Below is a hierarchical assurance case for the BlueROV2 system derived from the given pattern, with placeholders fully instantiated and the structure properly formatted using dashes to denote different levels:

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- Goal (G1, Hazards for BlueROV2 system addressed in accordance with ALARP principle.)

- Strategy (S1, Argument by risk reduction/elimination of each hazard)

- Goal (G2, No intolerable risks present in the system.)

- IncontextOf (G2, Definition of "intolerable")

- Strategy (S2, Argue that risk posed by any remaining hazards is negligible) - Undeveloped

- Strategy (S3, Argue that no other risks have been identified) - Undeveloped

- Goal (G3, Risk from hazard has been reduced as low as reasonably practicable)

- IncontextOf (G3, Assigned severity class is Hazard.Severity)

- Strategy (S4, Apply ReSonAte to estimate level of risk from hazard condition Obstacle encounter)

- Assumption (A1, Function avoidance logic required by BTD is available)

- Goal (G4, Model BTD accurately describes possible propagation of hazard Obstacle encounter)

- Goal (G6, Possible hazard propagation paths correctly captured in BTD) - Undeveloped

- Goal (G7, Barriers in the BTD correctly describe their respective control action including any required system functions) - Undeveloped

- Goal (G8, All non-negligible threats have been identified) - Undeveloped

- Goal (G5, Quantitative risk estimates are accurate and below acceptable threshold)

- Goal (G9, State probability distribution used for risk estimation is an accurate representation of expected system states) - Undeveloped

- Goal (G10, Estimated probability of collision is below allowable threshold for Major severity class)

- Solution (Sn1, Estimated risk level 10^-3 per hour)

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### Expanded Elements:

1. \*\*Goal (G1, Hazards for BlueROV2 system addressed in accordance with ALARP principle.)\*\*

- Argument encompasses all identified hazards (Deviation from the operating area, Obstacle encounter, and Loss of pipeline).

2. \*\*Goal (G3, Risk from hazard has been reduced as low as reasonably practicable)\*\*

- Addresses each hazard separately, with specific strategies and functional decompositions for obstacle encounters.

3. \*\*Goal (G4, Model BTD accurately describes possible propagation of hazard Obstacle encounter)\*\*

- BTD describes propagation paths and control strategies like Avoidance Maneuver and Emergency Stop.

4. \*\*Goal (G10, Estimated probability of collision is below allowable threshold for Major severity class)\*\*

- Provides a specific estimated risk level from the obstacle encounter hazard.

### Uninstantiated Elements:

- Elements such as C2, A1, G4, S4, and associated solutions had placeholders directly instantiated with relevant system-specific information from the domain description.

### Undeveloped Elements:

- Certain elements such as S2, S3, G6, G7, G8, and G9 were marked as undeveloped, meaning further detail or development is necessary.

This representation ensures that the safety case for the BlueROV2 system is well-structured and covers all aspects of hazard management according to the provided assurance case pattern.