SubRacing Series Safety News - Issue 1

Welcome to issue 1 of SubRacing Series Safety Bulletin where we explore the world of submarine racing and how it can be safely enjoyed. We aim to provide information on how to safely design, build and race these underwater vehicles to maximise enjoyment for all.

Human powered submarines have been around since the 17th century with the first officially recorded being that designed by Cornelis Drebbel, a Dutch inventor, who demonstrated his invention to King James I of England in the 1620s. There are even unsubstantiated claims that the King was given a trip down the Thames in it! So we follow on from a royal patronage.

With the start of the inaugural SubRacing Series Design Competition (DC26) on the horizon and the focus on building machines that are 'Safe By Design' or 'Designed For Safety' it seemed prudent to start this bulletin with some guidance on what this means.

'Safe By Design' is a widely used concept where safety is considered through the whole life cycle of a product; initial concept, design, manufacture, use, in service modifications and disposal rather than as an add on at the end of the process. This ensures that the hazards that may be encountered during operations, as well as those introduced by the product when it goes into service, are identified early to enable safety mitigations to be incorporated into the design from the outset. Incorporation of safety mitigations at the preliminary design stage is much easier and prevents potentially costly reworking once the product has been partially or fully manufactured or is in use.

Process Stages

Preliminary Design / Concept

This is the most important stage of the 'Safe By Design' process as it will develop the operational parameters for the product which in turn will help in the development of the operational hazards. It is therefore important to create a well-defined Design Specification for the operational requirements of the product to ensure that the technical requirements are completely captured for future reference.

This document is then used to identify the hazards that may be encountered by the product as well as those generated by it.

Hazards are defined as 'anything with the potential to cause harm, damage, or adverse health effects to people, property, or the environment'.

This is achieved through a Hazard Identification (HAZID) meeting where the project team, and a qualified risk assessor, will look at the proposed function and use of the product and identify the hazards generated. The HAZID should consider all potential hazards, even those considered as unlikely to happen, to ensure a complete picture is obtained. These can then be assessed and any considered to be unlikely to occur noted as such and archived to ensure an auditable trail. The final output from the HAZID is a Risk Register which records all the hazards identified, including those deemed improbable, and any mitigations identified to reduce the risk.

The credible risks are then assessed and entered into a Risk Assessment which details how and where the product will be used and the mitigations to reduce the risks to an acceptable level. This level is known in the UK as being 'As Low As Reasonably Practicable' (ALARP).

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The HSE website (www.hse.gov.uk) outlines the FIVE stages of risk assessment as:

1) Identify hazards
2) Decide who might be harmed and how
3) Evaluate risks (and assign a risk rating) and decide on precautions / mitigations to reduce them
4) Record findings in a Risk Assessment and implement them
5) Review the assessment regularly.

Stage 3 comprises three parts:

a. The credible hazards are assessed by the team and allocated an Initial Risk Rating which is based upon the assumption that no mitigations are in place.
b. Mitigations to reduce the risk to ALARP are identified and recorded in the Risk Assessment.
c. The hazard is reassessed assuming all mitigations are now in place and a Residual Risk Rating assigned.

A Risk Rating is defined as a combination of the Harm that the hazard could cause and the Likelihood of it occurring.

Example Risk Assessment forms can be found on the UK HSE website (www.hse.gov.uk).

An example of a Risk Rating Matrix is shown below. Many others are available.

Info RISK MATRIX		SEVERITY				
		C	Cr	Se	M	N
LIKELIHOOD	F	VH	VH	H	M	L
	P	VH	VH	H	M	L
	O	H	H	M	L	T
	R	M	M	L	T	T
	I	L	L	T	T	T

	SEVERITY			LIKELIHOOD Info	
	Health/Safety	Environmental		Health/Safety	Environmental
C	**Catastrophic** Multiple fatalities.	Severe damage, recovery time in years, permanent widespread damage.	F	**Frequent** Likely to be continually experienced.	Not surprised by activity, will occur several times a year or daily event.
Cr	**Critical** Single fatality, multiple severe injuries and/or reportable occupational illness.	Significant but less severe impact, recovery time less than one year, long term widespread damage.	P	**Probable** Likely to occur more than once throughout the activity.	Occurs repeatedly, an incident/task to be expected.
Se	**Serious** Single severe injury / illness, multiple minor injuries or cases of occupational illness (reportable).	Adverse impact with the effects limited to the local area, short term widespread damage.	O	**Occasional** Unlikely, but may occur once throughout the activity.	Occurs sometimes or is a 6 monthly/annual event.
M	**Minor:** Minor (first aid only) injury or short term absence (non-reportable).	Minor impact with effects limited to the immediate area, minimal clean up required, long term local damage.	R	**Remote** Extremely unlikely, but may exceptionally occur (e.g. one occurrence every few years).	Unlikely though conceivable, may occur every few years.
N	**Negligible:** Trivial consequence, no measurable effects; non-first aid (non-reportable).	Very little or no impact on the environment, short term local damage.	I	**Improbable** Theoretically could happen but probably never will.	Theoretically could happen but probably never will.

RISK RATING Info	
VERY HIGH	Work **must not** commence or facility shall not be used until management action has been taken to reduce the final overall risk rating. Approvals** required before proceeding.
HIGH	**Reduce risk** through additional controls include e.g. Safe Method of Work, Permit to Work, etc. Approvals** required before proceeding.
MEDIUM	Reduce risk through additional controls if practicable. Requires written safe system of work, training or competence needs documented. Approvals required before proceeding**.
LOW	This work which may be of a routine nature will be accompanied by simple work instructions.
TRIVIAL	Risk is adequately controlled, additional controls required only if the benefits justify the effort.

The Design Specification in combination with the Risk Register and Risk Assessment can then be used to develop a compliant design concept. The design can be assessed during it's development to ensure the functional and safety requirements are met and any new hazards identified assessed and mitigated.

Pre-Manufacture / Final Design Review

Prior to initiation of manufacturing, a Final Design Review should be held to verify that all the technical and safety requirements have been met and authority to manufacture given. If any changes are requested during manufacture, they should be assessed to identify whether safety or technical performance will be changed.

In Service

If any changes are identified during operations, they should be assessed to identify whether safety or technical performance will be changed before being undertaken.

The above may seem daunting at first, however a concerted upfront effort can reap dividends later on. If we can get the preparations right first time then all that remains is the fun part of undertaking the racing.

Additional information sources.

1. UK HSE website: Risk assessment: Steps needed to manage risk - HSE
2. UK HSE website: Risk assessment: Template and examples - HSE
3. UK Ministry of Defence: JSP Part 2 - Element 7: Equipment Design, Manufacture and Maintenance V1.3 September 2026
4. SubRacing Series – Competition Rules Design Competition (DC26) - SubRacingSeries-DC-Rulebook-Current.pdf

Happy designing.

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Issue Record

Version	Date	Notes
1.0	February 2026	Initial Issue
1.1	October 2026	Update to hyperlink to MoD JSP815 following issue of version 1.3 – Reference 3 Addition of hyperlink for Design Competition Handbook – Reference 4