**Area of Learning: Applied Design, Skills, and Technologies —   
 Remotely Operated Vehicles and Drones Grade 12**

**BIG IDEAS**

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| **Design for the life cycle** includes consideration  of social and  **environmental impacts**. |  | Personal design  interests require  the evaluation and refinement of skills. |  | Tools and **technologies** can  be adapted for  specific purposes. |

**Learning Standards**

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| **Curricular Competencies** | **Content** |
| *Students are expected to be able to do the following:*  Applied Design  Understanding context   * Engage in a period of **user-centred research** and **empathetic observation** to understand design opportunities   Defining   * Establish a point of view for a chosen design opportunity * Identify potential users, intended impacts, and possible unintended negative consequences * Make inferences about premises and **constraints** that define the design space, and develop criteria for success * Determine whether activity is collaborative or self-directed   Ideating   * Identify and examine gaps for potential design improvements and innovations * Critically analyze how competing social, ethical, and sustainability considerations impact creation and development of solutions * Generate ideas to create a range of possibilities and add to others’ ideas in ways that create additional possibilities * Evaluate suitability of possibilities according to success criteria, constraints, and potential gaps, and prioritize for prototyping * Work with users throughout the design process | *Students are expected to know the following:*   * historical background of remotely operated vehicles and recent developments * **uses** of remotely operated vehicles (ROVs), remote control vehicles (RCVs), autonomous underwater vehicles (AUVs), and unmanned aerial vehicles (UAVs, also known as drones) * **factors** affected by terrain for land-based vehicles * **underwater considerations** for ROVs * **principles of flight** * **control surfaces** of an aircraft * ethical, legal, and **regulatory considerations** * tethered control * **navigation** * **propulsion** * **structure, sensors, and attachments** * **radio-controlled (RC)** communication * operational planning from remote locations * programming and coding |

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**Learning Standards (continued)**

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| **Curricular Competencies** | **Content** |
| Prototyping   * Choose an appropriate form, scale, and level of detail for prototyping, and plan procedures * Analyze the design for the life cycle and evaluate its **impacts** * Visualize and construct prototypes, making changes to tools, materials, and procedures  as needed * Record **iterations** of prototyping   Testing   * Identify and communicate with **sources of feedback** * Develop an **appropriate test** of the prototype, conduct the test, and collect  and compile data * Evaluate design according to critiques, testing results, and success criteria to make changes   Making   * Identify appropriate tools, technologies, materials, processes, cost implications,  and time needed * Create design, incorporating feedback from self, others, and results from testing  of the prototype * Use materials in ways that minimize waste   Sharing   * Decide how and with whom to **share** creativity, or share and promote design and processes * Share the product with users and critically evaluate its success * Critically reflect on plans, products and processes, and identify new design goals * Evaluate new possibilities for plans, products and processes, including how they or others might build on them   Applied Skills   * Apply safety procedures for themselves, co-workers, and users in both physical  and digital environments * Individually or collaboratively identify and assess skills needed for design interests | * **emerging technologies** * design for the life cycle * future career options and opportunities in UAV design, production, and emerging applications * **interpersonal and consultation skills**  for interacting with colleagues and clients |

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**Learning Standards (continued)**

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| **Curricular Competencies** | **Content** |
| * Demonstrate competency and proficiency in skills at various levels involving manual dexterity and complex mechanical, electrical, and electronic problems * Develop specific plans to learn or refine identified skills over time   Applied Technologies   * Explore existing, new, and emerging tools, technologies, and systems to evaluate suitability for design interests * Evaluate impacts, including unintended negative consequences, of choices made about technology use * Analyze the role that changing technologies play pertaining to land, water, or air vehicles |  |