

# Your Soldering is Terrible (probably)

*or*

“How I learned to stop worrying and love flux”

Paul Pounds

28 March 2016

University of Queensland

---

# But first...

---

Some house keeping

# Calendar at a glance

Week	Dates	Lecture	Reviews	Demos	Assessment submissions
1	28/2 – 3/3	Introduction			
2	6/3 – 10/3	Principles of Mechatronic Systems design			Problem analysis
3	13/3 – 17/3	Professional Engineering Topics			
4	20/3 – 24/3	Introduction to Practical PCB Design	Progress review 1		
5	27/3 – 31/4	Your soldering is (probably) terrible			
6	3/4 – 7/4				
7	10/4 – 14/4		Progress seminar	25% demo	
<b>Break</b>	17/4 – 21/4				
8	24/4 – 28/4				
9	1/5 – 5/5			50% demo	
10	8/5 – 12/5		Progress review		
11	15/5 – 19/5			75% demo	Preliminary report
12	22/5 – 26/5				
13	29/5 – 2/6	Closing lecture		Final testing	Final report and reflection

You are here →

---

# Meditations on progress reviews

---

- Most people got the message loud and clear
  - But not everyone
  - If missed it: GET STARTED OMG!
- PAFs
  - Mostly people were pretty balance
  - Some of you were caustic – yikes!
  - No need to be crazy fine-grained – eg. 10.75...

---

# Incremental demos coming up

---

- Lots of people are super keen to be testing!
  - Great! 😊
- Hopefully we'll be ready to start working outside with the tank soon!
- Start thinking about whether you want to demo or not in week 7

---

# Hey, about that tank...

---

- Grant Tayles, the guy who was making our tank was involved in a motorcycle accident and suffered substantial injuries
  - He is no longer making our tank for us
  - Get well soon, Grant!
  - Expect some delay – hopefully before wk 7, tho!
- Ian Daniels is taking over
  - Ie. the guy working on the submarine...

---

# Hey, about that submarine...

---

- “Test” versions of the sub are almost done
  - Just waiting on final assembly and a bit of paint
  - Should be ready in a week, tops.
- The transparent model submarine will be available for you to play with in the interim
  - It’s fragile! The tutors will bring it to the room during prac slots, and take it back at the end

---

# Hey, about that water...

---

- We have arranged to get a shallow tub and a specially calibrated “bucket” in the lab
  - The bucket shall contain water equivalent in visibility to that which will fill the testing tank
- The water contains food colouring – do not spill it on yourself, the floor, or anything
  - I am trusting you here
  - Report any spills to me ASAP



---

# Hey, about that ocean floor...

---

- At the bottom of the bucket there shall be a sample of the ocean floor
  - Same make-up of pebbles, colours, depth, etc
- Later in the semester, I'll add some rocks

---

# FAQ Roundup

---

- **None as yet**
  - But yes, I'll get a FAQ compendium up as soon as I get the time...

---

# Back to business...

---

Soldering ahoy!

---

# Notes on safety

---

- Soldering is generally a low-risk activity, with the following exceptions:
  - Minor to moderate to severe burns
  - Cuts, punctures and lacerations
  - Electrocution
  - Lead poisoning, other chemical poisoning
  - Partial loss of eyesight, total loss of eyesight

**... so nothing to worry about, right?**

---

# Helpful safety tips

---

Zeroth rule of soldering:

- “Mind where you stick the hot pointy end”
  - Take note of people around you when working
  - Return the iron to its cradle when not soldering
  - If you drop it, don’t try to catch it!

---

# Helpful safety tips

---

First rule of soldering:

- Always assume a soldering iron is hot!
  - NEVER pick it up by the wrong end
  - A soldering iron will remain hot for a while after use, even when unplugged
  - Things heated by a soldering iron are also hot

---

# Helpful safety tips

---

- Treat a hot-air gun or hot-air reflow soldering station like a tiny lightsabre
  - Invisible beam of destruction 30 cm from tip
  - Nozzles also get extremely hot! ( $>500^{\circ}\text{C}$ )
- Fumes are less good for you than they smell
  - They cannot get you high (I can confirm this)
  - Work in a well-ventilated area
  - Use the extractor if you have it

---

# Helpful safety tips

---

- Wash hands before eating
  - ... no matter how good the lead tastes
  - Lead is toxic: acceptable exposure level is small
  - Use ROHS solder and materials where possible
- Use and dispose of chemicals responsibly
  - Don't just flush PCB washing chemicals
  - Be *extremely* careful of etching chemicals
  - Do not eat the flux (tastes terrible)



---

# Helpful safety tips

---

- Don't solder on flammable surfaces (duh)
  - Ceramic tiles make excellent surfaces!
  - \$1.50 worth of Not-Burning-Your-House-Down
- Keep flammable liquids and heat separated
  - Methylated spirits, kerosene, turpentine etc.
- Turn off circuit power before working on it
  - Pay particular attention to Lipo cells
  - Solder one lead at a time (insulate the other)

---

# Helpful safety tips

---

Wear eye protection. Always.

It might only matter once in your career,  
but you'll be grateful you did

---

# Warning

---

“Do not attempt to solder  
with remaining eye.”

*Always wear eye protection*

---

# Principles of soldering

---

- Soldering is the process of joining two metal surfaces with a fusible metal

Heat both surfaces simultaneously and then introduce solder to the joint

**Don't apply solder to iron first and *then* to joint**

- Clean surfaces, enough heat, enough flux
  - Quick zap and out

---

# Helpful soldering tips

---

- Solder flux is the universe's gift to you

It is highly likely that—

- You need to use less solder
- You need to use less heat
- You need to use more flux

*The solder must flow*

---

# How to identify a good joint

---

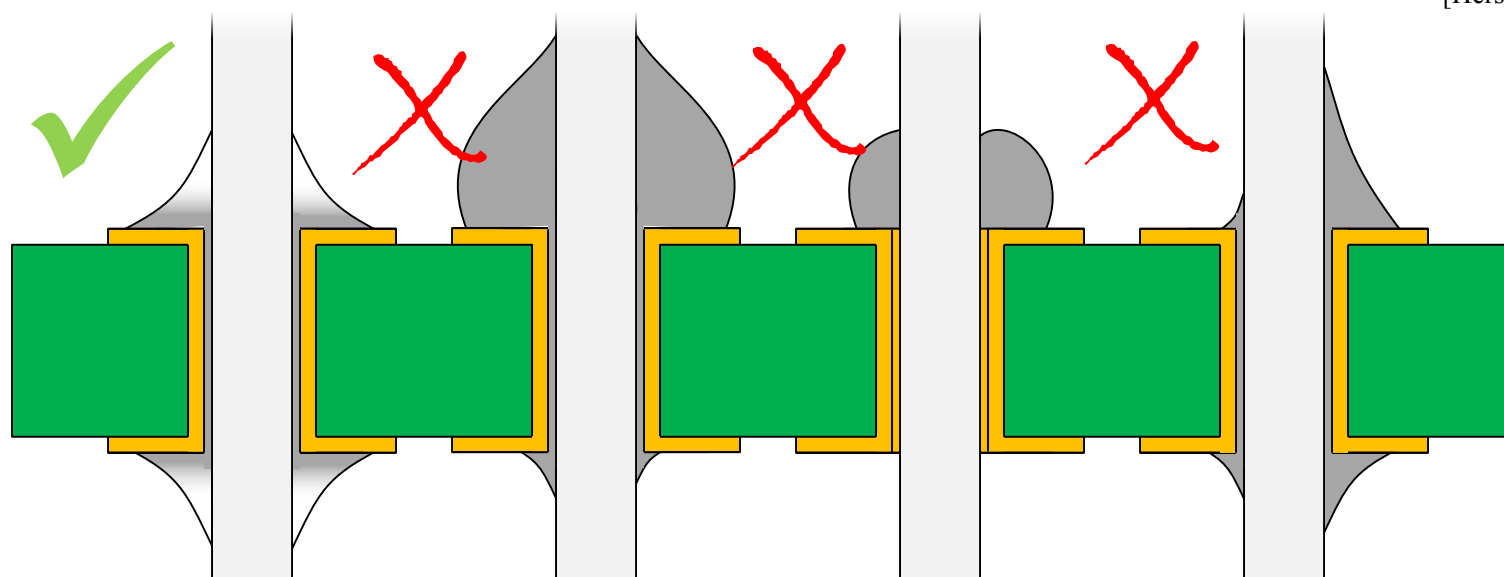


# Helpful soldering tips

- How to identify a good joint
  - Even, shiny symmetric meniscus
  - No Hershey's Kisses, no dull blobs



Hershey's Kiss  
[Hershey's]



Good joint!

Hershey's Kisses

Dry joint

Asymmetric joint

---

# How to fix dodgy a joint

---

- General method:
  1. Add a little flux
  2. Apply heat to the joint and hold
  3. Wait until the solder wicks into the joint
  4. Remove heat and let cool
  5. If more solder is needed, add more

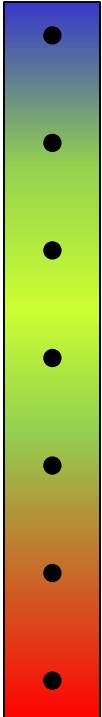


---

# Helpful soldering tips

---

## On temperature:

- 
- 250°C is probably too cold – bump it up!
  - 275°C can be ok for fragile parts
  - 300°C is pretty comfortable
  - 325°C is Just Right™
  - 350°C is more than enough
  - 375°C – what are you *doing*?
  - >400°C What the I don't even??

Different solders need different temperatures – know thine solder!

---

# Practical demonstration

---

- Working with wire
  - Stripping, tinning, joining to PCB
  - Joining and splicing
  - Heat shrink and insulation
  - Thick, multi-core wires
- Through-hole parts
  - Journey to the Lost World

---

# Topics to cover today

---

- SMD passives
  - Point to point, Pre-tin, Reflow
- SMD ICs: SOT-23/SOIC/TSSOP
  - Point to point, Tack and Drag, Pre-tin, Reflow
- Leadless SMD: LGA/QFN/BGA
  - Descent into the winding madness from which there is no escape, only the gnawing twisting spiralling frenzied desolation that chews upon the Ur-soul in the grip of its endless torment

---

# Questions

---

?



‘Hotflash’ aka “Princess Solderflux” [Firepixie]

---

# Tune-in next time for...

---

## Questions & Answers vol. 1

*or*

“Coffee makes the world go round.”

Fun fact: Biocompatible solder is 98% gold.  
It is frighteningly expensive.