**Rocketry Curriculum**

#### Overview

This curriculum spans 6 weeks in total, with 2 days per week, 2 hours per day. The program focuses on introducing middle schoolers to the fundamentals of rocketry, including physics, aerodynamics, and engineering principles, and is also partly designed to be a simulation of being a team member in TARC.

**Day 1: Introduction to Rocketry**

* Overview of rocketry:
  + History of rockets and space exploration.
* Basic rocket components:
  + Body tubes, fins, nose cone, engine, altimeter
  + Discussion of how each component contributes to flight.
  + Science behind the altimeter
* Start building beginner rockets
  + How to use epoxy
  + Making motor mounts and attaching shock cord
  + Cutting fin slots in tubes

**Day 2: Computer Aided Design (CAD)/OnShape for 3D printing (July 21)**

* How to use CAD:
  + Optimal CAD workflow
  + Basic ways of designing a component
* Design beginner rockets in CAD
  + Nose cone, fins, transition
  + All components will be 3D printed
* Continue building beginner rockets
  + Attach launch lugs
  + Tying parachute to shock cord
  + Using cyanoacrylate glue to reinforce body tubes
  + How to attach igniters

**Day 3: Basic Physics of Rocketry (July 27)**

* Newton’s laws of motion:
  + Explanation and examples of each law.
  + Application to rocket flight.
* Rocketry terminology
  + CP, CG, Apogee, Thrust Curve, etc.
  + Thrust, drag, lift, and weight.
* How these forces interact during launch and flight
* Continue building beginner rockets

**Day 4: Launch Day (July 28)**

* Launch their beginner rockets at launch site
* Feedback session
* Discuss future action items/ideas to improve design

**Day 5: Motors + OpenRocket (August 3)**

* Rocket motors lesson
  + Hobbyist motor nomenclature
  + Science behind how a motor works
  + Solid vs liquid propulsion
  + Core burning vs end burning
* OpenRocket lesson
  + Comprehensive overview on OpenRocket’s capabilities
  + Compete for the best OpenRocket design
* Start building low-power rocket

**Day 6: Advanced Rocket Construction August 4)**

* Model rockets vs NASA rockets
* How to paint a rocket
* Designing jigs to aid construction
* Design considerations for parachute packing
  + Parachute packing
  + Nomex vs dog barf
* Continue building low-power rocket

**Day 7: Build Day (August 10)**

* Brief introduction to computational fluid dynamics and other more advanced rocketry simulations
* Materials to bring to a launch
* Finalize low-power rocket construction
* Prepare for launch day

**Day 8: Launch Day (August 11)**

* Launch low power rockets
* Feedback session
* Future action items and discuss TARC simulation

**TARC SIMULATION PREPARATION FOR FINAL LAUNCH:**

**Day 9: TARC Simulation DAY 1**

* Design a TARC Rocket on OpenRocket
* Review our TARC guidelines and competition rules
* Start building final rocket
* Design 3D printed parts

**Day 10: TARC Simulation DAY 2**

* Continue building final rocket
* Hand back 3D printed parts

**Day 11: TARC Simulation DAY 3**

* Hand back 3D printed parts (improved)
* Finish building final rocket
* Write a 1-page report summary on what they learned.

**Day 12: TARC Simulation Grand Finale**

* Launch all rockets
* Score each launch
* Celebrate with parents

**TARC Sim Criteria:**

* Target altitude: 800 FT
* Time: 39 - 43 seconds
* Mass: 650 g
* One egg (enclosed in an egg casing)
* Both pieces should come down together, attached and held together by a shock cord.
* Altimeter must be beeping when the rocket is retrieved.
* No flight computer or pyrotechnics (other than the motor) may be used.
* Students can choose which motor.