Notes for Lathe Training

1 Safety

- Usual machinery rules apply – long hair, loose clothes etc
- PPE –
    - Safety glasses required
    - Hearing protection generally a bad idea – interferes with hearing what the machine is doing – but good for comfort if you have heavy cuts, chatter etc
    - Gloves – not for operation (risk of entanglement) but might be good for handling burred parts and clearing swarf
    - Footwear – good shoes or trainers required (e.g. no sandals)
- Biggest risks specific to the lathe:
    - Work flying out of the chuck - good secure work holding is essential
    - Entanglement – be careful of fingers, sleeves etc
    - The chuck key being left in – NEVER LEAVE THE CHUCK KEY IN (if lathe is turned on, it will be catapulted across the room)
- Safety features of the machine
    - Chuck guard – should be down whenever possible
    - Emergency stop button – press to activate, turn clockwise to spring out and reset

2 Machine Setup

- How to turn on the machine
    - Remove cover
    - Turn on DRO (little black switch behind) and lamp (little red switch on top)
    - Press the green button on the front of the headstock, the light should switch from the ref to the green button
- If the lathe doesn't power up, check the red isolator switch on the rear of the lathe, or check that the emergency stop button has not been activated (Although it's not the current recommendation, some members still turn these off when they finish using the lathe)

3 Workholding

- 3-jaw chuck only in basic training – easy to use and good all a rounder, but not always concentric
- Demonstrate holding a test bar
- Importance of stickout – as little as possible
- Explain tail support for flexible parts
- Briefly explain a few other methods that can be covered in specific training if needed
    - Collet chuck for more accurate holding of small parts
    - 4-jaw chuck for square parts, ultimate accuracy, or other fancy tricks
    - Faceplates if you have to do something really weird

- Between centres turning for ultimate accuracy and repeatability

4 Introductory Turning Work

- Types of tooling available (LHS carbide vs home ground HSS), different shapes
- Specifically introduce the hackspace carbide insert turning tool, best for facing and turning up to shoulders
- How to set a tool in the holder
- Introduction to main slide, cross slide, compound
- Mention power feed and why it's useful – but it will require subsequent extra training
  - Cover how to make sure it's off though
- Toolpost angles – how to set square
- How and when to use coolant
- Feeds and speeds
  - Not all that crucial to get right, especially if you are starting out, but good to know where to start
  - I personally use this table as my starting point:

GUIDELINE SURFACE SPEEDS FOR TURNING (m/min)			
MATERIAL	HSS	CARBIDE	PARTING/ FORM
FREE MACHINING STEEL	30 - 102	244 - 305	11 - 36
MILD STEEL	30 - 82	213 - 275	11 - 29
ALLOY/ TOOL STEEL	18 - 45	183 - 244	6 - 16
STAINLESS	30 - 55	73 - 91	11 - 19
CAST IRON	46 - 61	91 - 152	16 - 21
ALUMINIUM	122 - 213	244 - 366	43 - 75
BRASS	30 - 200	244 - 366	11 - 70
COPPER & BRONZE	15 - 70	130 - 195	5 - 25
PLASTICS	73 - 85	128 - 149	26 - 30

$$\text{Spindle Speed (rpm)} = \frac{318.3 \times \text{Surface Speed (m/min)}}{\text{Diameter (mm)}}$$

  - That said, I typically cap my speed at about 1000 rpm (second speed range on the machine turned all the way up), ignoring it if the calculated speed is higher than this
- Introduce a facing cut, get inductee to have a go
- Introduce a turning cut, get inductee to have a go

5 Introductory Tailstock Work

- Two main uses as far as we are concerned – as a tail support, and for drilling the ends
- Explain how to slide into position and lock off
- Explain how to extend and retract the barrel and hold tools
- Explain how to use a centre drill to give an accurate centre
- Demonstrate centre drilling and finishing up with a full size drill
- Speeds aren't critical but here's a guideline table:

GUIDELINE RPM FOR DRILLING												
mm:	≤ 2	≤ 4	≤ 6	≤ 8	≤ 10	≤ 12	≤ 14	≤ 16	≤ 18	≤ 20	≤ 22	≤ 24
in:	≤ 0.08	≤ 0.16	≤ 0.24	≤ 0.32	≤ 0.40	≤ 0.48	≤ 0.56	≤ 0.64	≤ 0.72	≤ 0.80	≤ 0.88	≤ 0.96
ALUMINIUM, PLASTICS	4000	4000	4000	3100	2300	1900	1600	1400	1250	1070	1000	900
BRASS, FREECUTTING STEEL	3400	3400	2500	1900	1450	1250	1050	900	800	700	640	560
BRONZE, GREY IRON, MILD STEEL	4600	2500	1700	1260	1000	800	700	600	540	480	420	400
TOOL STEEL, STAINLESS	3600	1700	1150	880	660	550	480	420	300	380	350	200
HARD CAST IRON	1800	1000	650	500	400	330	280	240	220	200	180	160

6 Measuring Progress & the DRO

- Explain the X and Z axes (compound does not have one)
- Explain how to set a Z-zero
  - Basic method by touching off is OK
  - If possible try to face off at the new zero point for maximum accuracy
- Explain how to set an X-zero
  - Touching off via piece of paper is quite inaccurate but might be fine
  - Turning a short length, measuring, and offsetting via 'X pre' button is best

7 Practice Time

- Give the trainee some time to practice on their own
- Have a sample part for them to practice on if possible
- Be around to answer any questions

8 Parting Off

- Expansion topic if they are comfortable and have time left
- Useful technique for cutting off a part but can be risky
- Slow rpm and slow hand feed are essential, with good lubrication
- Vital to set the blade square to the work
- Practice parting off the part made so far

9 Lathe Shutdown

- Restore 3-jaw chuck, double check chuck key is not in it, and remove any work from the chuck
- Disengage Thread Dial (if used)
- Remove Card from ACNode
- Turn off DRO and Lamp
- Remove any custom tools from their holders, put them away
- Check all tools are in place on headstock board
- Clean away chips – brush down loose ones, hoover, wipe down
- Oil the ways – pull slider on carriage then manually transfer some with the paintbrush
- Cover with cloth

10 Expansion Topics for Future Training

- Changing chucks/ plates/ centres
- Clocking in
- Boring
- Reamers
- Power feed
- Single-point threading

11 Revision Information

No	Date	Revision Description
r01	2022-03-12	First Release
r02	2022-04-22	General Improvements
r03	2022-06-23	Document re-numbered (was previously 21012-G001) Additional info added