**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 DesignUnderstanding 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
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