Thank you for attending this presentation of the Chelsea Amateur Radio Club where tonight we will present some of the basics of soldering as it might be applicable to amateur radio operators.

The Soldering Iron

- Attributes and Practices of the tip
  - Temperature
  - Size
  - Tinning
  - Switchable
  - Cleaning
  - Heat-up time
- Build Quality
- Correct tip for the task

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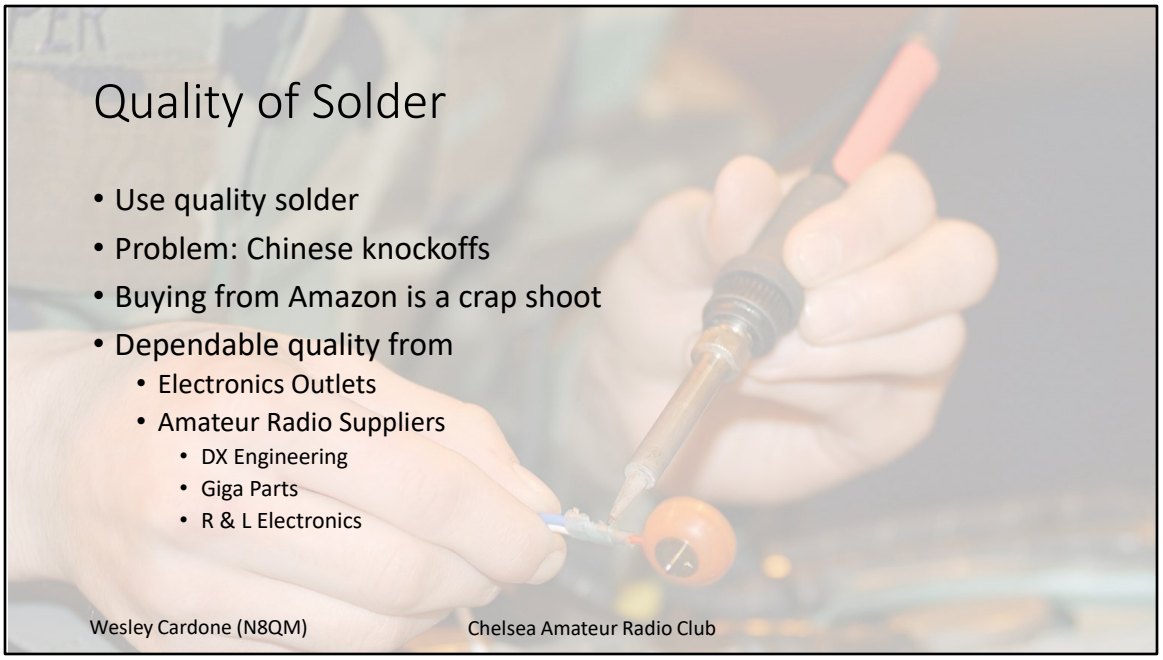
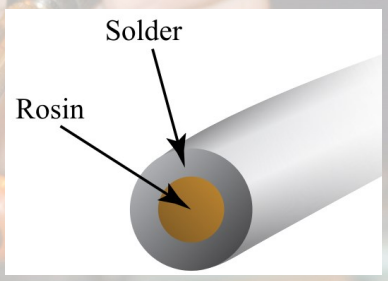
One very primary consideration in soldering is the soldering iron. Generally, for amateur radio you want to avoid at all costs the 1,500 Watt monster soldering guns. You can use them but it increases a risk of over-heating the joint and causing a variety of other problems. Considerations in the selectio of a soldering iron include temperature, size of the tip, how you tin the tip, are the tips switchable, iron cleaning, and time to heat the tip. Heating time might not seem like a big item but just wait until you start soldering and have to wait until the tip reaches a good temperature.



There was a day when you could go to your local hardware store or order online and not have to be concerned with the quality of the solder you are buying. Generally you are probably okay if you are looking to buy everyday solder. But if you are looking for eutectic solder, for example, you better go to the electronics supply houses and avoid Amazon.

Solder Flux

- Removes surface oxide films
- Increases the wetting ability
- Causes solder to flow more uniformly
- Modes of Application
  - Paste brushed on
  - Rosin-core solder
- Only use Rosin Flux, not acid



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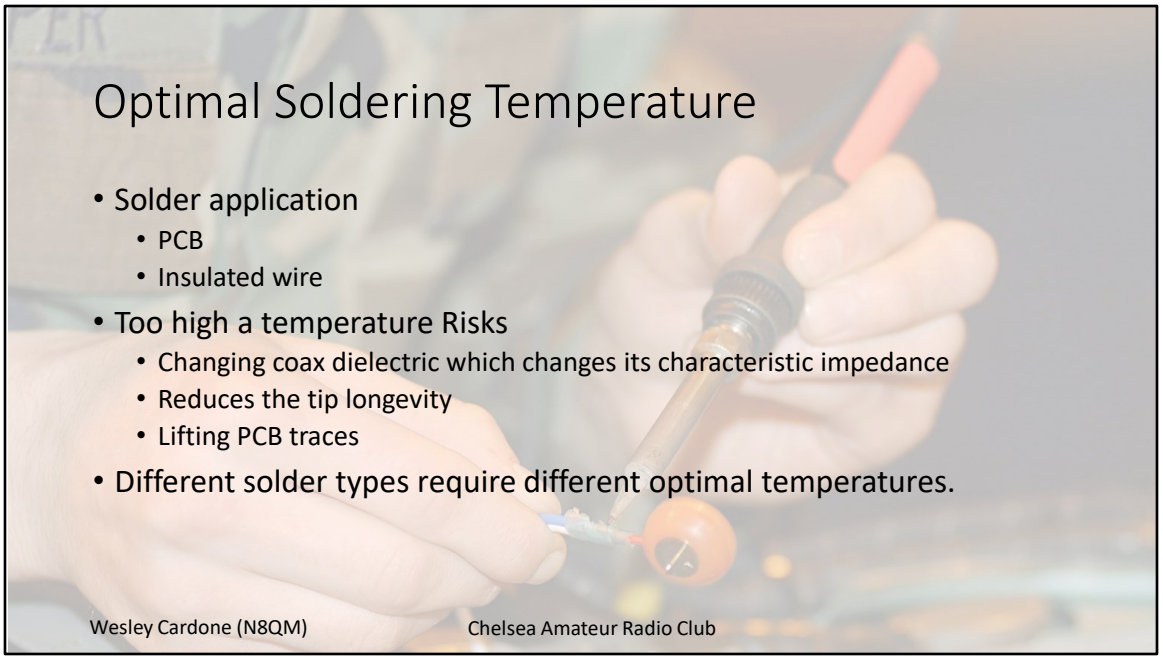
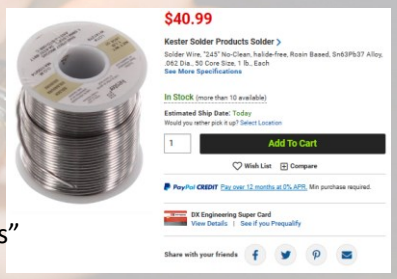
You want to add flux to any joint that you solder. Using rosin-core solder simplifies this so that it happens while you solder. However, you may want to consider brushing on flux in addition to what the solder core deliveres.



There are optimal soldering temperatures depending on varied conditions. However, if you use a typical soldering pen, you will be okay as a general rule. To be assured of optimal temperatures, you will have to research it. I would present more information here but the subject is too varied.

Different Solder Types

- Lead-based 60/40 (tin/lead) commonly Sn60Pb40
  - Melting point 180-190 °C
  - Best understood of all types
  - Reliable, preferred in mission critical applications
  - Available in a eutectic option
- Lead-free solder
  - Slightly higher melting temperature
  - Disadvantage: Promotes formation of “tin whiskers”
- Flux-core solder
  - Flux is released while soldering
  - All types of solder are offered with a flux-core option.

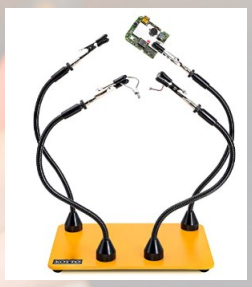


Longevity Tip Periodic Operations

- After each solder operation
  - Shake off excess solder
  - Plunge into brass wool a few times
  - Tin before replacing in holder
- After several solder operations
  - Use actual tip tinner
  - Then tin with solder
  - Place back into holder
- Before quitting and storage
  - Tin unusually heavy
  - Remove power
  - Carefully place in holder not jiggling so to not lose the solder ball

Helpful Accessories

- Jigs are a very great help
- Solder wicks are a must-have
- Solder tip brushes very useful



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Think seriously about accessories you want to have ready at the beck-and-call. They make life easy but moreso, they aid in producing reliable results. Probably on the top of the list is a jig with articulating arms. Also, there will be times when you decided you made a mistake and you want to de-solder. A solder-wick spool helps greatly in this.

Workstations

- Avoid Amazon (Chinese knockoffs possibility)
- DX Engineering & R&L Electronics
- Giga Parts & others

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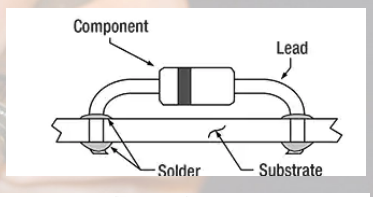
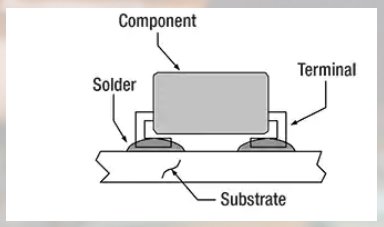
If you don't mind spending $200 to $400, a workstation will go a long way to easing your soldering life.

Component Lead Techniques

- PCB layouts
  - Bend the leads to minimize lead length



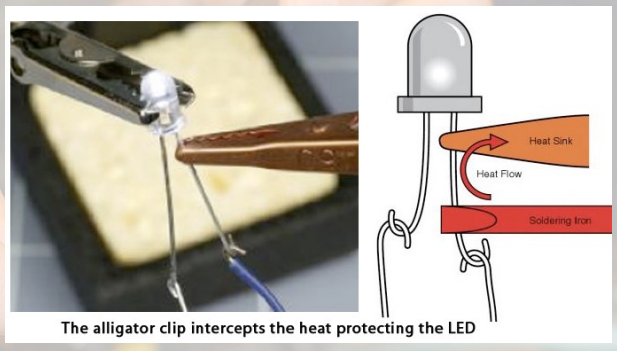


Time to Apply Heat

- Preheat no solder
- Apply solder
- Continue heat application briefly
  - Continued heat aids in flow
  - Excessive heat application to be avoided
    - Possibly lifts PC traces from board
    - Component can be damaged
    - Coax dielectric may melt changing its characteristic impedance
- Remove heat
  - Being careful to not introduce motion of components

Use Heat-Sink

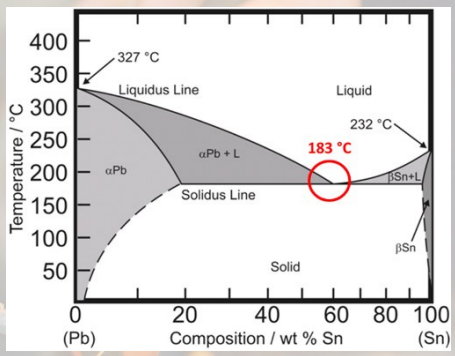
- Minimize heat flow to component by fixing a heat-sink device to the component.



The alligator clip intercepts the heat protecting the LED

Solder Blends—Eutectic & Plane (cheap)

- 60/40% Plane
  - 60% Sn (Tin)
  - 40% Pb (Lead)
- Eutectic
  - 63/37%
    - 63% Sn
    - 37% Pb
  - 95.5/4/0.5
    - 95.5% Sn (Tin)
    - 4% Ag (Silver)
    - 0.5% Cu (Copper)

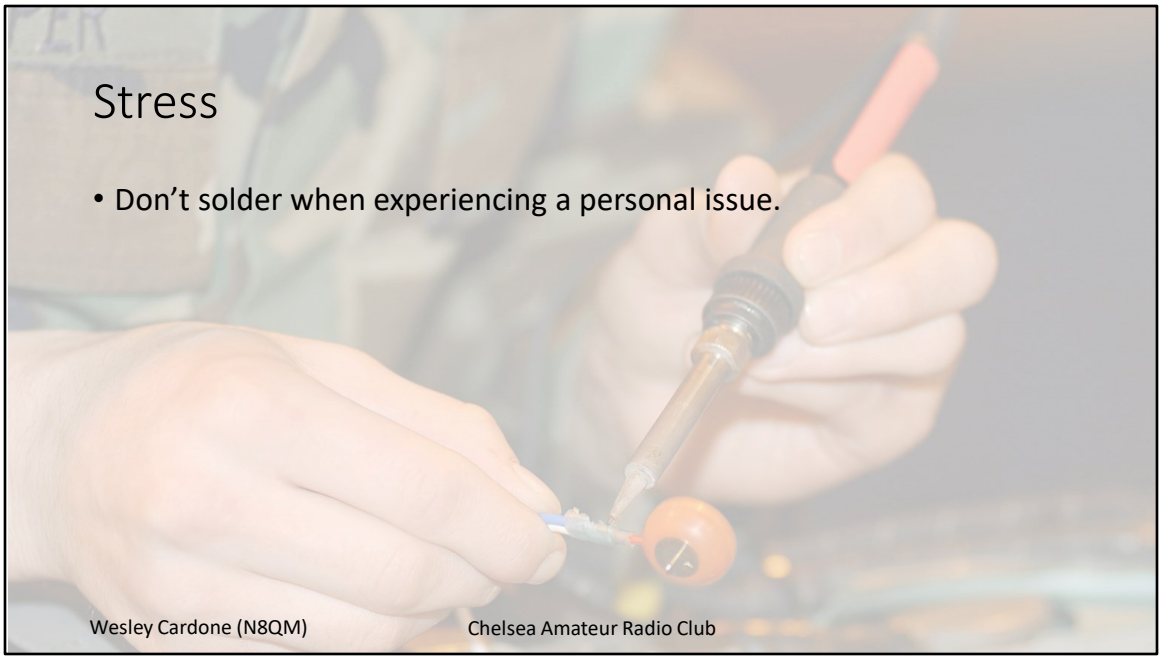


Facilities Ventilation

- Make some arrangement for air circulation.

PPE—Personal Protective Equipment

- Consumer Soldering
  - Face and eye coverings
  - Coveralls and rubber gloves
- Industrial Soldering
  - Include consumer PPE
  - Hard Caps
  - Protective footwear
  - Fume extractor
  - respirator


Stress
• Don’t solder when experiencing a personal issue.
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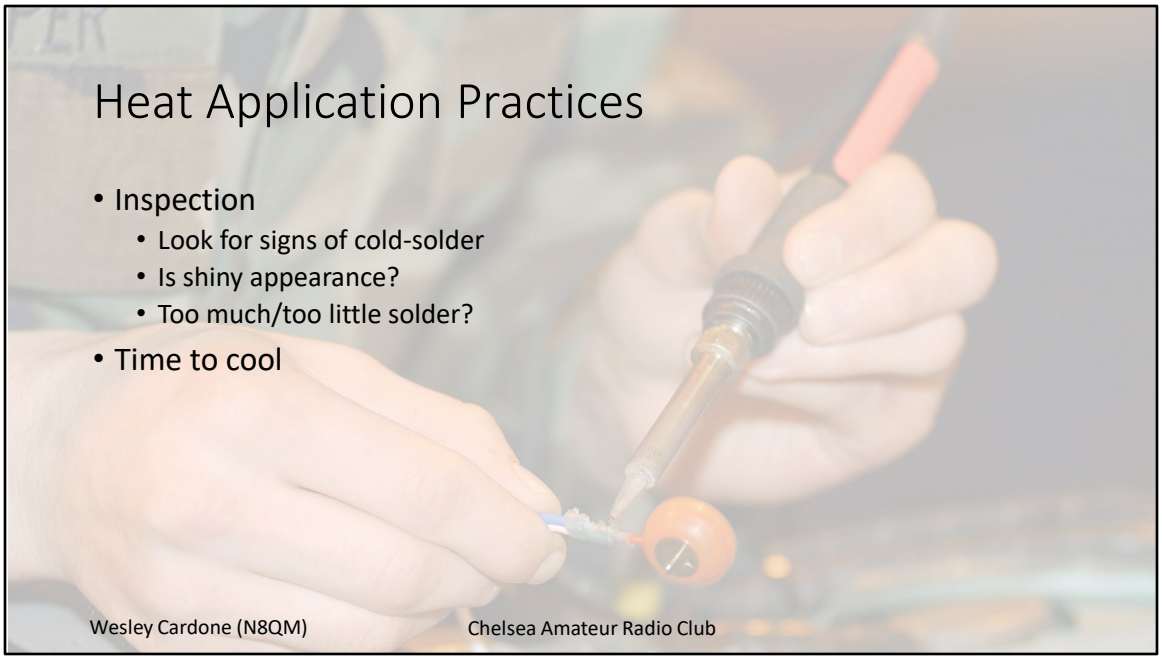
Heat Application Practices

- Inspection
  - Look for signs of cold-solder
  - Is shiny appearance?
  - Too much/too little solder?
- Time to cool



Cleaning Flux Residue

- Solutions
- Methods

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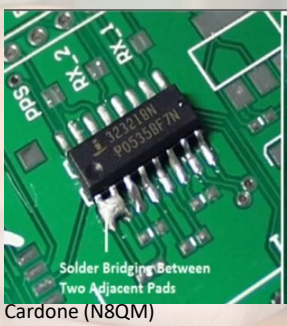
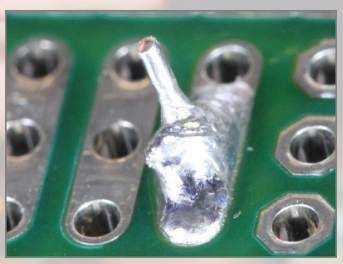
Bad Joints

- What is a cold-solder joint
- Solder Bridge





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Practice
• Your first solder joint will be a tragedy.
• Perfection only comes from practice.
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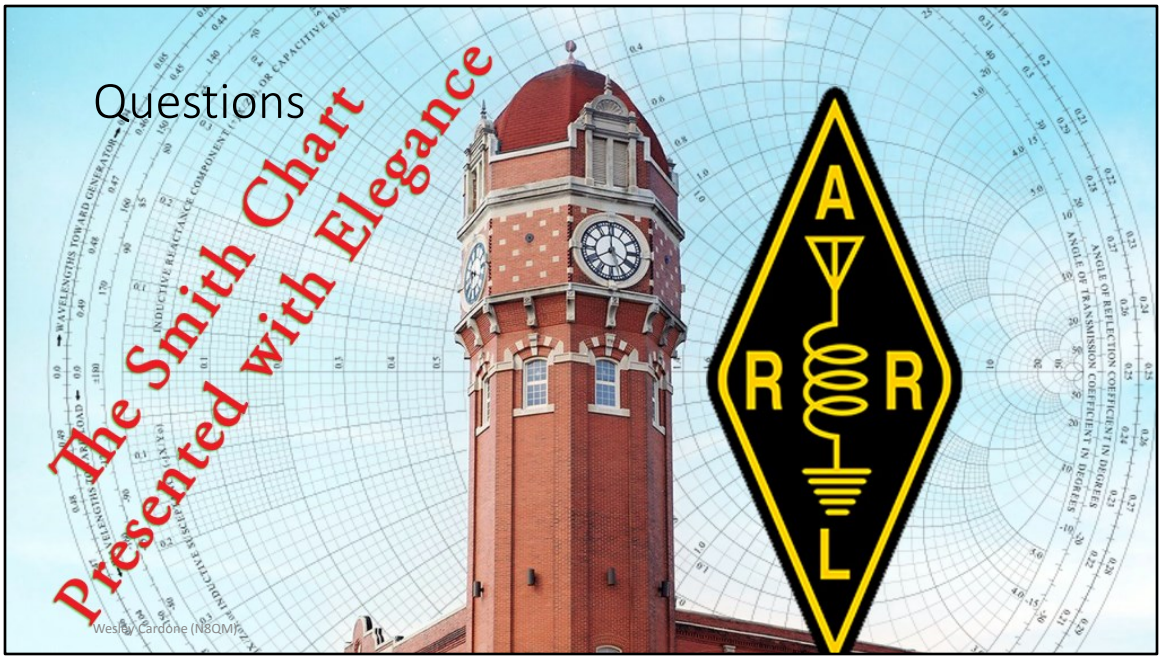
Questions
The Smith Chart
Presented with Elegance
Wesley Cardone (N8QM)