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Autonomous underwater vehicles — Risk and reliability

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Foreword

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Introduction

Autonomous underwater vehicles (AUVs) are uncrewed vehicles. They rely on sensors, control units, and mechanical parts to manoeuvre and complete mostly pre-defined tasks in the ocean environment. A growing trend in underwater technology is to face the extreme environment, which refers to, for example, polar environments, rapid currents, extremely high temperatures due to underwater volcanoes, underwater oil plumes, etc. The side effect of using AUVs in extreme environments, however, is a higher risk and probability of failure. The capacity for uncrewed underwater vehicles to perform an extreme mission, which is to perform in an increased level of difficulty, is unknown. Usually, a team of experts employs the vehicle within a trial-and-error process to:

a) achieve the system identification, and

b) measure (most of the time qualitatively) the reliability of the AUV for a specific mission.

This document specifies how an AUV can carry out the actions described in a) and b). This document can therefore be used by the owners and operators of AUVs when designing missions. It should be noted that risk and reliability by nature are probabilistic. This document serves as a linkage between the capabilities of the vehicle and its intended mission, so as to avoid foreseeable undesired settings and circumstances. Despite this ability to foresee problems, faults and failures of the vehicle can be due to uniquely encountered states that have never been observed before. In such cases, dynamic risk analysis and online topic models can be used to expand the operational proficiency of an autonomous vehicle.