To create the assurance case for the BlueROV2 system using the given pattern, we will follow the outlined steps:

1. \*\*Instantiating the Assurance Case\*\*: Replace the placeholders with BlueROV2 system-specific information.

2. \*\*Removing the Pattern Decorators\*\*: Remove additional assurance case pattern decorators such as (Uninstantiated, Placeholders, Choice, Multiplicity, Optionality, and the combined Undeveloped and Uninstantiated decorator).

3. \*\*Checking the Hierarchy\*\*: Ensure the hierarchical structure is depicted properly.

Here is the instantiated assurance case for the BlueROV2 system in a hierarchical tree format using dashes:

### Instantiated Assurance Case for BlueROV2

1. \*\*Top-Level Goal:\*\*

- \*\*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: Argument that risk posed by any remaining hazards is negligible\*\* \_(Undeveloped)\_

- \*\*S3: Argument that no other risks have been identified\*\* \_(Undeveloped)\_

- \*\*Context: Definition of "intolerable"\*\* \_(C1)\_

- \*\*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 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\*\*

- \*\*Solution: Estimated risk level 10^-3 per hour\*\* \_(Sn1)\_

- \*\*Assumption: Function avoidance logic required by obstacle encounter BTD is available\*\* \_(A1)\_

- \*\*Context: Assigned severity class is Major\*\* \_(C2)\_

### Explanation for Hierarchical Tree:

- \*\*Level 1:\*\*

- \*\*G1\*\* is the top-level goal that claims the assurance case principle.

- \*\*Level 2:\*\*

- \*\*S1\*\* is the strategy to achieve G1.

- \*\*Level 3:\*\*

- \*\*G2\*\* and \*\*G3\*\* are claims supporting S1.

- \*\*Level 4:\*\*

- \*\*G2\*\* is supported by two undeveloped strategies, \*\*S2\*\* and \*\*S3\*\*, and a context \*\*C1\*\*.

- \*\*G3\*\* is supported by strategy \*\*S4\*\* and context \*\*C2\*\*.

- \*\*Level 5:\*\*

- \*\*S4\*\* supports G3 with two sub-goals \*\*G4\*\* and \*\*G5\*\*, and an assumption \*\*A1\*\*.

- \*\*Level 6:\*\*

- \*\*G4\*\* and \*\*G5\*\* support S4.

- \*\*G4\*\* has three undeveloped sub-goals \*\*G6\*\*, \*\*G7\*\*, and \*\*G8\*\*.

- \*\*G5\*\* has two sub-goals \*\*G9\*\* and \*\*G10\*\*.

- \*\*G10\*\* is supported by solution \*\*Sn1\*\*.

This structure provides a clear hierarchy ensuring goals are substantiated through contexts, strategies, assumptions, and evidence.