School of Engineering/ College of Systems and Society

Concept of Operations

DOCUMENT STATUS

ConOps v1.5 is the current working document for the EntoSieve project. It records the current project direction and identifies open matters where relevant. It does not claim that the system has been built, verified or finally accepted.

Statements supported by evidence are cited. Matters that still require evidence or a decision are identified where they occur. Google Drive remains the authoritative working repository [REF-10].

Title Page

Title: Concept of Operations: EntoSieve reproduction, verification and optional improvement.

Sign-off route: Rui Jiang, Project Tutor Timothy Christie and Dr. Megan Head. Dr. Megan Head and Rui Jiang have signed; Timothy Christie's sign-off is pending.

Authors: ENGN8170 Group 01

Steve Abeyrathne Ishara.Abeyrathne@anu.edu.au

Sanika Borgaonkar Sanika.Borgaonkar@anu.edu.au

Jianchen Huang Jianchen.Huang@anu.edu.au

Rui Jiang Rui.Jiang@anu.edu.au

Ruohan Wang Ruohan.Wang@anu.edu.au

Zhishuai Zhang Zhishuai.Zhang@anu.edu.au

Document owner and release coordinator: Rui Jiang. Reviewers: all six team members. Weekly document review deadline: Sunday. Backup: pending.

Version number: v1.5

Version history

Version	Date	Notes
v0.1	Aug 4, 2026	Initial ConOps draft incorporating the working client-information record and early team planning [REF-06, REF-08].
v0.2	Aug 9, 2026	Restructured the stakeholder and cost sections. Clarified the operational concept and lifecycle. Aligned the audit content with the course template and drafting guide [REF-11].
v0.3	Aug 9, 2026	Audit 1 submission with updates to scope, governance, operations, evidence, cross-references and layout. Issued for team, tutor and client review.
v1.0	Aug 14, 2026	Review release updated after tutor feedback, with plainer language, clearer ConOps/PMP boundaries and fewer open decisions. Build, verification and sign-off remain pending.

Version	Date	Notes
v1.1	Aug 17, 2026	Clarified PA1 and PA2 maturity wording to match the Week 7 baseline-model target. Scope, SoI, lifecycle and acceptance status are unchanged.
v1.2	Aug 19, 2026	Clarified the working baseline gate for weaker-than-expected results and conditions requiring re-verification. Scope and acceptance criteria remain unchanged.
v1.3	Aug 20, 2026	Incorporated the team-confirmed primary role allocation and clarified lifecycle, integration, testing and handover interfaces. Reviewer, backup, due dates and document sign-off remain pending.
v1.4	Aug 20, 2026	Applied the repository rule, Sunday review cadence, sign-off route, role-evidence treatment, resource ownership and test-readiness controls. v1.4 is retained as an unsigned prior review release.
v1.5	Aug 25, 2026	Corrected the lower size group to d ≤ 3 mm, confirmed the size-band and exposure-time baselines, clarified lifecycle and restart evidence, and created the v1.5 sign-off record. Megan Head and Rui Jiang have signed; Timothy Christie's sign-off and downstream approvals remain pending.

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Purpose of Document

This Concept of Operations (ConOps) adapts the course-provided template [REF-01] and sets out the high-level definition of the EntoSieve system and how it is intended to operate. It explains:

- why the project is needed
- what system the team intends to deliver
- which stakeholder needs shape the work
- what is inside and outside the project scope
- how the system is expected to operate
- how the team plans to validate the system for its intended use.

The ConOps separates baseline reproduction and verification from optional improvement and stretch work. Optional work is not part of the baseline.

It provides a common basis for requirements, verification planning and the Project Management Plan (PMP). The working distinctions between ConOps and PMP, and between verification and validation, were recorded during the Week 2 tutor meeting [REF-09].

Scope of the Project

Project need

Phase 1 will reproduce the published EntoSieve design described by Ascenzi et al. (2025) [REF-02] using the linked OSF build resources [REF-04]. The client-nominated tutorial provides supplementary operational context [REF-03]; it is not verification or acceptance evidence. The team will record the exact source files and hardware used, then establish the controlled build and as-built configurations. The system will be evaluated under the recorded laboratory constraints [REF-07] and the current size-band and exposure-time baselines [REF-18].

Results reported in the paper are not project acceptance criteria. Project verification requires agreed methods and recorded evidence.

Project goal

The project aims to deliver a usable and reproducible EntoSieve system for sorting client-provided insect samples into the current release size groups. The system is intended to minimise specimen damage and support repeatable testing.

The baseline outcome will include the physical unit and the controlled information needed to reproduce, operate, verify, modify and hand over the tested configuration.

Potential engineering improvements will be considered after baseline verification. Marine-invertebrate application remains conditional stretch work.

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CRICOS Provider Code: 00120C

Project objectives

The project has four core objectives. The activities used to achieve them are described in the scope and lifecycle sections.

O1 — Reproduction and sorting

Reproduce and commission a controlled, usable EntoSieve system. Sort client-provided insect specimens by maximum body dimension, where d = max(L, W, H) and L, W and H are the maximum length, width and height [REF-18].

Use the current release size groups:

- Lower: $d \leq 3$ mm
- Middle: $3 \text{ mm} < d < 10$ mm
- Upper: $d \geq 10$ mm

O2 — Verified performance and limitations

Produce a documented evidence base that describes the achieved sorting performance and known limitations. The evidence will include classification results, specimen-condition observations, anomalies and cumulative time outside ethanol.

O3 — Reproducibility and handover

Provide controlled technical information, configuration records and verification evidence that enable an intended future user to reproduce, set up, operate, evaluate and hand over the achieved configuration.

O4 — Informed improvement

Provide verified baseline evidence that can support the selection, implementation and evaluation of client-approved engineering improvements.

Conditional stretch objective — Marine-invertebrate feasibility

After the four core objectives are achieved, and only if suitable samples, facilities, time and resources remain available, investigate the feasibility of applying the EntoSieve system to marine invertebrates. Record the test basis, results and limitations.

System of Interest and scope boundary

The System of Interest (SoI) is the reproduced EntoSieve sorting system. It includes the physical unit, installed control elements, the size-sorting function and the controlled technical information needed to build and operate the unit. Verification records and the handover package describe the SoI but are not system components.

Boundary position	Element or entity	Role and boundary treatment
Inside	**Controlled system configuration**	The identified physical unit and installed control elements adopted for fabrication, assembly and testing.

Boundary position	Element or entity	Role and boundary treatment
Inside	**Fabrication and assembly information**	Controlled information required to reproduce and assemble the baseline system.
Inside	**Operating sequence**	The defined sequence used to prepare, operate and complete the sorting process.
Inside	**Size-sorting function**	The system function that separates samples into the defined size groups.

System of Interest boundary (continued)

Boundary position	Element or entity	Role and boundary treatment
Outside	**Verification evidence**	External project records used to assess the controlled configuration.
Outside	**Change and approval records**	External project records. An approved change enters the SoI only after it is implemented and added to the controlled configuration.
Outside	**Reproducibility and handover package**	An external delivery record that packages the controlled system definition, operating guidance and evidence.
Outside	**Project team and clients**	Human actors who provide requirements, decisions, approvals, operation and review; they are not system components.
Outside	**Insect samples**	External operational inputs processed by the baseline system.
Outside	**Marine-invertebrate samples**	External inputs associated only with conditional stretch work.
Outside	**Ethanol and authorised sample-handling procedures**	External consumables and procedural constraints governing sample handling.
Outside	**Source documents and supplied files**	External reference inputs. Information enters the SoI only when formally adopted into the controlled baseline.
Outside	**Laboratory or manufacturing facilities, equipment and materials**	External resources used to fabricate, assemble, operate and test the system.

The table separates system components from the people, inputs, resources and records that support the project. An approved change becomes part of the SoI only after it is implemented and added to the controlled configuration.

Project work in scope

- Reconstruct, fabricate, assemble and commission a traceable EntoSieve baseline, including an as-built configuration record.
- Operate the baseline with agreed client-prepared insect samples under applicable authorised sample-handling procedures.
- Verify the sorting function under agreed conditions and record results, anomalies, specimen-handling observations and limitations.
- Maintain the controlled build information and handover guidance required to reproduce the tested configuration.
- Evaluate client-approved engineering improvements as optional post-baseline work.
- Investigate marine-invertebrate feasibility as conditional stretch work.

Project work out of scope

- Commercial manufacture or deployment at scale.
- Regulatory certification of the EntoSieve system.
- Routine operation, maintenance or support after handover.
- Laboratory-authorised ethanol or specimen-handling procedures.
- Marine-invertebrate sorting beyond conditional feasibility work.
- Performance claims not supported by the recorded test evidence.

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Scope priorities and gates

Project work will follow this order:

1. Reproduce and record the Phase 1 reference design.
2. Verify the reproduced baseline and document its limitations.
3. Evaluate client-approved engineering improvements.
4. Undertake conditional marine-invertebrate feasibility work.

Improvement or stretch work must not delay the baseline system, its verification or the minimum handover. The lifecycle section defines the evidence required at each decision gate.

Key constraints and pending decisions

Project delivery depends on access to the identified source files, client hardware, suitable samples, authorised laboratory procedures and required fabrication and laboratory facilities. The exposure-time record starts when classification begins. Returning a sample to ethanol during classification does not reset the timer. Cumulative time outside ethanol must not exceed four hours [REF-07, REF-18].

The size bands are stated in O1 and recorded in REF-18. No quantitative criteria have been agreed for sorting accuracy, repeatability or specimen damage. The team may report observations and limitations, but cannot claim formal acceptance against unconfirmed criteria. Other unresolved matters are listed in Readiness and Open Confirmations.

Scope management plan

This ConOps defines the current project scope for review. The scope remains under review until the applicable approval or sign-off is recorded. REF-02 and REF-04 define the adopted Phase 1 reference design. They do not yet define the controlled build or as-built configuration. Before freezing the controlled build, the team will preserve the exact REF-04 source snapshot, map it to collected hardware and record substitutions.

The team will review the scope at each Project Audit, before a material change and before handover. A proposed scope change must record its reason, the affected system elements and deliverables, its effects on schedule, cost, resources, risk, verification and handover, and the required approval.

The team will decide internal changes through its agreed governance process. Changes to client-facing scope, intended use, acceptance or handover require the applicable client approval. Approved changes must update the affected ConOps, requirements, configuration, verification and PMP records. Detailed change-control and escalation procedures are managed in the PMP and Team Charter.

Referenced Documents

This register lists the sources cited in this ConOps. REF-xx identifies a source; REQ-xx identifies a requirement. Inclusion provides traceability only. It does not change a source's authority or evidence status.

Each entry states the source type, its use in this ConOps and its limitations. Records from the same meeting or information chain are not independent confirmations.

REF-15 is the authoritative course source used for Project Audit timing and minimum project evidence. It does not define project-specific technical acceptance criteria.

Reference register

REF ID	Source	Type, use and limitations
REF-01	Concept of Operations Template ENGN8170.docx	Course template used for the ConOps structure. It has been adapted for this project. It does not define project-specific technical requirements or acceptance criteria.
REF-02	Ascenzi, A., Wührl, L., Feng, V., et al. (2025), "EntoSieve: Automated Size-Sorting of Insect Bulk Samples to Aid Accurate Megabarcoding and Metabarcoding," Molecular Ecology Resources, 25(6), e14097.	Peer-reviewed technical source used with REF-04 to define the Phase 1 reference design. It describes the published EntoSieve concept and test context. It does not define project acceptance criteria or prove the project build.
REF-03	EntoSieve Tutorial (YouTube)	Client-nominated operational demonstration used as supplementary context for intended operation. It is not a verification method or acceptance source.
REF-04	EntoSieve Open Science Framework (OSF) project and online building resources	Public build resource used with REF-02 to define the Phase 1 reference design. No tagged release has been identified. It does not define the controlled build or as-built configuration.
REF-05	Megan Head email, “RE: ENGN8170 Project – Initial Meeting and Project Clarifications,” 4 Aug 2026, 11:50 am	Direct client email supplying REF-02 to REF-04 and recording that the online build instructions were incomplete. It does not confirm that the linked material is complete, approved or sufficient for reproduction.

Referenced Documents (continued)

REF ID	Source	Type, use and limitations
REF-06	ENGN8170_Client_Info_01_Megan_and_Josh_2026-08-04_v0.1	Working record derived from Rui Jiang's post-meeting recollection. It is used for early project phasing, client-prepared samples and reproducibility direction. It is not independent client confirmation.
REF-07	August 11 Client Meeting Notes	Team record of the 11 Aug 2026 client meeting. It is used for RN Robertson laboratory arrangements, client authority, qualitative damage direction, exposure time, hardware availability and Phase 1 reproduction direction. Its earlier lower-bound wording is superseded by REF-18, and it is not a client-signed ConOps approval record.
REF-08	ENGN8170_Meeting_02_Week_01_Minutes_2026-08-01_1500	Team meeting record used for the provenance of early planning, literature review and use of the ConOps template. It does not support later client requirements.
REF-09	August 6 W2 Tutorial	Tutor-meeting record used for the working distinction between ConOps and PMP, and between verification and validation. Course assessment requirements are controlled by REF-15.
REF-10	ENGN8170_Group01_Repository_Usage_Guide	Internal team working guide used for repository organisation, naming and document-control practice. It does not replace course guidance or a confirmed team decision.

Referenced Documents (continued)

REF ID	Source	Type, use and limitations
REF-11	ENGN8170 ConOps Team Writing Guide and Task Allocation v0.1	Internal drafting and provisional allocation guide used for drafting provenance. It is not a client requirement. Its work-package assignments are not approved ownership.
REF-12	STP G05 Internal ANU Student Group Project Deed v2.0 ENGN8170.pdf	Available agreement template for an internal ANU-hosted student group project. It is used only to identify one possible agreement route. Applicability, project details, selected terms, signatures and an executed copy remain pending.
REF-13	STP 01 Industry Project Agreement v5.3 ENGN4300_ENGN8170.pdf	Available ANU-host agreement template for an external-host project. It is used with REF-14 to identify the external-host agreement route. Applicability, project details, selected terms, signatures and an executed copy remain pending.
REF-14	STP 02 Student Project Agreement v4.0 ENGN4300_ENGN8170.pdf	Available student agreement template for an external-host project. It is used with REF-13 to identify the external-host agreement route, and the selected intellectual-property terms must match. Applicability, signatures and executed copies remain pending.

Referenced Documents (continued)

REF ID	Source	Type, use and limitations
REF-15	ENGN8170 - Group Project Assessment Guide, Semester 2, 2026, Version V2026.S2.1.0	Authoritative course assessment guide used for the Weeks 3, 6 and 11 audit cycle; minimum repository content; ConOps, PMP and landing-page expectations; and primary, crash and stretch goals. It highly recommends sign-off by the project host, tutor and all team members. It does not define project-specific technical acceptance criteria.
REF-16	August 9 Zoom Meeting Minutes	Team meeting record confirming the flat collaborative structure, phase-dependent responsibilities, voting, Rui Jiang's client-liaison role and ongoing document/configuration control. It does not confirm individual work-package ownership or detailed governance procedures.
REF-17	Team role-allocation confirmation record, 20 Aug 2026	Team confirmation record derived from each member's WhatsApp role statement dated 20 Aug 2026. It is used for the confirmed primary roles, Sunday review cadence and Rui Jiang's release-coordination role. The underlying message evidence is not linked from this ConOps; the named backup remains pending.
REF-18	ENGN8170 EntoSieve ConOps v1.5 Review and Sign-off Record, 25 Aug 2026	Current release-control record for ConOps v1.5, recording the confirmed size bands, exposure-time rule and three-party sign-off route. Megan Head and Rui Jiang have signed; Timothy Christie's sign-off is pending. Sign-off approves this ConOps release only, not test criteria, safety authorisations, build completion or final acceptance.

Team Structure

The project team comprises six ENGN8170 students:

- Rui Jiang — Rui.Jiang@anu.edu.au
- Steve Abeyrathne — Ishara.Abeyrathne@anu.edu.au
- Sanika Borgaonkar — Sanika.Borgaonkar@anu.edu.au
- Jianchen Huang — Jianchen.Huang@anu.edu.au
- Ruohan Wang — Ruohan.Wang@anu.edu.au
- Zhishuai Zhang — Zhishuai.Zhang@anu.edu.au

The team works in consultation with the clients: primary client representative Dr Megan Head, megan.head@anu.edu.au. Josh Coates also participates in client decisions and holds operational stop authority during RN Robertson laboratory work. [REF-07]

The clients provide project context, available technical information and resources [REF-05, REF-07]. They provide laboratory direction and review input [REF-07]. Responsibility for planning and delivering the project remains with the student team [REF-16].

The team uses a confirmed flat and collaborative model [REF-16]. Roles may change with the lifecycle phase, work package, required skills, workload and project needs. This supports coordination without creating a permanent hierarchy or unilateral approval authority.

Rui Jiang is the confirmed client liaison and document integrator. The team-confirmed primary delivery roles are summarised below [REF-17]. Voting remains the formal team decision method. The project will maintain an ongoing document and configuration-control function.

Primary role leads are confirmed [REF-17]. All six members review documents by Sunday. Rui Jiang coordinates release. The named backup and task-level dates remain controlled separately.

External course stakeholders are Dr Zena Assaad and Dr Jenny Simmons as Course Convenors, Timothy.Christie@anu.edu.au as Project Tutor, and all members of ENGN8170 Group 02 as the assigned Shadow Team. Their identities and functions are confirmed. Detailed course approval boundaries and Shadow Team review topics remain pending [REF-15].

Team organisation by lifecycle phase

Lifecycle phase	Team arrangement and principal activities	Status and allocation boundary
Concept and baseline definition	All six members work together to define stakeholder needs, scope, the System of Interest, requirements, the system concept, interfaces, the baseline direction and the verification and validation direction.	Primary role leads are confirmed [REF-17]. All members review documents by Sunday. Rui coordinates release; backup pending.
Design and implementation	Rui Jiang leads document integration and 3D printing. Zhishuai Zhang supports printing and coordinates hardware assembly. Ruohan Wang leads Arduino software and control integration. Jianchen Huang supports electrical assembly and safety evidence.	Primary design and implementation roles are confirmed [REF-17]. Each material change still requires the applicable decision, review and approval.
Integration, verification and handover	Sanika Borgaonkar leads verification and validation, with Jianchen Huang supporting setup, data and evidence. Steve Abeyrathne leads reproducibility and the final handover package. Rui Jiang integrates controlled documents and client communication.	Integration, verification and handover roles are confirmed. Formal acceptance and sign-off remain subject to the applicable authority.

Responsibilities and Authorities

The phase table shows how the team organises its work. The table below records the confirmed primary role allocation and continuing authority boundaries [REF-17]. Roles may be reallocated by a recorded team decision under the confirmed flat, collaborative governance model [REF-16]. Assigned responsibility permits routine decisions within the agreed scope, but it does not permit unilateral changes to scope, requirements, the system baseline or team governance. Detailed procedures are maintained in the Team Charter and PMP.

Party / function and status	Responsibilities	Authority / boundary
Clients / Primary Stakeholder Representatives — Megan Head and Josh Coates; confirmed	Provide project context, technical information, available resources and suitable samples. Clarify intended outcomes and review baseline evidence, proposed improvements and material decisions.	Megan is the final client-side authority when client directions conflict. Megan and Josh may stop RN Robertson work. Restart requires client approval and all applicable facility, WHS, electrical and energisation authorisations. These powers do not extend to academic assessment or internal team governance.
Six-person Project Team — confirmed	Plan and document the project. Reproduce, assemble, commission, verify and evaluate the agreed system. Maintain evidence for reproducibility and handover. Investigate agreed improvements.	Voting is the confirmed team decision method. Detailed voting and escalation rules remain a working proposal for the Team Charter. Client-facing changes also require the applicable client approval and change control.
Primary delivery roles — confirmed [REF-17]	Rui Jiang: project coordination, client liaison, document integration and lead 3D printing. Steve Abeyrathne: reproducibility and final handover package. Sanika Borgaonkar: testing, validation and verification. Zhishuai Zhang: hardware assembly, 3D-printing support and fabrication-risk inputs. Ruohan Wang: Arduino Nano software and control integration. Jianchen Huang: electrical assembly, safety evidence and test support.	Each lead coordinates routine work, interfaces and evidence within the agreed scope. Support work does not create a duplicate stream. No role grants unilateral authority to change scope, requirements, the baseline, verification strategy, safety approval or team governance.
Client liaison — Rui.Jiang@anu.edu.au; confirmed	Coordinate routine questions, information exchange and meeting arrangements.	This is a communication function. It does not authorise independent commitments or project decisions for the team.

Responsibilities and Authorities (continued)

Party / function and status	Responsibilities	Authority / boundary
Document ownership, integration and release coordination — Rui Jiang; confirmed	Maintain controlled Google Drive working sources and prepare the Sunday OneDrive reference sync. Coordinate naming, versions, links, configuration records and traceability. All members review project documents by Sunday.	Rui coordinates document release. Megan Head and Rui Jiang have signed ConOps v1.5; Timothy Christie's sign-off remains pending [REF-18]. This role does not permit unilateral technical or scope changes. The named backup remains pending.
Course Convenors — Dr Zena Assaad and Dr Jenny Simmons; confirmed	Provide course governance and authoritative guidance on academic, assessment and escalation matters. STP G05 identifies Dr Zena Assaad as Course Academic Supervisor [REF-12].	Hold authority in applicable academic and course-governance matters. They are not the Project Host or routine technical decision-makers. Detailed approval boundaries remain pending authoritative guidance.
Project Tutor — Timothy.Christie@anu.edu.au; confirmed identity and function	Provide tutorial guidance, formative feedback and planned ConOps sign-off.	The planned sign-off is a document-release record. It does not replace client acceptance or final course authority. Timothy Christie's sign-off is pending [REF-18].
Assigned Shadow Team — all members of ENGN8170 Group 02; allocation confirmed, review topics pending	Review the repository and assigned audit criteria. Provide traceable peer-review feedback.	Provides advisory peer review only. It cannot approve client requirements, change scope or the baseline, or make formal course decisions.

Voting is the confirmed team decision method [REF-16]. Detailed quorum, tie, abstention, escalation and recording rules remain a working proposal for the Team Charter and PMP. Material team changes require a recorded team decision [REF-16]; client-facing changes also require the applicable client approval [REF-07].

Stakeholder Management Plan

The key stakeholder groups are the clients, project team, Course Convenors, Project Tutor and assigned Shadow Team. Their authority boundaries are summarised in Responsibilities and Authorities. The table below defines the communication channel, timing and evidence expected for each group.

Stakeholder / status	Needs and contribution	Channel, timing and evidence
Clients / Primary Stakeholder Representatives — megan.head@anu.edu.au and Josh Coates; confirmed	Need a usable, reproducible and evidence-supported EntoSieve outcome. Provide project context, available resources, suitable samples, domain input and review feedback.	Rui coordinates contact by email and scheduled meetings. Tuesday at 13:30 is the current working client-communication window and must be reconfirmed each week [REF-06]. Provide a brief progress update and proposed agenda in advance, then confirm whether a meeting is needed. Planned laboratory testing requires at least one week's notice [REF-07]. Retain advice, decisions and approvals in email, meeting minutes or the Decision Log.
Six-person Project Team — confirmed	Plans, delivers, integrates, verifies, documents and hands over the system and its supporting evidence.	Use WhatsApp for routine coordination, weekly team meetings for integration, and Google Drive for controlled records. Review documents by Sunday. Record material decisions, actions and configuration changes in the applicable minutes, register or Decision Log.
Course Convenors — Dr Zena Assaad and Dr Jenny Simmons; confirmed	Provide course governance and authoritative academic guidance. Dr Zena Assaad is also identified as Course Academic Supervisor in STP G05.	Use formal course channels when academic, assessment or escalation guidance is required. Engage before the affected decision or submission. Retain authoritative guidance, audit and submission records.

Stakeholder Management Plan (continued)

Stakeholder / status	Needs and contribution	Channel, timing and evidence
Project Tutor — Timothy.Christie@anu.edu.au; confirmed	Provides tutorial guidance and formative feedback on systems-engineering practice and project artefacts.	Use the weekly tutorial or email for formative review and clarification. Provide current evidence before the relevant tutorial or audit review. Retain tutorial notes, feedback and the team's response. Tutor feedback is not client acceptance.
Assigned Shadow Team — all members of ENGN8170 Group 02; confirmed, review topics pending	Provides independent peer-review feedback against assigned audit or review criteria.	Use the assigned audit or review channel during each scheduled review cycle. Provide current, scoped evidence before review. Retain comments, team responses and closure evidence. Peer review is advisory.
Other operational or technical stakeholders — identification pending	May include laboratory, facility, work health and safety (WHS), fabrication, technical-support or future-user representatives only where involvement is confirmed.	Define the channel, notice period, responsible contact and evidence record when the stakeholder and interface are confirmed. Engage before affected work starts or relies on that stakeholder's input, authority or resources.

Engagement and Evidence Principles

Record material stakeholder communications and decisions in controlled project records. Link them to the affected scope, requirement, configuration, verification activity or handover item where relevant. Keep client advice separate from client approval, tutor guidance separate from course authority, and Shadow Team feedback separate from both.

These communication arrangements are working practices unless a cited source states otherwise. Detailed review, escalation and closure controls are maintained in the PMP working source and Team Charter.

Cost and Resource Boundary

Available hardware is a client-provided input. Receipt, inventory and completeness checks remain pending.

Ruohan Wang maintains machine, control and electrical resource records. Rui Jiang maintains 3D-printing materials, print records and cost inputs.

Budget and purchase approvals follow the applicable university or project process. Published or OSF values are not the project budget [REF-02, REF-04].

Detailed estimates, approvals, purchases and expenditure are maintained in the Cost Plan working source and the PMP.

Operational Concept and System Lifecycle Process

The reference design, size bands and cumulative exposure-time rule are supported by the current evidence [REF-02, REF-04, REF-18]. Open readiness matters are listed in Readiness and Open Confirmations.

Operational Context, Actors and External Interfaces

Testing is planned in the RN Robertson laboratory [REF-07]. Applicable facility, WHS, electrical and energisation authorisations must be recorded before energisation or live testing. Ruohan Wang is the nominated machine and control operator. Ruohan maintains machine and control records. Rui Jiang maintains 3D-printing records [REF-17].

Nominal Baseline Operating Scenario

1. **Preparation:** Confirm the controlled configuration, cleanliness and safe setup. Identify the sample, test purpose and applicable size-boundary convention. Open the test record.
2. **Sample handling and loading:** Receive client-prepared samples and follow the applicable authorised laboratory procedure. Classification begins when the specimen or batch leaves ethanol. Start the exposure-time record at that point [REF-18]. Record each transfer between ethanol and water or another holding condition.
3. **Sorting:** Operate the reproduced system using the size convention defined in O1. Sort specimens into the confirmed size groups [REF-18]. Record the controlled configuration, operating conditions and observations required to reproduce the run.
4. **Sample recovery and inspection:** Recover each fraction without losing sample identity. Inspect for visible damage and possible misclassification. Return samples to the required holding condition. Sum every period outside ethanol. A temporary return to ethanol does not reset the total. Cumulative time outside ethanol must not exceed four hours [REF-18]. A client representative records exposure time. The named recorder and controlled record location remain pending.
5. **Close-out:** Clean, inspect and reset the system under the authorised procedure. Record blockages, mixed fractions, component or control anomalies and corrective actions. Preserve test and configuration evidence. Exploratory commissioning may record sorting and specimen-condition observations to develop the method. Formal measures, repetition count and the specimen-damage decision rule must be approved and frozen before formal verification.

Off-Normal Operation and Recovery

The following proposed operating controls remain a working proposal pending confirmation during commissioning and test planning.

Immediate stop

- An unsafe condition or WHS non-compliance occurs.
- Equipment damage is observed.
- A component or control failure occurs.

- Critical exposure-time records or traceability are lost.

Pause and inspect

- A blockage occurs.
- Unexpected mixing or possible misclassification is observed.
- Visible specimen damage is observed.

Possible misclassification is a test observation. It does not, by itself, require an immediate stop or establish a formal failure.

Megan Head and Josh Coates may stop RN Robertson laboratory work [REF-07].

After a pause or stop, preserve the controlled configuration, affected-sample identity and relevant evidence. Record the event, its effect on the run and any corrective action.

Testing may resume only after client approval and all applicable facility, WHS, electrical and energisation authorisations are recorded. Megan is the final client-side authority if client directions conflict [REF-07]. The controlled restart template, record location and named restart approver remain pending. Restart evidence is created only if a stop and restart occur.

System States and Transitions

The proposed working states are Out of service, Setup and inspection, Ready, Sorting, Paused or fault, Recovery and cleaning, and Test complete. Normal operation moves through setup and inspection, ready, sorting, recovery and cleaning, then test complete. An off-normal event moves the system from sorting to paused or fault, followed by controlled review or authorised recovery. Exact controls and transition criteria remain pending commissioning.

Verification, Validation, Reproducibility and Handover Direction

Verification. Verification determines whether the reproduced baseline satisfies confirmed requirements under stated test conditions. Exploratory commissioning may develop the method. Formal measures, repetition count and the specimen-damage decision rule must be approved and frozen before formal verification. Earlier observations remain exploratory and cannot support formal acceptance.

Validation. Validation determines whether the system supports the clients' intended classification use in the RN Robertson laboratory. Candidate evidence includes observed use, client feedback and review of operational limitations. Validation participants, criteria, approval authority and the controlled validation record remain pending.

Reproducibility and handover. Reproducibility and handover address whether the controlled build information, as-built configuration, operating guidance, verification evidence and known limitations support future reproduction and transfer. These records support verification and handover; they do not replace validation. The exact handover package and client acceptance record remain pending.

Systems Engineering Process and Decision Gates

The project uses a tailored staged systems-engineering lifecycle with V-model traceability. This project-specific process does not claim compliance with a particular systems-engineering standard.

The traceability relationships are:

- Stakeholder needs and intended to use trace to validate evidence.
- The confirmed requirements and stated test conditions trace to verification evidence.
- The adopted design and controlled configuration trace to integration and commissioning evidence.

Project definition establishes needs, scope and traceable requirements. Baseline reconstruction establishes the controlled build and as-built configuration.

Commissioning establishes safe, stable and recordable operation and develops the formal test method. Verification then produces evidence for the baseline evidence gate.

Baseline Evidence Gate — working proposal

Valid configuration and test evidence support recording achieved baseline performance, even when results are weaker than expected. Valid but weak results are recorded as achieved performance and limitations.

An invalid configuration, unsafe or unstable operation, invalid test basis, or invalid evidence keeps the gate open. Correction and re-verification are required.

No result is a formal failure against an unconfirmed criterion.

With valid evidence, the team may accept limitations for handover or approve a controlled improvement, subject to applicable client approval.

Every approved improvement must be compared with the baseline and re-verified before the baseline evidence gate is reconsidered.

Marine-invertebrate work remains a separate conditional stretch branch.

Project Audits are course review checkpoints. They do not replace technical readiness, baseline decisions or controlled approval records [REF-15].

Lifecycle phase	Purpose and principal activities	Exit evidence / decision gate
Project Definition	Clarify stakeholder needs, project boundary, source files, records and initial requirements.	Controlled scope and traceable initial requirements; unresolved items recorded.
Baseline Reconstruction	Control source records; obtain or fabricate approved components; assemble the reference design; maintain controlled-build and as-built records.	Recorded configuration ready for commissioning.

Project Lifecycle (continued)

Lifecycle phase	Purpose and principal activities	Exit evidence / decision gate
Commissioning	Establish safe, stable and recordable operation; confirm the achieved configuration; develop the test method; record anomalies.	Commissioning evidence supports formal-verification readiness. Exact measures and criteria remain pending.
Verification and Evaluation	Test confirmed requirements under stated conditions using the frozen method and client-provided samples.	Valid configuration, results, anomalies and limitations recorded for the baseline evidence gate.
Baseline Evidence Gate — working proposal	Review configuration validity, operational stability, safety, test basis and evidence completeness.	Proceed to handover, approve improvement, or require correction and re-verification. No result fails an unconfirmed criterion.
Knowledge Transfer and Handover	Deliver controlled files, the as-built record, guidance, verification evidence and known limitations.	Exact package contents and client acceptance record remain pending.
Engineering Improvement — optional branch	Evaluate an approved change using baseline evidence, engineering analysis and stakeholder feedback.	Update the configuration; return through re-verification and the baseline evidence gate.
Marine-invertebrate Feasibility — conditional stretch	Investigate only when the baseline, suitable samples, facilities, time and resources permit.	Record the basis, results and limitations. Update the handover record if undertaken.

Post-handover operation, maintenance and future modification are outside the project delivery scope but are supported by the reproducibility package.

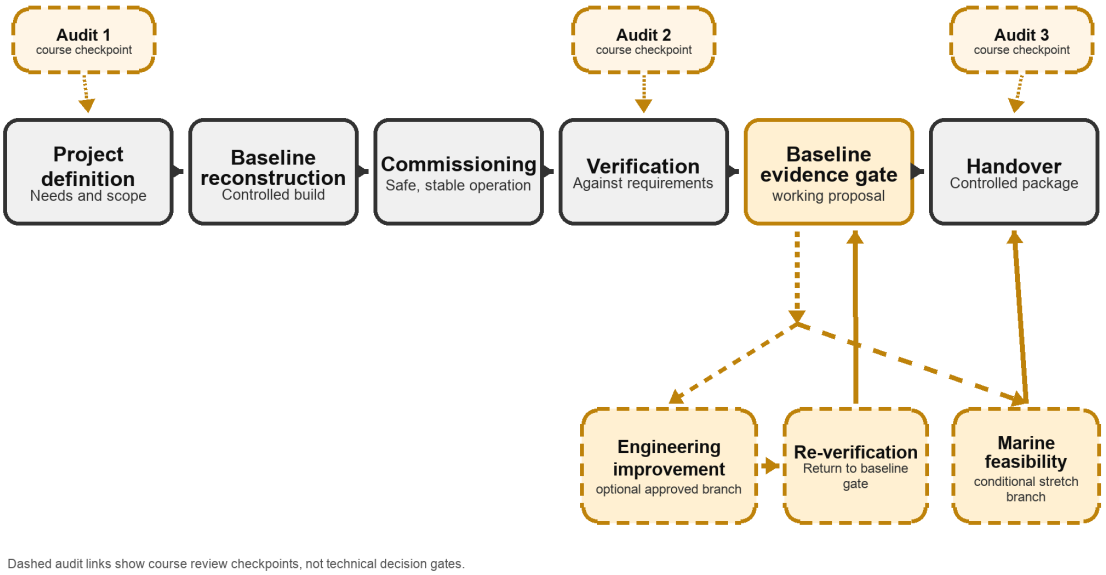


Figure 1. Tailored EntoSieve lifecycle, optional branches and course audit checkpoints

Project Audit Milestones

Project Audits occur in Weeks 3, 6 and 11 [REF-15]. They are course review checkpoints, not technical readiness or baseline decision gates. The milestones below describe expected project maturity. Detailed evidence and contingency controls remain in the PMP and repository.

PA1 — Week 3: Initial project definition, management controls and the baseline-reproduction plan demonstrated.

PA2 — Week 6: Baseline design and build progress, commissioning preparation and verification preparation demonstrated.

PA3 — Week 11: Achieved configuration, evidence, limitations and handover package demonstrated.

Readiness and Open Confirmations

The following decisions must close before the relevant lifecycle gate. Each closure requires a controlled record.

- Release-signature gate — pending: Obtain Timothy Christie's sign-off and retain REF-18.
- Formal-verification gate — pending: Approve and baseline the performance measures, repetition count and specimen-damage decision rule.
- Energisation and live-test gate — pending: Record the applicable facility, WHS, electrical and energisation authorisations.
- Document-control continuity — pending: Assign a backup and retain the linked REF-17 evidence.
- Live-test record readiness — pending: Name the exposure-time recorder and controlled record location before live testing [REF-18].
- Restart control — pending: Define the restart record and location before live testing [REF-07].
- Validation gate — pending: Confirm participants, acceptance basis, approval authority and the formal validation record.
- Baseline and handover gate — pending: Confirm the controlled-build, as-built, handover-package and acceptance records.
- Stakeholder review — pending: Confirm any additional operational or technical stakeholders before affected work begins.
- Project agreement route — pending: Confirm and execute either STP G05 [REF-12] or STP 01 with STP 02 [REF-13, REF-14].

12 October 2026 — Link maintenance only. The main content is unchanged; the existing signed approval continues to apply to that unchanged content.