successful completion of this project: |
| The OPSARS concept is, to the best of our knowledge, a world first and, as such, a full development proposal (worth in the region of ~£750k) will require a feasibility study backed up by solid engineering and scientific analysis of the system, as well as a clear understanding of the level of risk – engineering, scientific and commercial – involved. The partnership between the two Faculties, NOC and Planet Ocean was designed specifically to address these three facets.  We propose to target the July 2016 NERC funding round or other similarly timed appropriate forthcoming funding calls (e.g. EPSRC/Horizon 2020/Innovate UK) with a technology-led proposal for the development of OPSARS. We aim to complete by March 2016, in time for a submission to the internal peer-review round.  We will build this proposal on a double argument.  On the one hand, OPSARS reduces the need for large research vessels, which meshes well with the NERC priority of reducing dependence on fossil fuels. Also, at research vessel costs of £30-50k/day, substantial savings can be made by replacing ship time with a system that can cover the continental shelf from the shore and can significantly speed up exploration in the case of more remote, ship-based operations.  On the other hand, OPSARS creates capabilities that do not exist at the moment. The key elements here are rapid response (allowing better time-domain resolution) and access to locations that are very difficult to reach with present capabilities – the pilot project is to assess science cases corresponding to each. The system’s ability to provide rapid response in inaccessible and hazardous environments also has transferability into oil spill response, operational ocean modelling and defence applications. In addition to refining the technological concept, the proposed pilot project will be used to select which of these science applications should support the final NERC or other submission. |

|  |
| --- |
| Approximate timeline for completion and spend out by 31 July 2016: |
| We propose a 15 October start and a 15 March completion, in time for an internal pre-submission for the NERC summer standard round. A four-page outline of the bid document will be available by 1 February. |

|  |
| --- |
| Budget request and justification. (NBFaculty Finance Office can provide actual costing): |
| We request funding to cover the personnel costs of the OPSARS feasibility study. We estimate the outlined programme of work to be completed in a period of five months by a suitably qualified Early Career Researcher at L4/27, at a cost of 5 x~£3,020\* = ~£15,100  \*Estimate provided by FEE Finance. |

|  |
| --- |
| Receipt of previous HEIF or similar funds from SMMI or other Institute/Faculty: |
| N/A |

|  |
| --- |
| Details of successful delivery of outputs from previous applications: |
| N/A |

|  |
| --- |
| Appendix |
| Figure A1. The University of Southampton’s Spotter UAV in flight.  http://www.discoversouthampton.co.uk/uploads/media_items/633x424x2seas-uav-press.633.424.s.jpg.pagespeed.ic.XLD1ooyIkF.jpg  *(Source: <http://www.discoversouthampton.co.uk/living/news/2015/06/25/southampton-to-provide-major-boost-to-uk-robotics-and-autonomous-systems-capability>)*  Figure A2. Conceptual model of the Planet Ocean Ltd- NOC AUV currently under development. |

*Please return completed application forms by* ***1 September 2015*** *to:*

*Sue Smith, SMMI Coordinator,*

*Southampton Marine and Maritime Institute*

*Room 1017, Building 28, Highfield Campus*

[*s.b.smith@soton.ac.uk*](mailto:s.b.smith@soton.ac.uk) *023 8059 2316*