Assembly Instructions for Tartan Artibeus v0

I. Assembly prep: all the steps that need to happen before beginning pocketQube assembly. These instructions assume all PCB's are fully populated.

- Solder short female headers to PWR board (mating side up), clip any metal that extends below the board
- Solder stacking female headers to EXPT and CTRL boards (mating side up)Solder male stacking headers to COMM boards (***mating side down***)
- Solder cap to back of power board-- pay attention to +/-
- Dremel out little half moon in Comm board so we can thread GPS antenna through. (See "half-moon-dremel.png)
- Dremel out plastic from the kill switches so that when we push a screw through them, the screw is roughly flush with the top of the kill switch
- Place kill switches in slots in FR4, screw down, secure with nut on opposite side of FR4. (See "dremeled_switches.jpg"
- Push GPS antenna through FR4 hole so that wire is near antenna hole and white part of antenna pokes out on the same side as the kill switches (See "gps_antenna(1/2).jpg)
- Put Kapton tape at locations indicated in the following pictures: kapton(1-4).jpg
- Prep solar panels
    - Solder wires to the positive terminals of the solar panels, solder on the **back** of the panels to avoid damaging the solar cells (See solar_panel2.jpg)
    - Solder negatives to aluminum chassis by putting braided wire through negative terminal and fraying the end, later we will squish the frayed end against the chassis (See solar_panel1.jpg)
- Prep Comm board
    - Connect braided wire to GND pins near CTRL and COMM rails, later we will twist wire out of chassis and fray the end, then push wire back against outcropping in chassis so the frayed wires get pushed against the chassis when we tighten down the solar panels (See comm_layer.jpg)
    - Attach wires to the solar_in pins on the comm board, make them long enough to reach the board face closest to each solar panel (See comm_layer.jpg)
    - To get panel on top of chassis, need to use extra long wire from solar_in pins that is threaded out through the chassis then along the side and back through the nearest big hole in the top of the chassis
    - Add Y's from GND near EXP and VCAP (See comm_layer.jpg)-- don't forget to kapton the joints!

- Burn wire circuit on CTRL

        - If using CTRL v0.1, use exacto knife to *cut through the traces below the* db1 silkscreen label (cut straight from the edge of the “d” out to the edge of the board, the trace we need to cut is in the top copper, so you don’t need to go too deep)
        - Place MOSFET on back of CTRL board near the BURN, GND, DBG0 pins, clip center lead
        - Flip upside down and solder: Drain → DBG0, Gate → BURN, Source → GND. Use a bunch of solder on the drain
        - Solder 1MOhm resistor between Gate and GND for pull down
        - Make sure the solder joints at the pins end up fairly flat so they don’t interfere with the headers
- Burn wire circuit on COMM
    - Cut loop of nichrome, twist the ends around VCAP and DBG0, make sure the loop is long enough to poke through the fr4. Push the loops down over the vcap and dbg0 pins, then use a bunch of solder to trap the nichrome down, don’t bother trying to solder to it.
- Screw all 4 ¾” m2 screws through FR4 standoff holes (See stanoff_screws.jpg)
- Wrap the 4 standoffs in kapton
- Wrap the sides of the heads of 2 ¼” m2 screws in kapton

- Build the comm antenna (see finished_antenna.jpg)

    - Connect UFL mating connector to blue wire:

        - Strip an inch of blue wire
        - Make tiny loop out of stripped end
        - Use solder paste and smear a bit on the signal pad of the ufl mating connector and at the end of the loop of the blue wire.
        - Line everything up on top of a surface that won’t melt (e.g. grab a blank pcb with the helping hands and suspend a couple inches off the mat)
        - Use heat gun at 100-110 degrees C to melt the solder paste. Remove the heat after the connection is made
    - Connect the blue wire to thicker wire using the red end of a heatshrink tube
        - Wrap the blue wire around the thicker wire so very little blue wire is left hanging, and solder
        - Snip heat shrink tube so only red end is left
        - Melt red end of joint between thicker wire and blue wire
    - Connect the thicker wire to the nitinol using the solder sleeves and heat shrink
        - Strip other end of thick wire (if not stripped)
        - Slip solder sleeve into blue heat shrink tube

    - Thread thicker wire through heat shrink and solder sleeve, catch in middle crook of solder sleeve
    - Thread nitinol through opposite side of heat shrink and solder sleeve, also catch in middle crook
    - Apply heat (up to 140 degrees C) to melt solder sleeve, heat shrink, and glue inside.
    - CHECK CONNECTIVITY BETWEEN NITINOL AND BLUE WIRE

II. Assembly: Once all the pieces are ready, the whole pocketQube can be assembled.

- Assemble stackup
    - Squish together PWR, EXP, CTRL boards into single stackup (be careful as you're doing this, it's easy to ruin headers.
    - Check connectivity of all pins from PWR-->CTRL
    - Slip stackup into prepared chassis (See first_set.jpg and first_set_top.jpg)
    - Attach GPS antenna to CTRL board-- support the fr4/gps antenna throughout the rest of assembly, that antenna wire will break (See first_set_gps.jpg)
    - Slip comm board down into chassis and mate to CTRL board headers, use cutout in COMM board to allow GPS antenna to be fed through (See gps_through.jpg)
    - Check connectivity of all pins from PWR-->COMM, make sure none are shorted to GND because of cap
- Twist out GND connections (See gnd_connections.jpg and full_stackup.jpg)
- Connect solar panels
    - Connect all solar panel + wires to Solar_in wires using solder. Kapton the joints
    - Once you connect the bottom panel, immediately screw it to the chassis add all 4 m2 screws on the bottom face and keep kim wipes underneath for the rest of assembly to keep that panel from getting scratched or crushed
    - Screw on the solar panels on the north/south sides of the cube, check for connectivity between negative terminals and Chassis GND, check for connectivity among all the positive solar panel terminals, make sure the positive terminals aren't shorted to GND
- Attach the comm antenna to UFL connector, thread gingerly through the comm antenna hole in the FR4 base plate. MAKE SURE THE THICKER WIRE BEARS THE BRUNT OF ANY TENSION PLACED ON THE COMM ANTENNA.
- Secure base plate
    - Place all 4 kapton'd standoffs above the standoff holes
    - Thread Y's through the hole in the fr4 near the kill switches
    - Squish down the fr4 so the ¾" screws go through the standoffs and so that that the Y's stay through, the comm antenna stays through **and the burn wire makes it through the burn wire slot, you may need tweezers to pull it through** (See standoffs_in_place.jpg)

    - Attach the fr4 to the chassis using the kapton'd ¼" screws through the chassis holes in the fr4 opposite the kill switches
    - Continue to attach the fr4 using the two normal ¼" screws through the chassis holes near the kill switches

- Secure standoffs
    - Retract ¾" screws until they're not visible below the comm board
    - One side at a time, take standoff holder with slightly thicker part facing towards outside of board, use tweezers to hold up against bottom of comm board so that one hole is in line with one standoff screw. Screw down standoff screw until it's through the standoff holder (See
    - Turn standoff holder until other hole is in line with other standoff screw, screw down the free standoff screw. Standoff holder should be level and tight to comm board when this is finished (See standoff_holder.jpg)
    - Repeat on other side
- Screw in East/West solar panels
- Check panel connectivity
- Trim and strip Y's (See nearly_done.jpg)
- Solder one lead from the Vcap Y to the center of each kill switch
- Solder one lead from the GND Y to the kill switch pin closest to the center of the board
- Tie down antenna (See comm_tie_down.jpg for sketch)
    - Wrap antenna around screw closest to burn wire and pull back towards inside of Qube.
    - Wrap around screw opposite the first screw, and then back towards the first screw, making a figure 8. Make a second figure 8 around the screws
    - Pull the loose end under the antenna's heat shrink
    - Use fishing line to tie the loose end, and the two layers of the figure 8 to the burn wire.
        - You will probably need tweezers to pull it tight.
    - See finished_tie_down.jpg for final result