Based on the provided assurance case pattern and domain-specific information for the BlueROV2 system, we will first instantiate the placeholders and decorators, and then represent the assurance case in a hierarchical tree format using dashes.

### Instantiated 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)

- C1: Definition of "intolerable" (G2 specifies risks that are intolerable as per company XYZ's operational standards)

- G3: Risk from Deviation from the operating area has been reduced as low as reasonably practicable

- G3.1: Risk from Obstacle encounter has been reduced as low as reasonably practicable

- G3.2: Risk from Loss of pipeline has been reduced as low as reasonably practicable

- S4: Apply ReSonAte to estimate level of risk from hazard condition Deviation from the operating area

- G4: Model for BTD describing the Obstacle encounter accurately describes possible propagation of Deviation from operating area

- 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 for Deviation 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 is 0.0001 per hour

- C2: Assigned severity class is Major (Deviation from operating area and Obstacle encounter) and Minor (Loss of pipeline) (uninstantiated)

- A1: Function required by BTD (emergency stop and avoidance maneuver) is available (uninstantiated)

@End\_Assurance\_case

### Hierarchical Tree Representation:

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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)

- C1: Definition of "intolerable"

- G3: Risk from specific hazards has been reduced as low as reasonably practicable

- S4: Apply ReSonAte to estimate level of risk from hazard condition

- G4: BTD accurately describes possible propagation of hazard

- 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)

- C2: Assigned severity class is Major (uninstantiated)

- A1: Function required by BTD is available (uninstantiated)

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

- G9: State probability distribution used for risk estimation is accurate (undeveloped)

- G10: Estimated probability of consequence is below allowable threshold

- Sn1: Estimated risk level (uninstantiated)

```

In this assurance case, the instantiated elements like G2, G3, G4, G5, G10 and strategies like S1 and S4 represent how the BlueROV2's risk factors are managed following the ALARP principle, with references to specific hazards and system functions. Uninstantiated and undeveloped placeholders indicate areas needing further specification or development.