

AIMS SeaSim Access Guidelines and Collaboration Framework for External Collaborators.

1 Executive Summary

The National Sea Simulator (SeaSim) is a \$35 million research facility, owned and operated by the Australian Institute of Marine Science (AIMS), and located at our HQ in Townsville on the doorstep of the Great Barrier Reef.

SeaSim was designed to enable sophisticated experiments on tropical marine organisms under a broad suite of simulated environmental conditions. In line with the Institute's mission of conducting research of national and international significance, we are in the process of developing a broad research program to fully utilize the facility's capability.

Recognizing the potential for SeaSim to provide a quantum step in our understanding of the complex interactions between stressors on tropical marine ecosystems (e.g. climate change, ocean acidification, impacts of dredging, reduced water quality etc), AIMS is making up to 50% of the SeaSim capability available to scientists and research institutions from around Australia and the world to work on collaborative research projects with AIMS staff.

The process for external collaborators applying for SeaSim capability is outlined in detail below. Science merit of proposals will be reviewed by an expert advisory panel, with all decisions on access and funding support made by the AIMS CEO.

As AIMS has allocated a fixed budget for the SeaSim operations, external collaborators may be required to contribute to the costs of their use SeaSim, depending on the complexity and scale of proposed experimental work. The costs to external scientists of undertaking research in the SeaSim will be determined through the process of developing proposals with AIMS SeaSim Precinct Team and research collaborators.

2 Principles and approaches to use of SeaSim

The following principles and approaches guide and prioritize use of SeaSim:

1. SeaSim capabilities will be focussed on enabling world-class research on issues of national and global significance.
2. Collaborative research is strongly encouraged and up to 50% of SeaSim facilities will be made available for collaborative projects, of appropriate calibre and relevance, between AIMS staff and national and international researchers.
3. Proposed projects must align with the core research themes of 1) Future Oceans, 2) Marine Diseases and Pests, and 3) Sediment and Pollution (explained in more detail below)
4. A SeaSim Advisory Panel comprising external and AIMS researchers and key stakeholders will make recommendations to the AIMS CEO on merit and priority of proposals within the core research themes submitted by external researchers and their AIMS collaborators. The criteria used in evaluation will be:
 - a. relevance to Australian tropical marine research priorities (weighting = 20%)
 - b. scientific quality and feasibility (weighting = 30%)
 - c. capability and experience of the Chief Investigators (weighting = 20%)

- d. alignment with core research themes and opportunities for integration with other projects (weighting = 10%)
- e. likelihood of achieving stated outcomes and research impacts (weighting = 20%)

These guidelines apply across all AIMS' seawater facilities housed at Cape Ferguson, collectively called the AIMS SeaSim Precinct and comprising:

- The newly constructed SeaSim buildings and facilities
- the SeaSim Prototype Facility
- A Greenhouse Facility that contains aquaria
- AIMS@JCU controlled environment rooms
- Aquaria rooms housed within the Centre for Marine Microbiology and Genetics (CMMG)
- Other outdoor, but covered, aquaria and holding facilities

3 Background

The National Sea Simulator (SeaSim) is a research aquarium facility that integrates technology to enable experimental research not previously possible, such as:

1. large multi factorial experiments where sophisticated environment and process control is required;
2. long duration multi-organism experiments (particularly corals, sponges and seagrasses) in large scale tanks (mesocosm-style) with precise control over seawater and ambient conditions;

Initially, research programs will be focussed on supporting research aligned to three themes:

Future Oceans

Increasing atmospheric CO₂ both warms and acidifies our oceans. Whole-of-ecosystem understanding of how species will respond to these changes requires experiments with numerous species, including their different life history stages and under numerous scenarios.

Marine diseases and pests

Marine diseases and pests are increasingly being recognised as environmental and economic threats. Biosecure experimentation is required to investigate diseases and pathogens of marine organisms and their contributing environmental factors, and outbreaks of marine pest species to identify vulnerabilities at their different life history stages that can be exploited for intervention options.

Sediment and Pollution

Our coastal seas are experiencing increased long- and short-term impacts from sediment generated during dredging and extracted from the land by flooding rain and rivers. Chemicals are injected from farming, urbanisation and industry. Undersea resources (e.g. oil and gas) are being extracted exposing the marine environment to risks of leaks and spills of these hydrocarbons. The sensitivity of marine organisms to these potential insults is known only for a few species and for only some of their life stages. Their ability to recover is even less well known. Replicating exposures that marine animals experience in the real world will allow more informed decisions by resource managers and planners.

Through its investment in SeaSim, AIMS is committed to producing and improving Australia's capabilities to conduct sophisticated research within these themes. This includes further development of innovative seawater technologies to replicate natural water motion and exposure to

chronic and fluctuating conditions as well as diurnal seasonal and annual cycles (e.g. sunlight [spectrum and intensity], water conditions [temperature, pH/pCO₂, nutrients, salinity], natural water movement [flow and turbulence]). Biological response capability will also be enhanced by developing model marine organisms and living collections. An example is the development of standardized experimental coral specimens with consistent genetic makeup and physiological traits.

4 SeaSim Precinct Operating Model

4.1 Access for External Researchers

External researchers will be able to access space and SeaSim capabilities by two mechanisms.

Firstly, AIMS welcomes external researchers to join collaborative teams led by AIMS scientists to conduct experiments relevant to AIMS strategic interests. The normal method of developing such collaborations would be through direct communication with relevant AIMS scientists.

Secondly, up to 50%¹ of the SeaSim experimental capacity² will be available for projects lead by external scientists working in collaboration with AIMS staff. Selection of these projects will be through a competitive process sponsored by the AIMS CEO. A SeaSim Advisory Panel will assist the CEO in judging project merit. Calls for proposals will normally be made once per year (space availability being a limiting factor) with a second call occurring if the circumstances.

5 SeaSim Advisory Panel

A SeaSim Scientific Advisory Panel will advise the AIMS CEO on proposal quality and their likely impact, as well as provide feedback on ongoing and recently completed projects.

Roles and Functions

1. The Panel will have no decision making role, as the allocation of SeaSim resources rests with AIMS through its CEO.
2. A SeaSim Advisory Panel comprising external and AIMS researchers and key stakeholders will make recommendations to the AIMS CEO on merit and priority of proposals within the core research themes submitted by external researchers and their AIMS collaborators. The criteria used in evaluation will be (noting that proposed projects must align with the core research themes of 1) Future Oceans, 2) Marine Diseases and Pests, and 3) Sediment and Pollution):
 - i) relevance to Australian tropical marine research priorities (weighting = 20%)
 - ii) scientific quality and feasibility (weighting = 30%)
 - iii) capability and experience of the Chief Investigators (weighting = 20%)
 - iv) alignment with core research themes and opportunities for integration with other projects (weighting = 10%)
 - v) likelihood of achieving stated outcomes and research impacts (weighting = 20%)
3. Review of project performance including annual reporting against milestones and recommendations related to modification or termination of non-performing projects
4. Provide recommendations on the promotion of SeaSim research impacts and encouraging submission of high calibre proposals

¹ AIMS reserves the right to manage the proportion of SeaSim space allocated to external collaboration, depending on merit of the proposed projects and their fit to National and Institutional priorities.

² This is calculated as 50% of the research space available after excluding space required to develop experimental capacity and capability (development of standardized experimental specimens, development of new experimental regimes, season- and time-shifted spawning populations)

Composition and appointment

The Panel will comprise:

- Two AIMS representatives (Research Director, relevant Program Leader or their delegates)
- JCU representative (Vice Chancellor nominee)
- International scientist (AIMS CEO nominee)
- One scientist with extensive experience in aquarium-based experimental research from either an Australian university or a national research institution

The Chair of the Panel will be the AIMS Research Director.

The SeaSim Precinct Operations Manager will be an ex-officio member of the Panel as a technical advisor.

The Panel will meet annually to review any proposals but may also convene by videoconference between meetings if the need arises;

Where possible, the timing for evaluation of proposals and allocation of SeaSim facilities will accommodate the timelines involved in applying for funding from major agencies such as the Australian Research Council (ARC).

6 Operations and Maintenance

All operations and maintenance (from seawater intakes to discharge) within the SeaSim Precinct will be managed by a dedicated SeaSim Precinct Team, reporting via the AIMS Data and Technology Innovation Program. Operation and maintenance of civil structures, heating, ventilation, air conditioning and general lighting are supported by the AIMS Operations and Infrastructure Section.

1. The SeaSim Precinct Team will undertake the following centralised functions:

	Aspect	Examples
1	General Operations	<ul style="list-style-type: none"> • Facility operations and maintenance • Provision of high quality water to the required specification each experimental location • Regular reports on general water quality conditions • Provision of automated experimental controls via the “supervisory control and data acquisition” (SCADA) system, monitoring and alarming
2	Operation of centralised corporate aquaria	<ul style="list-style-type: none"> • Quarantine aquaria • Holding and propagation aquaria • Larval settlement and grow out aquaria • Out of season breeding tanks (plans to be finalised)
3	Experimental Equipment Development	Development of experimental technologies (subject to an agreed plan) for areas such as lighting, temperature control, pH and salinity control, water movement control, husbandry.
4	Experimental equipment management	Management of all experimental equipment not currently in use. This includes a booking system for future use by researchers.

2. External Users will be provided with the following support during the different phases of a research project:

Project Development	<ul style="list-style-type: none"> • Design input (including compulsory equipment standards) • CAD drawings of system designs at various stage • Engineering advice and guidance to align with SeaSim standards • Experimental design advice • Identification of required new equipment purchases (i.e. what cannot be provided from the equipment pool) • Where necessary, advice on programmable controls (capabilities, programming needs) • Advice on husbandry • Development of a comprehensive safety plan for the proposed experiment • Final experimental system design approval • Advice on logistics
Setup	<ul style="list-style-type: none"> • Construction support for electrical, hydraulic, mechanical, tank, lighting, seawater manipulation systems • System induction • System build quality assurance • Programming of system controls and confirmation of program performance • Assistance with field collections where agreed • Assistance with logistics
Commissioning	<ul style="list-style-type: none"> • Confirmation of performance with design parameters • Troubleshooting and rectification
Experiment	<ul style="list-style-type: none"> • Access to up to one hour direct technical support per day during the standard work week • Oversight of automated experimental controls via the (SCADA) system, monitoring and alarming • Troubleshooting and rectification (including a staff member remaining on-call out of normal business hours to respond to system alerts and alarms *) • Access to and advice on experimental specific measurement systems <ul style="list-style-type: none"> ○ Equilibrator with LiCor IR CO2 measuring system ○ Buoyant weight ○ Respirometry ○ Diving PAM, Mini PAM, Imaging PAM ○ Water quality sampling and analysis (costs associated)
Post experiment & Decommissioning	<ul style="list-style-type: none"> • Logged data of those experimental parameters monitored centrally • Decommissioning controls and electrical systems • Assistance with logistics

* A SeaSim staff member remains on-call outside normal business hours and will receive system alerts and alarms. If the staff member has to return to work to fix an experimental system rather than attend to troubleshoot system-wide issue, the project proponent may be asked to contribute to the additional staff costs.

A member of the SeaSim Team will also be nominated as the single contact point for the life of an experiment to maintain a clear line of communication between the user and the SeaSim Team.

Unless otherwise negotiated the SeaSim Precinct Team will not provide support for the general operation and maintenance of individual experiments and associated specialized equipment beyond that indicated in the table above.

3. External Collaborators will be responsible for funding and implementing the following aspects of SeaSim experiments:

Aspect		Function
1	<p>Designing of experimental systems</p>	<p>Specifying research goals and preliminary design of experimental system.</p>
	<p>Final design approval</p>	<p>Final approval of the experimental system design rests with the SeaSim Technical Team and AIMS to ensure a seamless integration within SeaSim and maximise the likelihood of project success</p>
	<p>Equipment assessment and approval</p>	<p>The ability to control seawater parameters in SeaSim is unprecedented and achieved through the use of sophisticated technologies and systems. Equipment that users provide because SeaSim does not already possess it or it is unavailable due to other uses will need to be assessed for its ability to integrate into the control and data logging systems. Equipment quality and safety features must also be assessed.</p>
2	<p>Construction of experimental systems</p>	<p>The SeaSim Precinct Team will advise users of any potential improvements to the user provided preliminary designs of experimental systems as well as the most cost-effective means for any construction. Final costs, and their apportionment to the User or SeaSim budget, as well as design will be approved by the Program Leader, Data Technology and Innovation after consulting with the SeaSim Precinct Operations Manager and User.</p> <p>All construction activities not agreed to be completed by the SeaSim Precinct Team will be undertaken by the user and their team.</p> <p>Users will purchase all new experiment-specific equipment, where required noting that there will be an equipment pool which might be accessed by prior consultation. Some charges may be levied for expensive tailor-made items.</p> <p>On occasion, such equipment may have potential use across other projects in SeaSim or may improve SeaSim capability and SeaSim operating funds may be co-invested into these purchases. This will be decided during the detailed design phase for experimental systems.</p>
3	<p>Operating Experiments</p>	<p>All general experimental operations, including husbandry, tank maintenance, experiment-specific measurements.</p> <p><i>Funding of all associated labour and variable costs are the responsibility of the user.</i></p>
4	<p>Decommissioning Experiments</p>	<p>All non-electrical and controls decommissioning, unless otherwise agreed with the SeaSim Precinct Team.</p>

7 General Access Conditions

SeaSim users will gain access to well-maintained facilities in which their experiment will be housed, capability in operating those facilities, technical design know-how and advice on experimental set-up, as well as Facility monitoring data for the duration of their project. Access to SeaSim capacity will be based on time, space and capability.

The SeaSim is no ordinary experimental aquarium facility and contains sophisticated control systems and technologies. Consequently, the suitability of equipment external users intend to use must be considered by the SeaSim technical experts who may require the use of different equipment or approaches but achieves the same outcome as originally intended. An important consideration will be the maintenance of the high safety standards that exist within SeaSim which external users will need to comply. The ability to integrate into the control and data logging systems is another important consideration.

To ensure SeaSim maintains quality facilities and capabilities, a maintenance and development program will run in parallel with research. Some biological services may also be provided such as:

- Biodiversity holding (e.g. acclimation of field collected specimens);
- Biodiversity sub-samples (e.g. coral nubbin production);
- Quarantine to prevent introduction of disease or even undesired strains of symbionts (e.g. some zooxanthellae strains in the case of some specialised coral experiments);

Some of these activities will be conducted in the ancillary facilities in the SeaSim Precinct but outside of the SeaSim building itself. The effort required for these biological services will depend upon the type and scale of research projects being conducted and some preparatory time must be allowed prior to projects commencing.

Ordinarily, the timing for the proposal process will be:

Step	Timing targets
Call for proposals	Start
Consultation with Key AIMS and SeaSim staff	Ongoing
Final proposal submitted	6 weeks from Start
Advisory Panel Review	3 weeks from submission
Results announced	2 weeks after review completion

A flow chart describing the process to access the SeaSim Precinct is depicted in Appendix 1 in more detail which also highlights the responsibility of AIMS and the External Collaborator.

The successful External Collaborator's organisation will be asked to sign a Collaborative Research Agreement with AIMS that outlines the terms and conditions which includes but is not limited to the following:

- AIMS is not responsible for and does not guarantee the outcomes or success of the External Collaborator's experiments carried out at the SeaSim.
- All Project Intellectual Property ("PIP") relating to marine biodiversity husbandry, process and systems technology, will vest in AIMS and licensed (non-exclusive, royalty- free, irrevocable licence) to the External Collaborator for research purposes.

- All PIP relating to research findings, will vest in the External Collaborator and licensed (non-exclusive, royalty- free, irrevocable) to AIMS for any purpose.

Other salient terms of the proposed Collaborative Research Agreement are set out in the Term Sheet.

8 Contacts

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Appendix 1: Steps for External Collaborators to access SeaSim Precinct



Appendix 2 AIMS staff, contact details, and alignment with the major research themes in the SeaSim Precinct (see page 2)

1. *Click on staff name to access their on-line curriculum vitae*
2. *Queries with regards research that will develop SeaSim's general experimental capability should be directed to Craig Humphrey (c.humphrey@aims.gov.au) or Lyndon Llewellyn (L.Llewellyn@aims.gov.au)*
3. *AIMS e-mail addresses take the form of first initial.surname@aims.gov.au and are not case sensitive (for example, the e-mail address for Jane Smith would be j.smith@aims.gov.au)*

Staff name	Research Themes		
	<i>Future Oceans</i>	<i>Marine Diseases and Pests</i>	<i>Sediment & Pollution</i>
Alan Duckworth			✓
Andrew Heyward	✓		
Andrew Negri	✓		✓
Cristian Lonborg	✓		✓
David Bourne	✓	✓	
David Francis		✓	
Frederieke Kroon	✓	✓	✓
Katharina Fabricius	✓		✓
Ken Anthony	✓		
Line Bay	✓		
Lone Hoj	✓	✓	✓
Madeleine van Oppen	✓		
Michelle Heupel	✓		
Mike Hall		✓	
Neal Cantin	✓		
Nicole Webster	✓		✓
Ross Jones			✓
Sven Uthicke	✓	✓	✓