**Build an Aluminum Whistle**

# Description

In this activity plan the students will further develop their machining and metalworking skills by fabricating a two-piece aluminum whistle. The project will cover basic lathe operations, layout procedures, drill press operations, and a polished finish process.

# Lesson Objectives

The student will be able to:

* Use a machine lathe to form, tool cut, face off, centre-drill, bore, ream, knurl, file, and sand aluminum in a scrolling 3-jaw chuck
* Lay out hole locations for drilling
* Use a drill press with a drill press vise to pilot drill and bore to a given nominal size
* Cut stock aluminum longitudinally in a bench vise and cross cut in a vise
* Use a vise to press-fit parts together
* File, sand, and buff the whistle to a polished finish

# Assumptions

The student will already know:

* Hand tool safety
* Measurement
* Basic layout techniques
* Names and usages of layout and hand tools



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# Terminology

**Knurl**: small ridges or bumps on a metal surface to help grip the object. Also used to describe the act of cutting knurls.

**Peck cycle drilling**: a method of drilling in which the bit is periodically retracted a short distance to clear chips from its flutes.

**Reamer**: a rotary cutting tool used to enlarge a previously cut hole to a high precision.

# Estimated Time

* 1. 5 hours

# Recommended Number of Students

20, based on the *BC Technology Educators’ Best Practices Guide*

# Facilities

Metal shop as per the *BC Technology Educators’ Best Practices Guide*

# Tools and Equipment

* + - Drill bits: bell end centre drills, 5⁄16" body, ⅛" tip
    - HSS twist drills: ⅛", ¼", 11⁄32"
* 3⁄8" chucking reamer
* HSS blank to grind forming tool
* Layout tools, including height gauge, centre punch, scribe, dividers, layout dye, layout hammer
* Hacksaw
* Bench vise
* Flat file and mill file
* De-burring tool
* Drill press
* Machine lathe with knurling head and custom HSS forming tool, LH tool holder/bit
* Belt machine with 60 g and 220 g belts
* Buffing machine and black or brown buffing compound

# Materials

Note: Materials are sourced in SAE dimensions for ease and economy.

* Body: ½" diameter 6061 T6 aluminum or similar alloy, 75 mm (3") long piece per whistle
* Fipple (reed): 3⁄8" diameter 6061 T6 aluminum or similar alloy, 18 mm (¾") long piece per whistle

# Teacher-Led Activity

## Whistle Body

1. Cut body to 75 mm length using hacksaw or band saw.



1. Form one end round in lathe using HSS forming tool.



1. Centre-drill end opposite ball end.



Then peck cycle drill 11⁄32" x 50 mm (2") deep @ approx. 1200 rpm.



1. Ream 3⁄8" × 25 mm (1") deep @ approx. 300 rpm.



1. Knurl using medium or fine wheels approx. 25 mm along body from ball end.



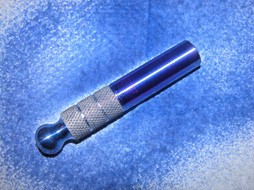
1. Cut three grooves in knurl at even intervals.



1. File (use lathe file), then sand (320 g) non-knurled section of body.



1. Lay out for holes: Spray with layout dye.



Establish centre line.



Mark off heights 18 mm from flat end and 6–7 mm from ball end.



1. Centre-punch at the two scribe intersections.



1. Drill ⅛" pilot holes.



1. Drill ball end ¼" through ball and 11⁄32" through top side of body only.



## Reed/Fipple

1. Lay out dye ⅛" aluminum stock material and mark at 18 mm. Hold in vise and hacksaw angularly from ½ to ¾ of its diameter over an 18 mm length, removing a wedge-shaped piece.



1. File smooth and flat. Cut off to length. File thicker end smooth with sharp edge and then slightly chamfer end.







## Assembly

* 1. Ensure that all holes in whistle body have been de-burred inside and out. Using a bench vise, press-fit thick end of fipple into body as far as edge of tone hole. Fipple is perpendicular to the drilled hole.







## Finishing

1. Belt grind or file fipple flush with end and then taper end at about 45 degrees parallel with the flat of the fipple.

1. De-burr fipple end and lightly chamfer outer edges. Slightly grind ball end flat at hole ends and de-burr hole.



1. Buff all areas of body to high lustre except knurled section. Clean with toothbrush and solvent then with soapy hot water. Pat dry.

## Finished whistle

# Evaluation

Consider co-creating the evaluation criteria with your students at the beginning of the activity/ project. You may want to include the following:

* + Overall size and shape
  + Hole placement, sizing, and alignment
  + Formed end size/shape
  + Knurl quality
  + Groove spacing and depth
  + Fipple alignment, shape, finish quality
  + Prefinish: filing and sanding, removal of all tool marks
  + Buffing: all sanding marks removed; even lustre