# Hulusi — Print Packet

*Shop-floor reference for the wooden cucurbit free-reed flute family — F-key prototype 1, Bb / C / D / G family scaling.*

---

*Print this and take it to the bench. It bundles the design table summary, BOM, cut list, and tuning loop into one shop-friendly document.*

| | |
|---|---|
| Build packet ID: | HUL-001 · v4.1 instrument-maker scaffold |
| Source workbook: | hulusi-design-table.xlsx (Master_Inputs sheet) |
| Default key: | F (key_midi = 65; tonic = 349.23 Hz; all-closed = F4) |
| First prototype: | HUL-P0 reed coupon → HUL-P1 melody pipe → HUL-P2 full F-key |
| Generated: | 2026-05-05 |
| License: | MIT — github.com/tonykoop/hulusi |

*If any value in section 1 changes, re-print this sheet — every length downstream depends on it.*

# 1. Master_Inputs (set before any cutting)

| Variable | Default | Yours |
|---|---|---|
| key_midi | 65 (F4) | _____ |
| mel_bore_ID | 0.500 in | _____ |
| mel_hole_dia | 0.275 in | _____ |
| dr1_target_offset | +7 (5th) | _____ |
| dr2_target_offset | +12 (oct) | _____ |
| reed_thickness | 0.008 in | _____ |
| reed_tongue_w | 0.157 in | _____ |
| pull_down_cents | –30 ¢ | _____ |
| correction_pct | 0 % | _____ |
| c_speed | 13,552 in/s | _____ |
| A4_ref | 440 Hz | _____ |

# 2. Cut targets (F-key default — re-derive from *Pipes* sheet for other keys)

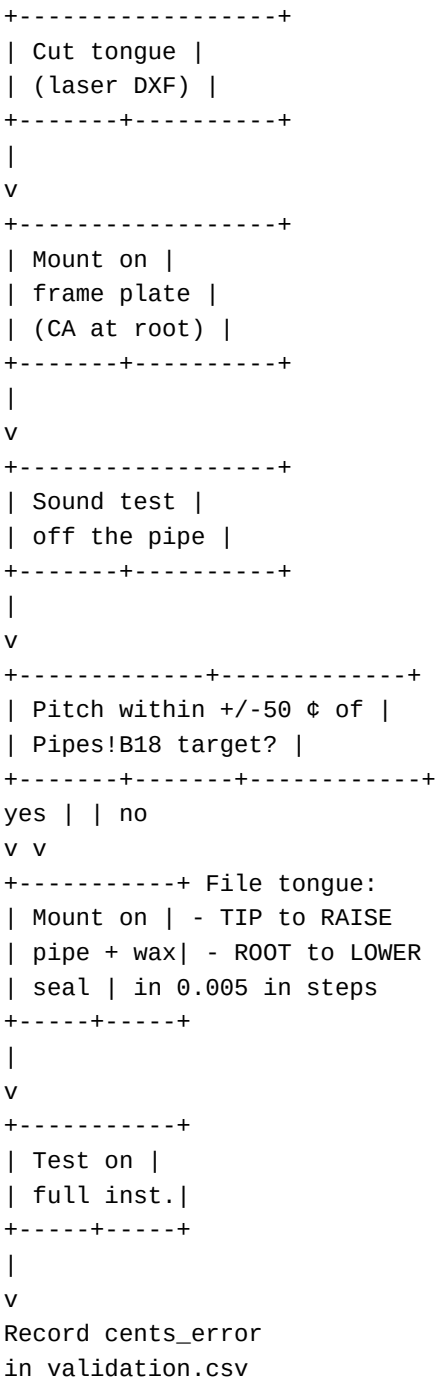
| Part | Length | Bore | Notes |
|---|---|---|---|
| Melody tube | 10.05 in | 0.500 in | + reed_pad already included |
| Drone 1 (5th) | 6.82 in | 0.500 in | fixed pitch, no holes |
| Drone 2 (oct) | 5.20 in | 0.500 in | leave foot for wax plug |
| Reed tongue mel | 0.798 in | — | 0.157 W × 0.008 T brass |
| Reed tongue dr1 | 0.652 in | — | 0.157 W × 0.008 T brass |
| Reed tongue dr2 | 0.564 in | — | 0.157 W × 0.008 T brass |
| Reed slot opening | 0.163 in × tongue_L+0.040 | | tongue + 0.003 / side clearance |

# 3. Finger-hole positions (F-key, from foot)

| Hole | Note | Frequency | Distance from foot |
|---|---|---|---|
| 1 (low front) | G4 | 392.0 Hz | 8.51 in |
| 2 | A4 | 440.0 Hz | 7.58 in |
| 3 | A#4 | 466.2 Hz | 7.16 in |
| 4 | C5 | 523.3 Hz | 6.38 in |
| 5 | D5 | 587.3 Hz | 5.68 in |
| 6 | E5 | 659.3 Hz | 5.06 in |
| 7 (thumb back) | F5 (octave) | 698.5 Hz | 4.78 in |

**Drill undersize first** (0.250 in pilot). Ream to 0.275 in only after the acoustic test confirms the hole position is right.

## 4. Reed cutting + voicing loop




## 5. BOM checklist (one F-key build)

| | | |
|---|---|---|
| [ ] | HUL-BOM-001 | Walnut gourd blank, 5 in × 8 in |
| [ ] | HUL-BOM-002 | Pakkawood melody tube, 1 in OD × 18 in |
| [ ] | HUL-BOM-003 | Pakkawood drone 1 tube, 1 in OD × 14 in |
| [ ] | HUL-BOM-004 | Pakkawood drone 2 tube, 1 in OD × 10 in |

| | | |
|---|---|---|
| [ ] | HUL-BOM-005 | Brass shim 0.008 in × 6 in × 12 in |
| [ ] | HUL-BOM-006 | Brass plate 0.040 in (frame plates × 3) |
| [ ] | HUL-BOM-007 | Beeswax (food grade) |
| [ ] | HUL-BOM-008 | Pine rosin |
| [ ] | HUL-BOM-009 | Boxwood / horn mouthpiece blank |
| [ ] | HUL-BOM-010 | Tassel (optional cosmetic) |
| [ ] | HUL-BOM-011 | Brass binding ring (optional) |
| [ ] | HUL-BOM-012 | Reed file set |
| [ ] | HUL-BOM-013 | Tuner (smartphone Cleartune OK) |
| [ ] | HUL-BOM-014 | CA glue + accelerator |
| [ ] | HUL-BOM-015 | Brad-point drill set (need 7 mm or letter-N for 0.275 in) |

## 6. Family quick reference (other keys)

| Model | Key | Tonic | Mel L | Dr1 L | Dr2 L | Reed L mel |
|---|---|---|---|---|---|---|
| HUL-Bb | Bb | 175 Hz | 14.89 in | 10.05 in | 7.62 in | 0.977 in |
| HUL-C | C | 196 Hz | 13.30 in | 8.99 in | 6.82 in | 0.922 in |
| HUL-D | D | 220 Hz | 11.89 in | 8.05 in | 6.12 in | 0.871 in |
| HUL-F * | F | 262 Hz | 10.05 in | 6.82 in | 5.20 in | 0.798 in |
| HUL-G | G | 294 Hz | 8.99 in | 6.12 in | 4.67 in | 0.753 in |

** = standard; full data in family-spec.csv. Set key_midi in Master_Inputs and the Family sheet recomputes.*

## 7. Tuning fast-reference

| Symptom | Likely cause | Fix |
|---|---|---|
| Reed silent | Tongue jammed in slot | File slot or tongue 0.001 in larger |
| Reed warbles | Tongue too tight in slot | Same — clearance issue |
| Reed pitch off 20–50 ¢ | Tongue length wrong | File TIP raise / ROOT lower |
| Pipe doesn't speak | Air leak at gourd-pipe joint | Re-wax + rosin |
| All 7 holes flat by similar ¢ | Pipe too long globally | Set correction_pct positive next build |
| One hole sharp/flat (others OK) | Hole position error | Ream that hole or wax-fill |
| Drones overpower melody | Drone reed too thin | Sub thicker shim or partly block drone foot |
| Pitch drifts overnight | Wax seal unstable | Re-melt wax with higher rosin % |

## 8. Top-3 risks — verify these first

| # | Risk | Test |
|---|---|---|
| A1 | Reed pull-down assumption (–30¢) | HUL-P0: cut 3 reeds, sound off-pipe, fit pull_down_cents. |
| S1 | Pakkawood splits during boring | First bore at 2 in/min, peck 0.25 in. Look for heat/gum/split. |
| S3 | Gourd glue-line failure | Pressure-vacuum test at 30 / 60 / 90 days post-glue. |

*Full risk register (18 entries × 5 categories) at risks.md.*

## 9. Validation log (write here, transcribe to validation.csv after)

| Build | Pipe | Cond | Target | Measured | ¢ err | Action |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

## 10. Notes / shop log

## File map (where to find more detail)

| File | Contents |
|---|---|
| README.md | Project overview + family table + status. |
| design.md | Stopped-pipe + free-reed physics + cultural lineage. |
| hulusi-design-table.xlsx | Master_Inputs + 6 derived sheets (33 named globals). |
| bom.csv / sourcing.csv | Bill of materials + supplier candidates. |
| cut-list.csv | 12 cuts including family scaling row. |
| validation.csv | Target/measured/cents-error log scaffolded for HUL-P0..P3. |
| assembly-manual.md | 14-step shop sequence + failure modes. |
| risks.md | 18 tracked risks × 5 categories + verification tests. |
| family-spec.csv | Per-key dimensions for B■ / C / D / F / G. |
| photo-shotlist.md | 14 build-log photo shots. |
| drawings/hulusi-{Bb,C,D,F,G}.svg | Per-family-member dimensioned drawings. |
| drawings/reed-detail.svg | Reed slot + tongue + frame plate (4×). |
| cad/hulusi_master.scad | Parametric OpenSCAD master. |
| cad/hulusi-design-table.txt | SolidWorks global-var parity reference. |
| wolfram-starter.wl | Physics sanity-check notebook. |
| site/index.html | Build-log static site (recruiter-facing). |
| capstone-deck.pptx | 12-slide capstone deck. |