In this task, we are going to instantiate an assurance case from an assurance case pattern provided above for the BlueROV2 system, following the steps given:

1. Remove all additional assurance case pattern decorators (e.g., Uninstantiated, Placeholders, Choice, Multiplicity, Optionality).

2. Replace placeholders and generic information with specific BlueROV2 system information based on the domain.

### Assurance Case for BlueROV2 System:

@Assurance\_case

- \*\*G1\*\*: Hazards for BlueROV2 system addressed in accordance with ALARP principle.

- \*\*S1\*\*: Argument by risk reduction/elimination of each hazard

- \*\*G2\*\*: No intolerable risks present in the system.

- \*\*S2\*\*: Argue that risk posed by any remaining hazards is negligible (undeveloped)

- \*\*S3\*\*: Argue that no other risks have been identified (undeveloped)

- \*\*G3\*\*: Risk from obstacle encounter has been reduced as low as reasonably practicable.

- \*\*S4\*\*: Apply ReSonAte to estimate level of risk from hazard condition obstacle encounter.

- \*\*G4\*\*: Model avoidance maneuver BTD accurately describes possible propagation of hazard obstacle encounter.

- \*\*G6\*\*: Possible hazard propagation paths correctly captured in BTD (undeveloped)

- \*\*G7\*\*: Barriers in the BTD correctly describe their respective control action including any required system functions (undeveloped)

- \*\*G8\*\*: All non-negligible threats have been identified (undeveloped)

- \*\*G5\*\*: Quantitative risk estimates are accurate and below acceptable threshold

- \*\*G9\*\*: State probability distribution used for risk estimation is an accurate representation of expected system states (undeveloped)

- \*\*G10\*\*: Estimated probability of collision is below allowable threshold for severity class major

- \*\*Sn1\*\*: Estimated risk level 0.001 per hour.

- \*\*C1\*\*: Definition of "intolerable"

- \*\*C2\*\*: Assigned severity class is major for the hazard obstacle encounter.

- \*\*A1\*\*: Avoidance logic function required by avoidance maneuver BTD is available.

@End\_Assurance\_case

### Explanation:

- \*\*G1-G10\*\*: Key goals addressing different safety concerns are laid out, detailing how each aspect of the system and its interactions contribute to overall system safety.

- \*\*S1-S4\*\*: Strategies provide structured arguments on how safety is being assured, focusing on risk reduction, tolerability, and risk estimation accuracy.

- \*\*Sn1\*\*: Points to real, quantified risk estimates derived from system analysis.

- \*\*C1-C2\*\*: Contexts clarify definitions and classes essential for understanding the severity and tolerability of hazards in the system.

- \*\*A1\*\*: An assumption states that necessary system functions for hazard control are in place.

This instantiated assurance case represents the application of the pattern with specific and concrete information about the BlueROV2 system, showing how the system integrates multiple safeguards to manage risks associated with underwater operations while meeting safety standards guided by the ALARP principle.