**Small Group Activity #1: Proving and Selecting a Concept**

**Automated Flying Lifeguard**

**Facts:** The Center for Disease Control reports that about ten people die from unintentional drowning every day. Of these, two are children aged 14 or younger. Drowning ranks fifth among the leading causes of unintentional injury death in the United States (Source: CDC.gov). The risk of drowning increases significantly at beaches where tides and currents work together to form “deadly killers”. Beaches that are unattended by lifeguards pose a risk for even casual waders.

**Description:** You will watch a team of engineers attempt to prototype two different flying lifeguard systems to save swimmers in danger on unguarded beaches. One is an air cannon designed to shoot a “lifesaver” out to a swimmer in distress close to the shore. The other is an autonomous plane that flies over and drops a life preserver to distressed swimmers. Both prototypes are deployed by the push of a button of a GPS transceiver by the swimmer in need of assistance. The goal is to evaluate and select a viable, life-saving prototype that can be marketed and deployed at beaches around the world.

**Objectives:**

* Demonstrate the relationship between the Requirements Definition Phase and the Concept Definition Phase.
* Provide practice in evaluating potential concepts and selecting a winning concept based on a trade-off analysis of relevant characteristics.
* Demonstrate a quantitatively driven process to objectively evaluate concepts.
* Show how the concept definition process is used to validate system requirements.

**Goal:** Your team will select the best concept using evaluation criteria driven by system requirements. Using the provided “Concept Selection Criteria” your team will evaluate the two final concepts using the Evaluation Form and determine which of the two concepts scores the highest and, hence, determine the “go forward” solution.

**Concept Evaluation Criteria:** Use the provided Evaluation Form to score each concept against the “Concept Evaluation Criteria”. Rate each concept against the criteria using a scale of 1-4.

4 = Exceeds Requirements

3 = Meets Requirements

2 = Somewhat meets Requirements

1 = Does Not Meet Requirements

**System Requirements**

SR1: Receive and respond to a GPS signal of a distressed swimmer with a high level of accuracy.

SR2: Be capable of delivering a lifesaving device (e.g., lifesaver or personal flotation device) within ten feet of the distressed swimmer.

SR3: Respond to a distress signal and deploy a lifesaving device within 30 seconds of the swimmer initiating a rescue call.

SR4: System components should be reusable to the greatest extent possible with minimum maintenance effort.

SR5: System should be capable of being quickly implemented on beaches with a limited number of component pieces to reduce downtime caused by weather and a harsh marine environment.

SR6: System should be capable of delivering a lifesaving device to swimmers who are located beyond the surf at 100 yards.

**Concept Evaluation Criteria:** Use the provided Evaluation Form to score each concept against the Concept Evaluation Criteria shown below. Rate each concept against the criteria using a raw score scale from 1 to 4 where:

4 = Exceeds Requirements

3 = Meets Requirements

2 = Somewhat meets Requirements

1 = Does Not Meet Requirements

 **Criteria Category Weight**

Performance 40

Maintainability 10

User Friendliness 10

Ease of Deployment 20

Cost 30

Multiply the raw score (1-4) times the weight when evaluating each concept. For example, a raw score of “4” for performance (“Exceeds Requirements”) is multiplied by 40 to derive a weighted score of 160 for that evaluation criteria.

**Cost Calculation**

Cost is a significant factor in the overall process of determining the best concept. As you watch the video, identify the materials used in the final tested concepts (not including R&D). Once you convene with your group, work together to develop a refined list of necessary items and do your best to estimate the cost of each of these materials. The less expensive concept will receive a higher raw score rating for the “Cost” evaluation criteria, resulting in a higher weighted score for the cheaper concept.

|  |  |  |
| --- | --- | --- |
| **Air Cannon Materials** |  | **Drone Materials** |
| Item | Estimated Cost |  | Item | Estimated Cost |
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**Team Report**

**Preparation:** Using the System Concept Evaluation Form, score each concept.

**Presentation:** Each team’s project manager will present the group’s concept evaluation form discussing the factors that played into how the team scored each evaluation criteria. Provide a rationale to how the winning concept was determined. Be prepared to respond to the questions from the team’s determination and selection.

**Time Limit**:

Exercise Introduction: 7 minutes

Video Presentation: 43 minutes

Team Breakout Discussion: 30 minutes

Class Debrief: 10 minutes

**Lessons Learned:**

* Concept Definition turns ideas into concepts. The Concept Definition is used to validate System Requirements and select the best concept from several possible concepts capable of meeting requirements.
* A System Concept is not a detailed design or a specification. Concept development and evaluation is not a precise science and there are no “right” answers. Concept definition culminates in a System Concept Review (SCR).

**Concept Evaluation Form**

|  |  |  |  |
| --- | --- | --- | --- |
| Evaluation Criteria | CriteriaWeight | Air Cannon | Drone |
|  |  | *Raw Score* | *Weighted Score* | *Raw Score* | *Weighted Score* |
| Performance | 40 |  |  |  |  |
| Maintainability | 10 |  |  |  |  |
| User Friendliness | 10 |  |  |  |  |
| Ease of Deployment | 20 |  |  |  |  |
| Cost | 30 |  |  |  |  |
|  |  |  |  |  |  |
| Totals |  |  |  |  |  |