

Electronics for  
the Rocket  
Scientist

A photograph of a yellow and green model rocket, likely a high-power rocket, set against a blue sky background. The rocket is oriented vertically, with its nose pointing upwards. The text is overlaid on the right side of the image.

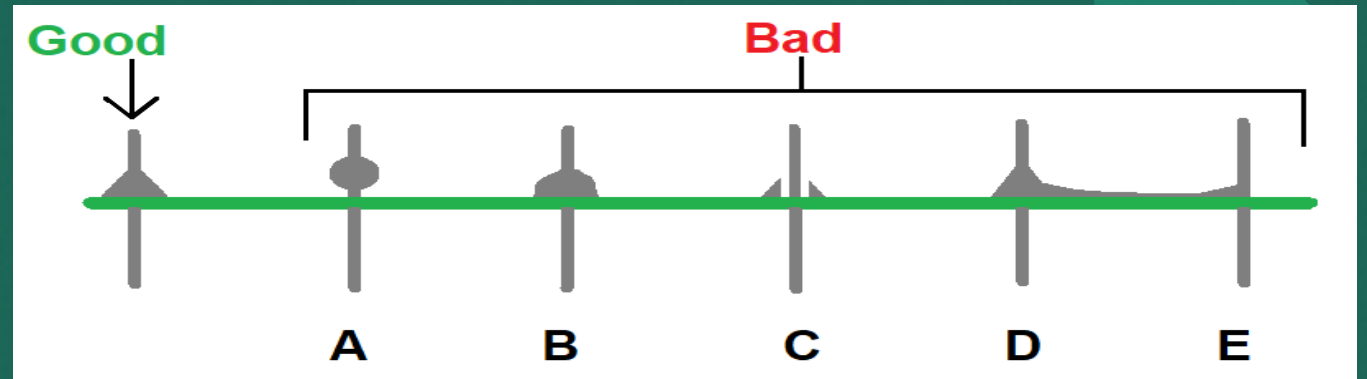
**Tripoli  
Minnesota  
High Power  
Rocket Club**

# Rocketry can be a very hostile environment for electronics

Don't let your electronics skills be the root cause for a crash.

## Soldering/Wiring

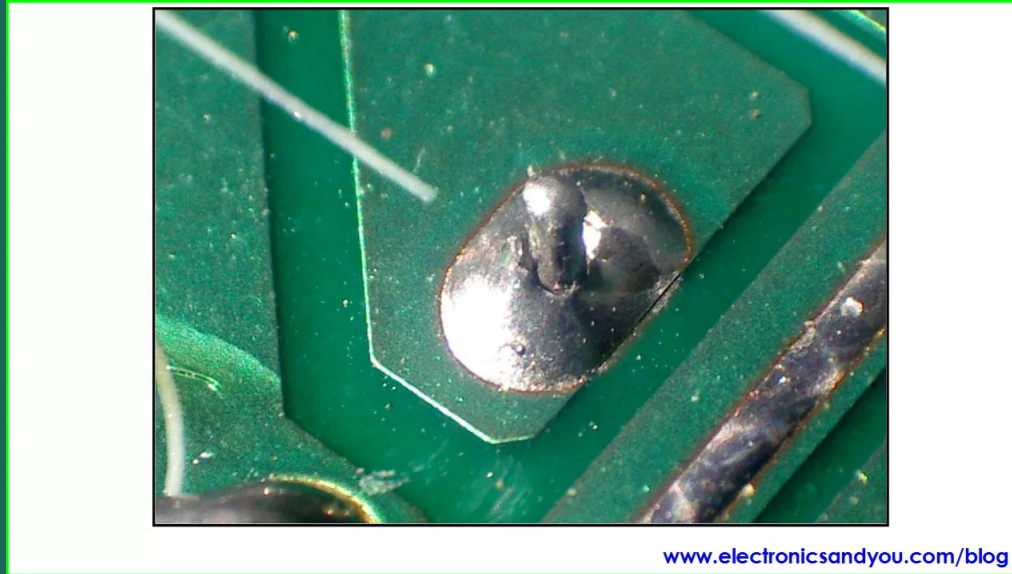
# The good, the bad, and the ugly



# Cold Solder Joint

A cold Solder Joint can be dangerous because It might work fine on the ground, but given the stress of a flight, the solder may shift, or even break and lead to a failure.

Cure: Clean any excess flux, reheat the joint, add solder.



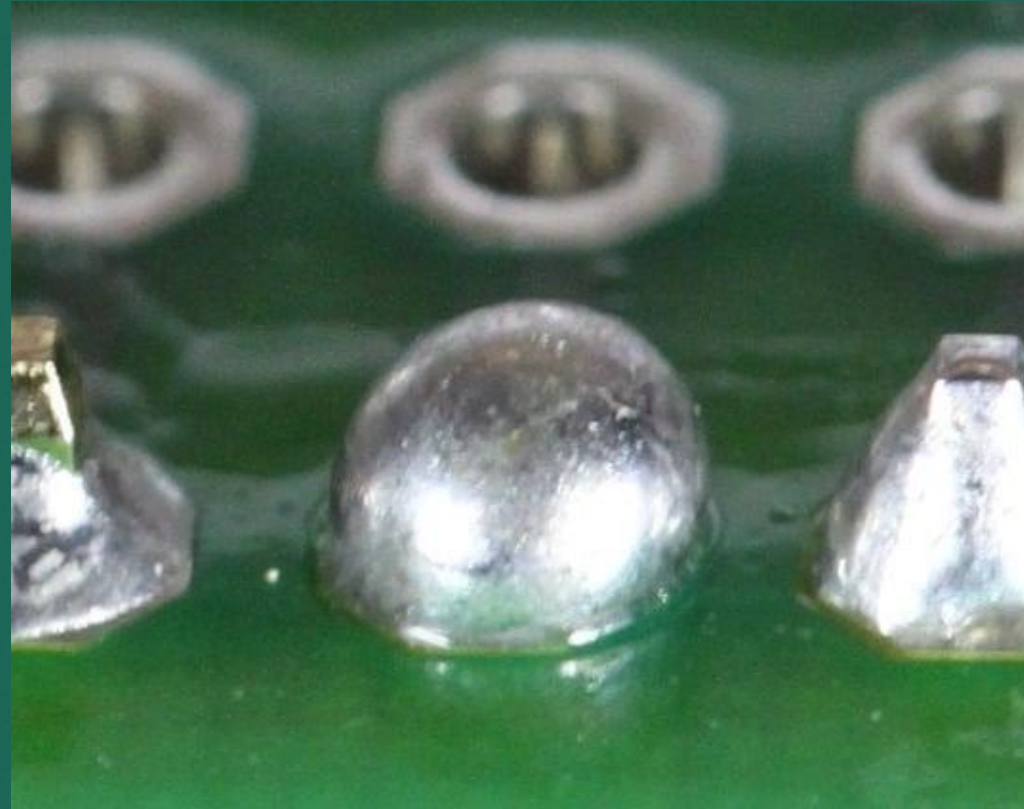
# The Blob

Putting too much solder on a joint. Reheat it and try and remove some.

Solder wick

Heat and flick

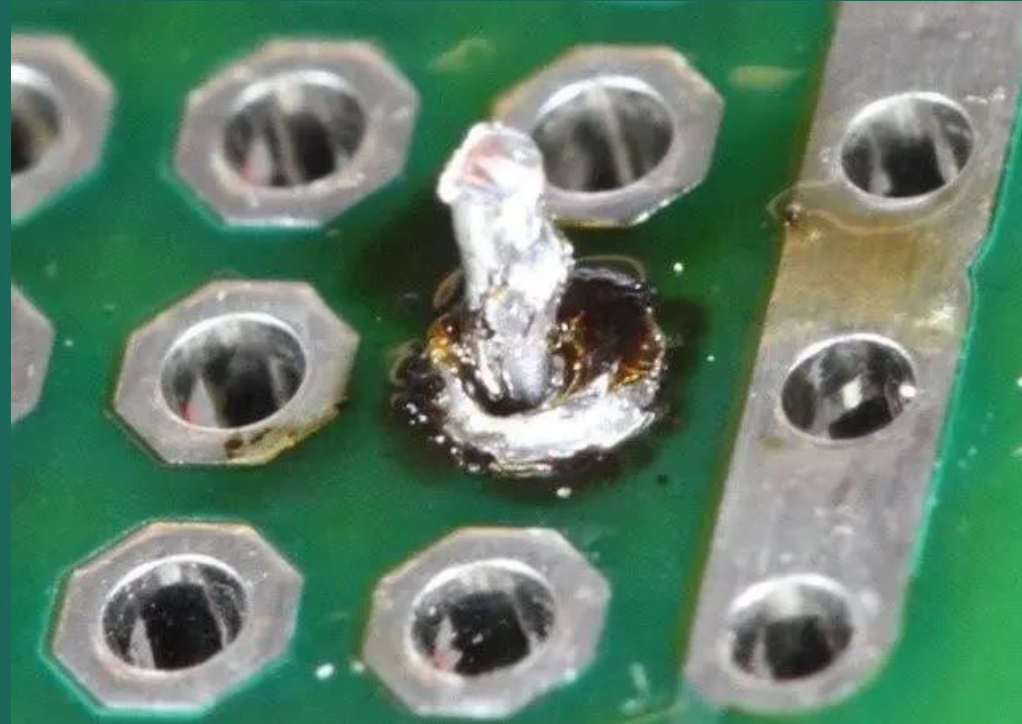
Solder sucker





# Fried Joint (great with catsup)

- Too much heat for too long
- Use a solder with a diameter less than your wire/pad
- Don't use acid core solder, that's for pipes.
- Invest in a cheap 25w solder pen, not a big bulky solder gun.



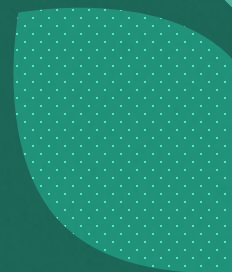
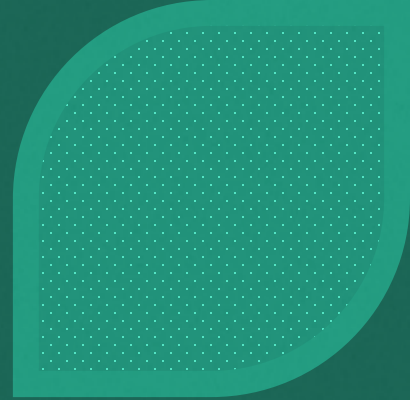
# A Bridge Too Far



# Dry Joint

Need to add more solder

Don't rush





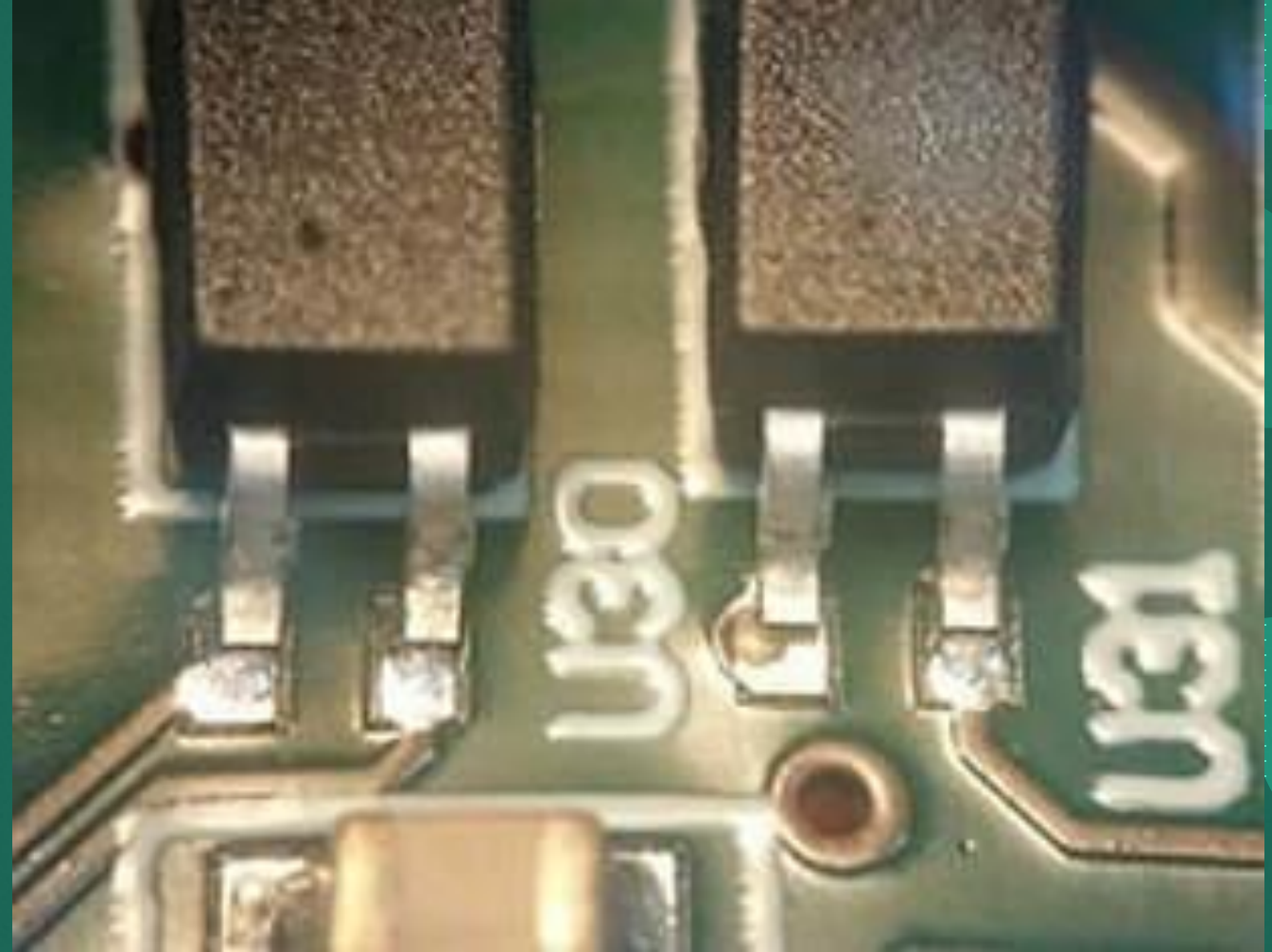
# Flying Joint

What can I add...



# Surface Mount (SMD) Technology

Parts are mounted directly to the metal pads on the printed circuit board. The part may also be glued (epoxy) to the board to make it more rugged.



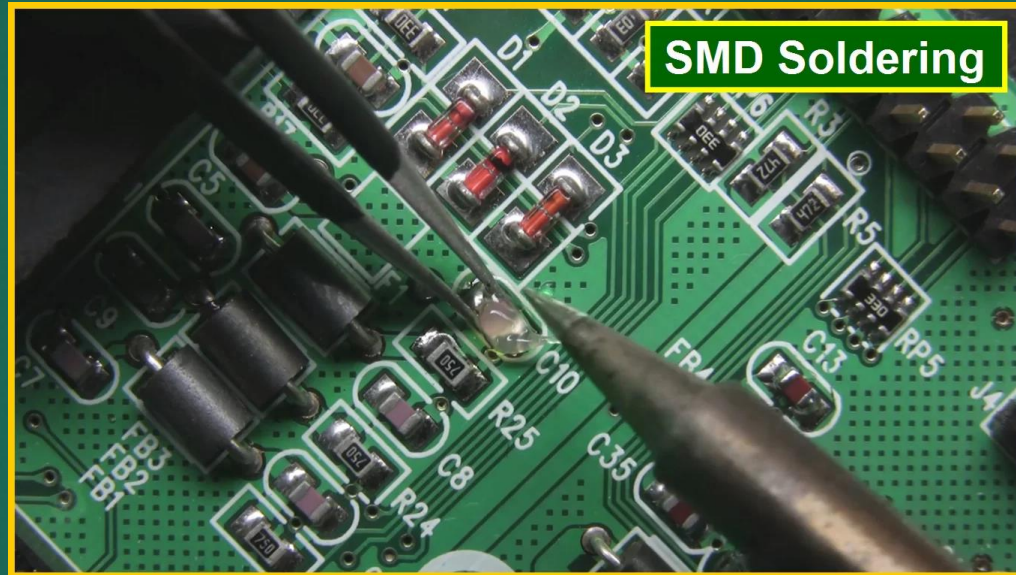
# SMD (cont.)

Most electronics parts are now only SMD.

High density, but sometimes you need a microscope.

Use a temperature-controlled soldering iron and very fine tip (1/64")

Hot air rework stations can be used to repair/rework SMD





# Hot Air Station

Blows very hot air (up to 500°C) on a very specific location of a board.

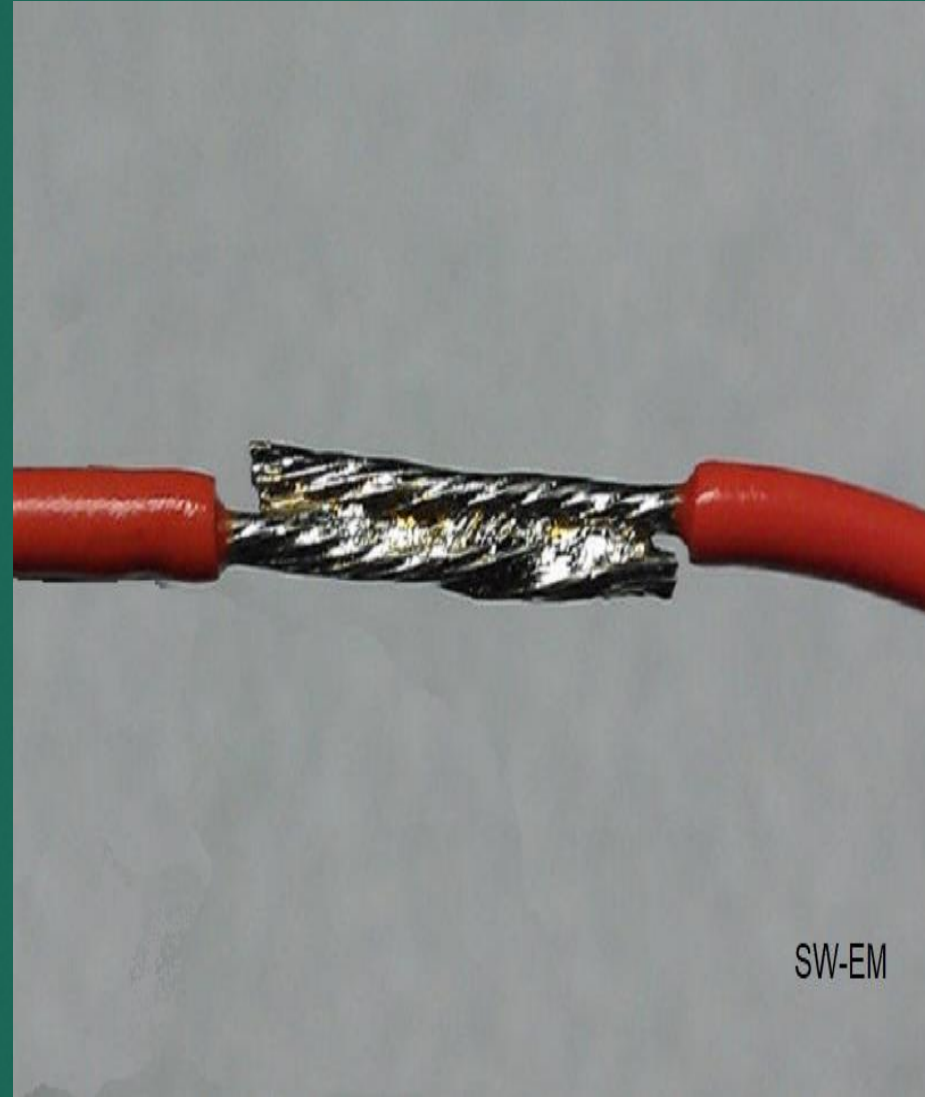


# Soldering Wires

BAD!

Solder is much weaker than the wire resulting in breakage.

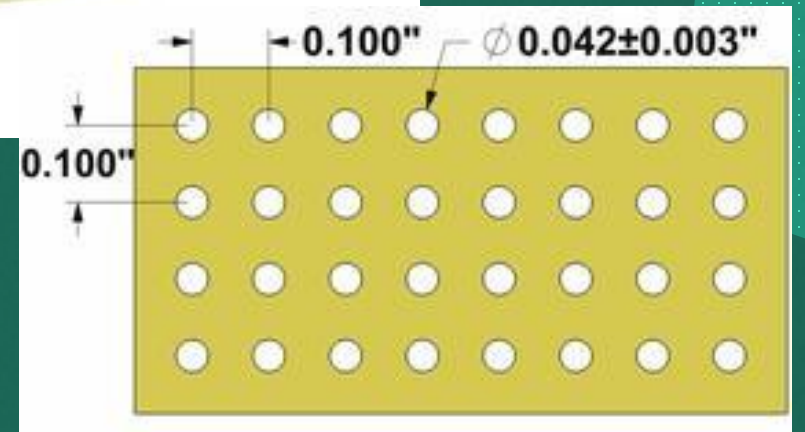
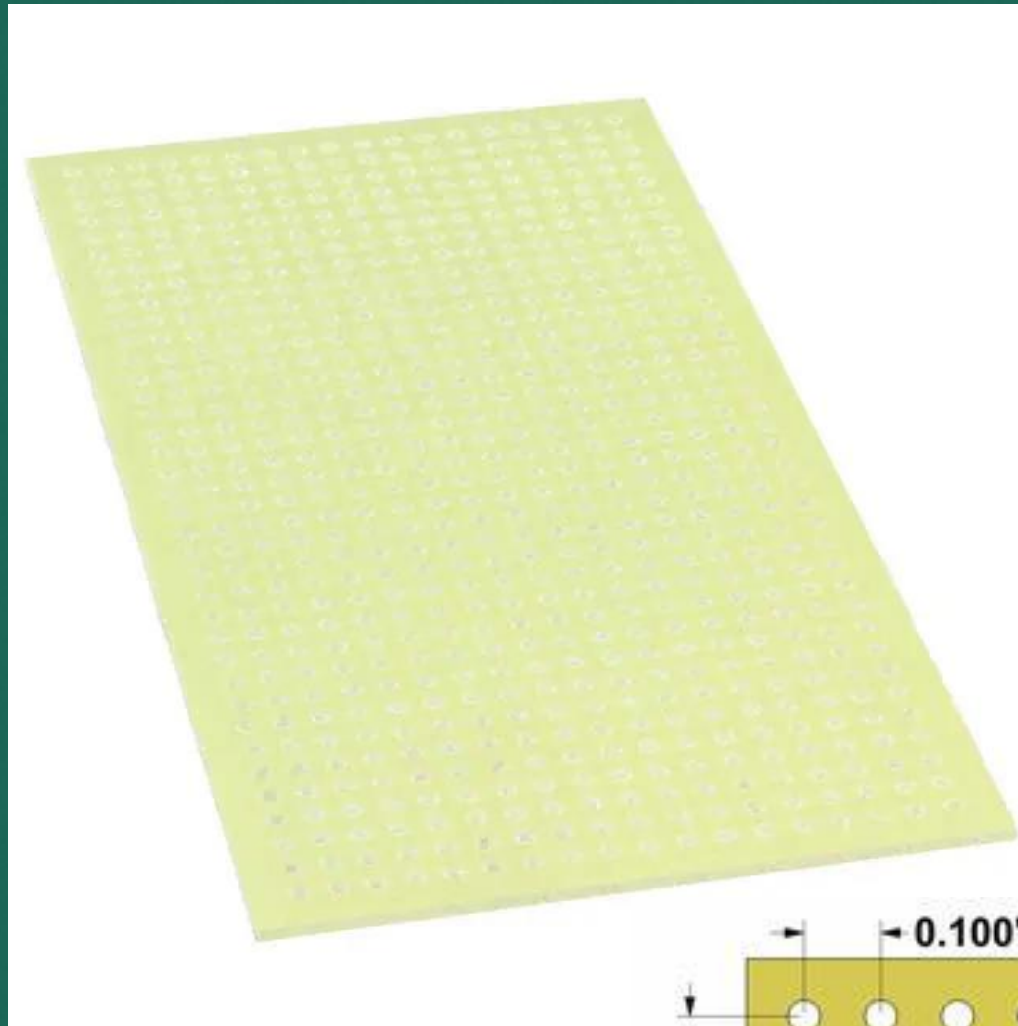
This caused many issues with our low power launch system





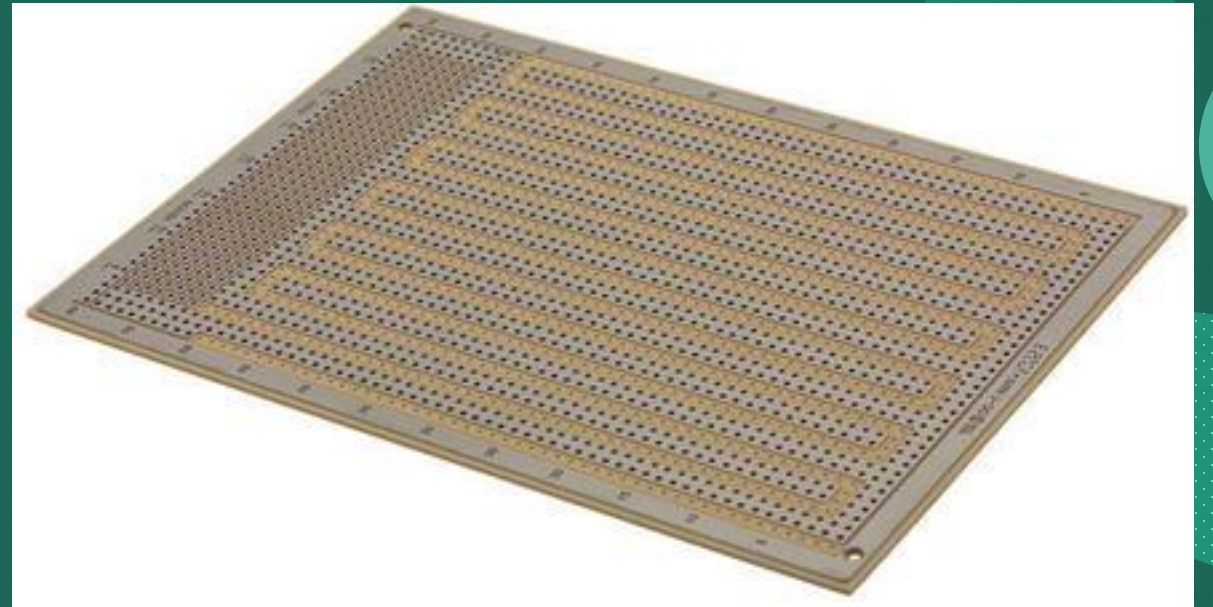
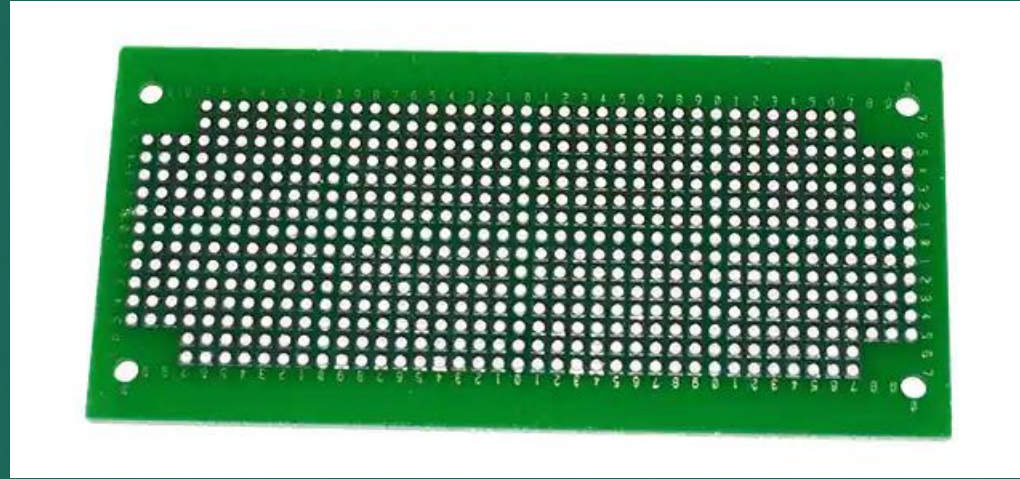
# How to get around tack soldering

Vector board. G10 fiberglass with predrilled holes every .1 inch



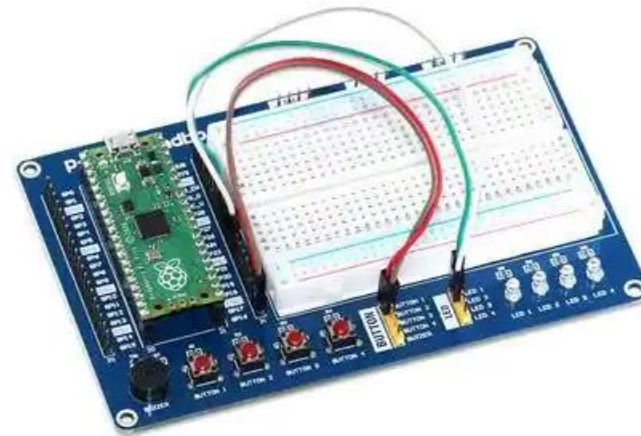
# Etched Vectorboard

Many sizes and patterns to  
choose from.



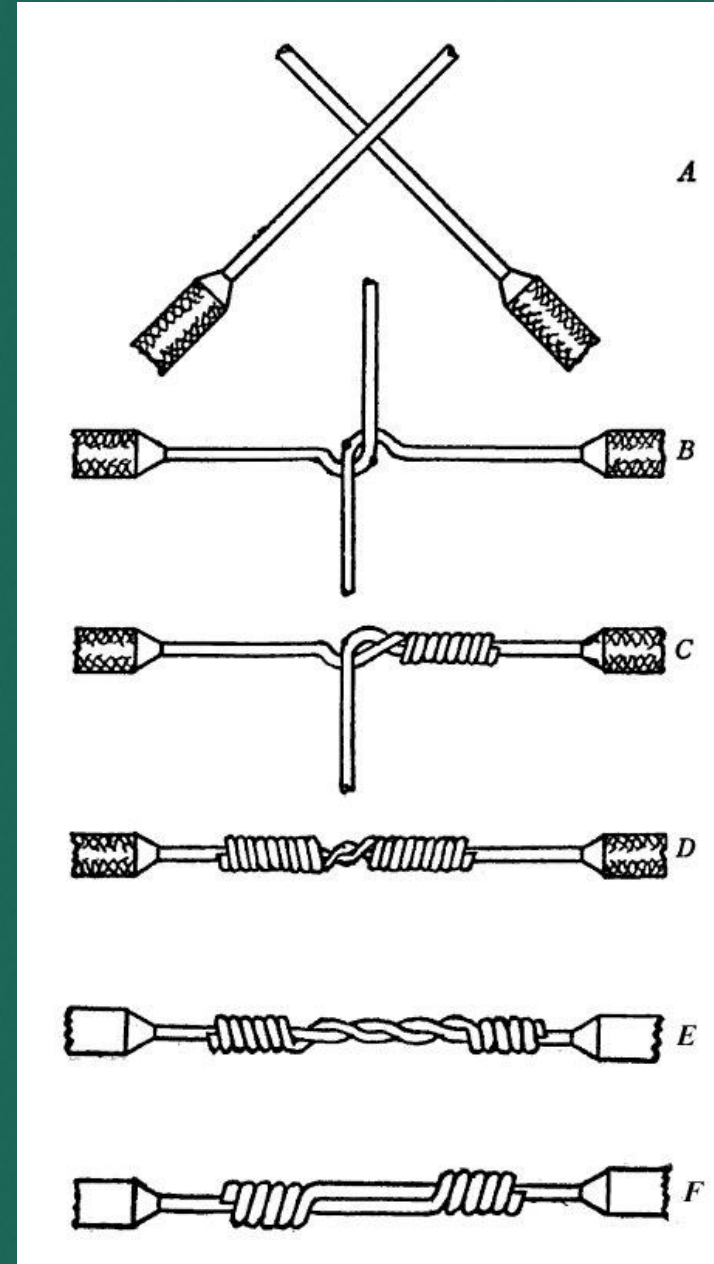
# Breadboard

Not meant for flight, but a great way to design new electronics



# Western Union Splice

When you have to splice 2 wires together





# Solder splicers

Heat shrink tubing on the outside

Solder in the center

Glue on the inside

Waterproof, vibration resistant, very strong (100lb pull force)

Common for marine and aircraft use.



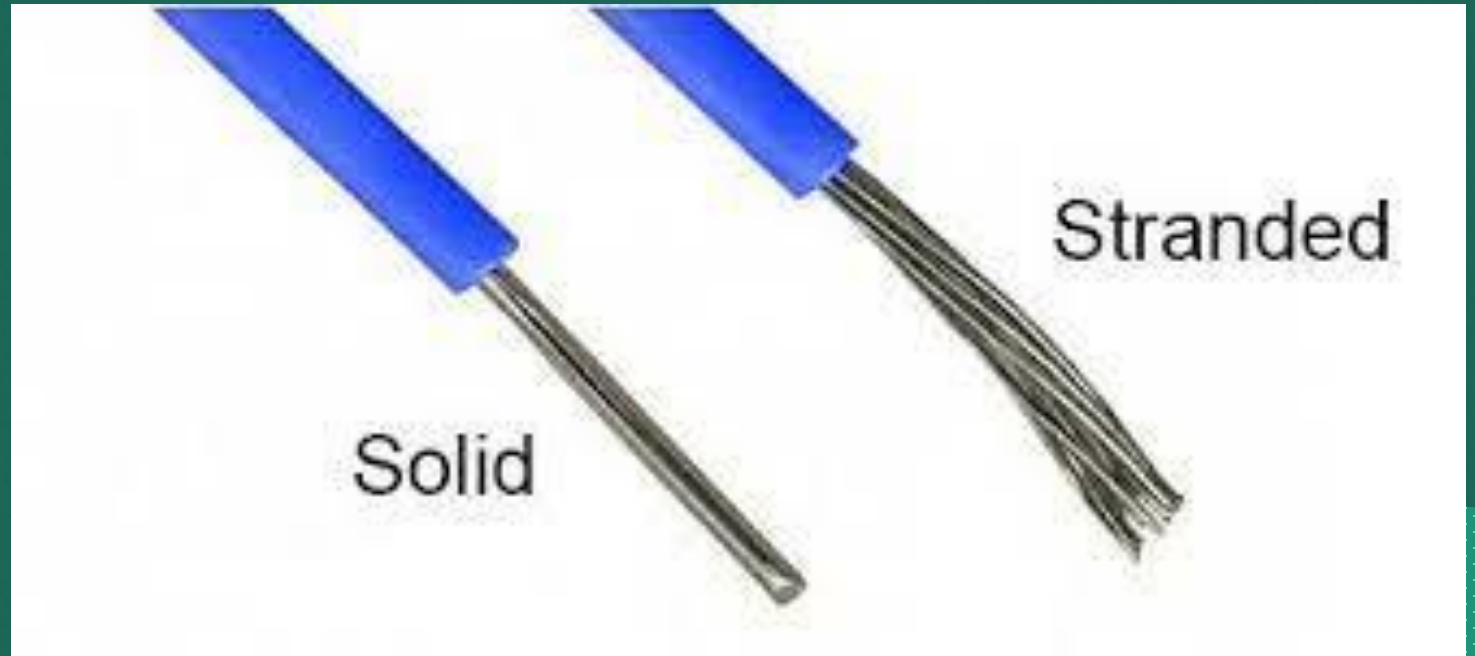


# What wire do I use?

Stranded for environmentally challenged area. Bends and handles vibration and motion. Less current.

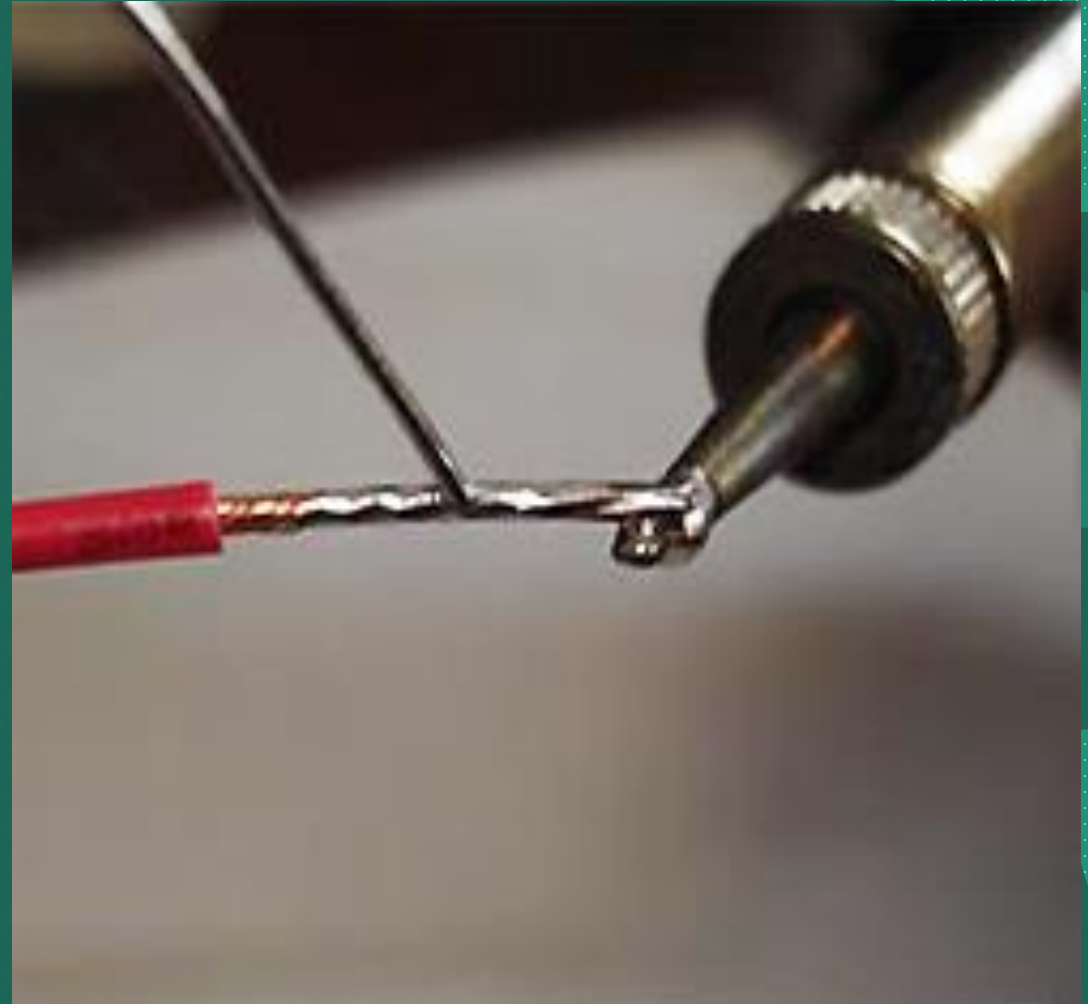
Solid for anything else (like nothing on a rocket).

In other words, use stranded everywhere.



# Tinning Stranded Wire

Although stranded wire handles vibrations better, tinning the ends increases its strength near connections.



# Common Wire Gauges

Note that long runs of small gauges can cause high resistance.

AWG	Diameter (mm)	Area (mm <sup>2</sup> )	Copper resistance (Ω/km) (mΩ/m)	Maximum Amperage for wiring (amps)
0 (1/0)	8.251	53.5	0.3224	245
1	7.348	42.4	0.4066	211
2	6.544	33.6	0.5127	181
12	2.053	3.31	5.211	41
14	1.628	2.08	8.286	32
16	1.291	1.31	13.17	22
18	1.024	0.823	20.95	16
20	0.812	0.518	33.31	11
22	0.644	0.326	52.96	7
24	0.511	0.205	84.22	3.5
26	0.405	0.129	133.9	2.2
28	0.321	0.081	212.9	1.4
30	0.255	0.0509	338.6	0.86

# Making Connections

Banana Plugs/Jacks – high current, cheap. Beware the bargain basement.

Barrier block/Terminal Lugs

Ring connectors. Use a star (lock) washer to enhance electrical connectivity.

