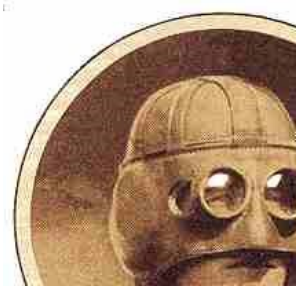

Copper Cables; Aluminum Cables? There's Something Much Better.

In the 1970's Piper Aircraft thought they had a better idea and sold lots of small airplanes with aluminum high-current wiring. Years later they sheepishly issued Service Bulletins 836 and 836A to remove this wiring and change it back to copper. This happened around the same time the housing industry was regretting all the aluminum wiring they had put into houses when the houses started to burn down.

But hold on a second! The only problem Piper had was a plague of poor-starting troubles. There was one wire/fire accident, but its cause is still in doubt. The housing industry's problem was that they used aluminum wire with connection hardware designed for copper.

Aluminum is used everywhere in the electrical industry. Motors are wound with it, high-voltage lines are made with it, and the drop from the power line to your house's circuit breaker box is probably aluminum.

But the problem with aluminum is that you have to do things in a very particular way. For example—the bare surface of aluminum becomes non-conductive when exposed to air. The thermal expansion has to be taken into account so the wire won't creep out from under a clamp. Aluminum can be a great choice or an awful choice of material…*it depends*. Aluminum is neither as strong, nor as fatigue resistant as copper. Aluminum melts into a puddle at temperatures where copper still has plenty of strength.

Metals from which you could make wire	Conductivity= 1/Resistivity	Mass Density	Figure of Merit (Conductivity per unit Mass)
(Partial list)	1/(microOhm-cm.)	g/cm^3	Cond./density x 1000
Aluminum	0.37	2.70	Highest 137
Copper	0.59	8.89	66
Silver	Highest 0.63	10.50	60
Zinc	0.17	7.10	24
Gold	0.42	19.30	22
Molybdenum	0.18	10.20	18
Nickel	0.14	8.80	16
Cadmium	0.14	8.64	16
Iron	0.10	7.03	15
Cobalt	0.11	8.71	13
Tin	0.09	7.29	12

Roman soldiers dropped copper coins in the dirt and you can still dig them up and read them. So what's wrong with copper wire? The above chart shows that aluminum conducts over twice as easily as copper for a given mass of wire. True, the aluminum wire would be fatter, but the weight of wire needed to conduct the same current would be halved!

Given the weight of wiring in an airplane, aluminum looks like a good way to save weight, but it represents some compromises—Aluminum is much harder to work with than copper. Furthermore, low-voltage wiring is particularly tricky with aluminum. Power companies have to strengthen aluminum high-voltage cables that hang from transmission towers with steel wire. Special connectors are required. Special goops are necessary to prevent corrosion at joints, and sometimes the outside of the aluminum must be coated, plated or anodized to make its surface behave. There is still a long history of problems with aluminum wire, and a lot of engineers spend their careers trying to solve the problems.

But the ideal solution is to make a wire that is copper on the outside and aluminum on the inside. This is like packaging the aluminum inside copper tubing. The wire has the low-corrosion characteristics and great solderability of copper but possesses the high-conductivity-per-mass of aluminum, resulting in a huge weight savings. *This is NOT copper-plated*. The CCA wire starts as a huge slug of aluminum inside a copper sleeve— then it is fused by a special process before it is drawn into wire. The cable is a little fatter but much lighter. If you replace copper with Super-CCA, you save half the weight compared to copper. This is especially important if your battery and starter are far apart.

FACT: A long problem-history exists using plain aluminum wire, but there is no problem-history with copper-clad-aluminum (CCA) wire at all.

Installation: CCA can be treated exactly like copper, it crimps almost the same and it solders even easier.

The cable is more expensive due the small production runs, but the big airplane guys like Airbus and Boeing use this stuff by the mile. Unfortunately, *they* won't sell you any.

Perihelion Design sells CCA battery cable—both Super-2-CCA to replace copper AWG 2, and Super-4-CCA to replace copper AWG 4, and Super-8-CCA to replace copper AWG 8. This replaces the big battery/starter cable and ground cables that all airplanes need. Even if you use copper.

(The Super-4-CCA uses common AWG 2 lugs; the Super-2-CCA uses AWG 1/0 lugs. The Super-8-CCA uses AWG 6 lugs)

Other recent applications:

Dragsters and similar vehicles.
Racecars, both NASCAR and Indy,
Military UAVs and drones.
Helicopters, to shorten turbine spool-up time,
Electric airplanes (manned and unmanned)

We also make custom sizes with specified insulation if you can buy a minimum of only 500 feet. Delivery time is usually only 3-4 weeks.

We will send free samples to interested buyers. Quantity discounts and specials are available. Please contact us.

Fatwire	Insul (std)	Dia w/Insul	Ohms per ft	Weight per foot	Typical Engines
Super-2-CCA	TPE	0.56" (14.6 mm)	0.156 mOhms/ft	2.45 ounces/foot	400-800 cu in.
Super-4-CCA	TPE	0.43" (10.9 mm)	0.244 mOhms/ft	1.72 ounces/foot	300-380 cu in
Super-8-CCA	ETFE	0.27" (6.9 mm)	0.641 mOhms/ft	0.78 ounces/foot	LSA, 100-280 cu. In.

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