Robot Drone League (RDL) × Pennsylvania STEM Standards (Science, Technology & Engineering, Environmental Literacy & Sustainability (STEELS), ITEEA STEL, NGSS Engineering, Framework for P–12 Engineering Learning, CSTA Computer Science Standards, K–12 Cybersecurity Standards) — Alignment Guide for Educators and Program Leads

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Overview

The Robot Drone League (RDL) immerses students and educators in robotics, drones, electronics, advanced manufacturing, computer science, and cybersecurity through hands-on labs and integrated STEM learning. This alignment connects the **Pennsylvania Department of Education Science, Technology & Engineering, Environmental Literacy & Sustainability (STEELS) Standards** for grades 9–12, **ITEEA Standards for Technological and Engineering Literacy (STEL)**, **Framework for P–12 Engineering Learning: Engineering Literacy Expectations for High School Learners**, **CSTA Computer Science Standards (Grades 9–12)**, **K–12 Cybersecurity Learning Standards**, and **Next Generation Science Standards (NGSS) HS Engineering Design** to the **Robot Drone League (RDL) Challenge and Curriculum**.

The Pennsylvania STEELS standards can be found at: https://www.pdesas.org/Page/Viewer/ViewPage/58/?SectionPageItemId=12998. The ITEEA STEL benchmarks: https://www.iteea.org/stel. NGSS Engineering Design standards: https://www.nextgenscience.org/topic-arrangement/hsengineering-design. CSTA Computer Science Standards: https://csteachers.org/Page/standards. Framework for P–12 Engineering Learning: https://p12framework.asee.org/. K–12 Cybersecurity Standards: https://cyber.org/standards.

Standards Crosswalk

Abbrev: Std = Standard; Skills = Key skills from PA STEELS/ITEEA/Framework for P–12/NGSS/CSTA/Cybersecurity frameworks; RDL Sections = related manual content; Evidence = artifacts for verification.

Safety & Health

PA STEELS Safety / ITEEA STEL 1 / NGSS HS-ETS1-2 / Framework for P–12 Safety Practices
Skills: PPE, ESD precautions, tool safety, hazard ID, ergonomic setup, online safety.
RDL Sections: Safety briefings; Design & Safety Requirements; ESD in wiring labs; Flight safety.
Evidence: Safety logs; ESD mat use; inspection checklists; ergonomic workspace plans.

Electronics & Circuitry

PA STEELS Electrical Systems / ITEEA STEL 4 / NGSS HS-ETS1-3 / Framework for P–12 Applying Technical Knowledge
Skills: Component ID, schematics, DC/AC theory, analog/digital electronics, soldering, troubleshooting.
RDL Sections: ECP layout; crimping; continuity checks; Arduino integration.
Evidence: Wiring diagrams; assembled PCBs; oscilloscope captures; code linked to hardware.

Robotics & Mechanical Systems

PA STEELS Mechanical Systems / ITEEA STEL 7 / NGSS HS-ETS1-2 / Framework for P–12 Systems and Optimization
Skills: Chassis assembly, drivetrain design, manipulator build, autonomous/teleop control, design optimization.
RDL Sections: goBILDA chassis build; claw; Arduino drive code; scrimmage operations.
Evidence: Build photos; gear ratio calcs; code with comments.

Advanced Manufacturing

PA STEELS Manufacturing / ITEEA STEL 8 / NGSS HS-ETS1-1 / Framework for P–12 Design and Production
Skills: Blueprint reading, CAD modeling, CAM/CNC programming, machining, quality measurement.
RDL Sections: CAD review; Onshape parts; precision measurement of parts; additive manufacturing of drone/robot components.
Evidence: CAD exports; G-code; tolerance measurement logs.

Computer Science Integration

PA STEELS Systems / ITEEA STEL 3 / NGSS HS-ETS1-4 / Framework for P–12 Computational Thinking in Engineering / CSTA 9–12
Skills: Device selection, troubleshooting, network basics, computational thinking, programming, modeling/simulation, data visualization, collaboration, ethics in computing, algorithm design, abstraction, data analysis.
RDL Sections: Arduino/FTW programming; autonomous mission simulation; data logging; networked controller setup; safe online collaboration.
Evidence: Pseudocode; algorithm diagrams; data visualizations; troubleshooting logs; code repositories.

Cybersecurity

K–12 Cybersecurity Standards / CSTA / PA STEELS Digital Literacy
Skills: Cyber hygiene, password management, network security basics, identifying threats, understanding encryption, safe digital collaboration, risk assessment, secure coding practices, threat modeling, incident response.
RDL Sections: Secure programming practices; controller network security setup; data transmission protocols; implementing authentication and authorization; cybersecurity awareness in team projects.
Evidence: Security configuration logs; incident response simulations; encryption demonstration; cybersecurity awareness checklists; secure coding reviews.

Credential Pathways

- **OSHA-10 General Industry**
- **ETA Basic Systems Technician (BST)**
- **NC3 Electricity Introduction & Precision Measurement Instruments**
- **MACWIC Level 1**, **NIMS Machining Level 1**
- **FAA Airframe/A&P**

Evidence Checklist

- Safety logs; PPE and ESD compliance
- CAD screenshots; wiring diagrams; CAM/G-code files
- Breadboard/PCB builds; soldering samples
- Arduino and FTW code with documentation
- Flight logs; inspection sheets; data visualizations
- Cybersecurity audit logs; secure configuration files