|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Criteria | |  | | Weight | | | Materials | | | | | | | | |
| Frame | Body | | Canister | Gripper | | **Score** | | | | | | | |
| HDPE | Acrylic | Aluminum | | Stainless steel | | 3D printing | |
| 1 | **Transparency** | 0 | 0 | | 0.1 | 0 | | 0 | 10 | 0 | | 0 | | 0 | |
| 2 | **Strength** | 0.1 | 0.4 | | 0.3 | 0.2 | | 6 | 4 | 9 | | 10 | | 6 | |
| 3 | **Cost &Availability** | 0.2 | 0.2 | | 0.3 | 0.4 | | 8 | 6 | 7 | | 5 | | 8 | |
| 4 | **Fabrication(ease)** | 0.5 | 0.3 | | 0.2 | 0.2 | | 9 | 7 | 7 | | 6 | | 8 | |
| 5 | **Ductility** | 0.1 | 0.1 | | 0.1 | 0.1 | | 7 | 3 | 8 | | 6 | | 4 | |
| 6 | **Specific Gravity** | 0.1 | 0 | | 0 | 0.1 | | 9 | 8 | 7 | | 2 | | 8 | |
| Total Score Formula | |  | | | | | | | | | | | | | | **Selected material** |
| Total Score | | Frame | | | | | **8.3** | | 6.5 | | 7.3 | | 4.6 | | 7.4 | **HDPE** |
| Body | | | | | 7.7 | | 5.6 | | **8.1** | | 6.8 | | 7 | **Aluminum** |
| Canister | | | | | 7.1 | | 5.3 | | 6.8 | | 4.7 | | **7.5** | **3D printing** |
| Gripper | | | | | **7.6** | | 5.2 | | 6.8 | | 5.6 | | 7.4 | **HDPE** |

**Material Selection Matrix**

Table () presents the weighted selection criteria per component, where materials are chosen by maximizing the sum of weighted property scores.

**Buoyancy**

The ROV is designed to have positive buoyancy by carefully selecting lightweight materials and ensuring the buoyant force is slightly greater than its weight. Using Archimedes' principle and SolidWorks simulations, we confirmed that the ROV naturally surfaces while maintaining stability. This was achieved by positioning the center of buoyancy above the center of gravity, ensuring smooth and controlled movement in the water.

A transparent object with many parts

AI-generated content may be incorrect.A black and white machine

AI-generated content may be incorrect.

**Figure ():** Buoyancy model in SolidWorks

**Figure ():** Simply stated, if an ROV displaces more water than its own weight, it will float; otherwise, it will sink.

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Mass | 18390.88 grams |
| Volume | 18390882.63 cubic millimeters |
| Center of Buoyancy | X= -0.05, Y = -20.00, Z= -0.10 millimeters |

**Table 1:** Mass properties of water displaced (buoyancy force)

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Mass | 17389.17 grams |
| Volume | 8925547.20 cubic millimeters |
| Center of Gravity | X = 0.03, Y =- 21.53, Z = -7.36millimeters |

**Table 2:** Mass properties of the product and all internal components (weight force)

**Wet weight is calculated as follows:**

The buoyancy analysis determined that the ROV, with a mass of 18,390.88 grams, displaces 17,389.17 grams of water, resulting in a net wet weight of 1,001.71 grams. Since it is positively buoyant, the ROV will float. Therefore, after installing the electrical and other components, the buoyancy was checked again to ensure positive buoyancy was maintained. Based on these values, a flotation system was implemented to provide the ROV with a buoyant force of approximately 45 Newtons.