Your Soldering is Terrible (probably)

or

“How I learned to stop worrying and love flux”

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University of Queensland
But first…

Some house keeping
House keeping

• Please keep lab tidy
  – It’s not terrible… yet. Don’t let it be.

• Design briefs are in… and out!
  – Pick them up after the lecture

• No luck on Tesla Motors engineer lecture
  – No lecture that day 😞
  – Maybe get him to Skype in later
Design briefs

• Common threads:
  – Lots of simply restating the problem description
  – Limited translation of goals into requirements or constraints – little pre-chewing of the problem
  – Lots and lots of design decisions…
  – … and precious little reasoning for it them
  – Hardly any analysis – yes, this includes you.

A design brief is about the problem, not the solution
Design briefs

Number

Mark %

45 50 55 60 65 70 75 80 85 90 95 100
House keeping

• Minor spec revision – v0.4 20140324
  – Clarifications on 15 mins for 5 min lap
  – Clarifications on spare swap-out parts
  – Clarifications on gearboxes/gearmotors
  – Clarifications on what can/can’t be bought

Make sure you read it so you’re up to date
House keeping

IMPORTANT:

• You must submit your designs to Doug for machining parts no later than week 7
  – No parts will be machined for you after then
  – You can machine your own parts, but you won’t be able to go through the workshop
## Calendar at a glance

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<th>Reviews</th>
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<td>Final testing</td>
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You are here... Soon
Progress reviews

• Progress reviews are next week!
  – 15 minute slot per group
  – Each group member presents in turn
  – Should only take 3-4 mins each

• Sign up for session slots via Doodle poll
  – Link to poll will be sent out via Blackboard announcement after the lecture (closes Friday)
Progress reviews

• How to sign up:
  – Have **one and only one** member of your team nominate a time for your team on the
  – When they sign up, they must include their **full name and team number**. If they don’t have both, the slot will be cleared.

• If you absolutely can’t get a slot that works for all of your group, email me ASAP
  – *But this should never happen*
Progress reviews

What is expected for the progress review?

• Need to show that you’ve made a decent start to the project: **tangible evidence**
  – **Desired**: rigorous analysis, detailed simulations working compiled code, breadboarded electronics, mockups of mechanical design
  – **Inadmissible**: scrawled pictures, isolated printouts of code, lousy rushed CAD or circuit diagrams, datasheets of that part you found
Progress reviews

• Don’t panic: we are reasonable
  – The progress review is entirely to motivate you to get started early, and check your progress

• We can tell very easily if you’ve actually made an effort – if you have, you’ll be fine!
Progress Review flow chart

Are you at the meeting?

Have you done anything useful?

Not just the stuff other folks did?

Have you got evidence for it?

Is it a real contribution?

Pass
FAQ Roundup

• Do we have to buy pit-stop spare parts from our $150 budget?
  – No. You can now just replace the part you’ve swapped out.

• Can we use pre-made gearboxes/gearmotors?
  – If your gear motor/gearbox comes as pre-integrated part, then yes. If you have to assemble it yourself, then you must build your own housing. This includes most Tamiya gear kits.

• How do we get costs for machined parts?
  – Ask Doug – make sure you bring him your sketches/CAD

• What batteries count towards the 15 kJ lipo limit?
  – All flammable Lithium-based chemistries: Li Poly, Li Ion, Li-FE, etc. Non-Lithium chemistries do not count: NiCd, NiMH etc.
Lecture nominations

• Now is the time to nominate lecture topics
  – Send to me via e-mail before Monday
  – I will announce a Doodle poll next week

• The first bespoke lecture will be 8th April
  – If there are no nominations, it will be Q&A
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!

• Always assume a soldering iron is hot!
  – NEVER pick it up by the wrong end
  – Remains hot for a while, 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°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 ZERO
  - Use ROHS solder and materials

- Use and dispose of chemicals responsibly
  - Don’t 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!
  – $5 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 join

• Enough heat, enough flux, clean surfaces
  – Quick zap and out
Helpful soldering tips

• God gave solder flux to you.
  – Gave solder flux to you.
  – Put it in the soul of everyone.

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~
Helpful soldering tips

• How to identify a good joint
  – Even, shiny symmetric meniscus
  – No Hershey’s Kisses, no blobs
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 like different temperatures – know your solder!
Practical demonstration

• Working with wire
  – Striping, 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 endless torment
Questions

‘Hotflash’ aka “Princess Solderflux” [Firepixie]
Tune-in next time for...

Nothing!

or

“When I catch Vincent I will hit him with a stick until he gives us a guest lecture on the awesome stuff he done built.”

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