



Networking or Notworking?

“Safety Moments, presented at CCA Stations and Posts”

By Chuck Hawley and Stan Honey, San Francisco Station, August 2024

On occasion, a small mistake expands to create havoc that seems wildly disproportionate to what one might expect.

- In 1975, a candle that was being used to show low velocity air movements in a nuclear power plant caused a fire that resulted in the shutdown of two reactors due to the damage to cables inside the plant (Browns Ferry Nuclear Plant.)
- In 2009, the icing of airspeed sensors on Air France Flight 447 caused the pilots to not recognize that the aircraft was in a stall, resulting in the loss of 228 lives.
- A routine but buggy software upgrade from CrowdStrike on July 19, 2024 caused immense computer problems around the world, particularly in the medical, banking, and airline industries.



Browns Ferry Nuclear Plant. The fire occurred three months after the plant started operation.

While not nearly as dangerous, small errors or mistakes can affect the performance of navigational instruments on a boat, especially if the error is propagated throughout due to the reliance on a network. For the most part, the introduction of the NMEA2000 (commonly referred to as N2K) network standard has been tremendous for recreational boat owners and crews by providing an easily-installed, fast, and relatively trouble-free network that can connect myriad devices together that can share information and compute heretofore unavailable functions. For example, with an N2K network, instruments can take the true wind angle of the vessel, the vessel's position, and the desired waypoint and display laylines on a cockpit display.



A Garmin "T" connector, used to add additional items to an N2K network.

One of the features of components on an N2K network is that it uses relatively small molded plugs which plug into a "backbone" cable that runs stem to stern (or hull to masthead) through the vessel. The backbone cable has larger conductors than the smaller "drop" cables, and can provide power to unpowered sensors (transducers, paddlewheels, masthead wind sensors, fuel flow sensors) simply by connecting them to the network.

But the very fact that it is a network can allow a single fault to impact many or all of the components on the network. One pinched wire, or chafed conductor, or a pair of connectors that were forced together so that they are not connected correctly can create mayhem for the entire string of connected devices. CCA member Stan Honey tells the story of having navigated the maxi *Perpetual Loyal* in the Sydney Hobart Race, and then receiving a call from the crew as he and Sally toured Tasmania. The entire instrument network was "down" and the vessel was unable to be sailed back to Sydney.

Stan and Sally returned to the sailboat and began diagnosing the problem. "*Loyal*" was a very complicated boat with perhaps 40 devices connected to the network. Stan had a diagram showing how the network was connected, so he didn't have to trace wires throughout the 100' boat. His technique was to divide and conquer: by disconnecting the network at particular junctions, he could isolate the problem based on whether the disconnected components allowed the rest of the network to function correctly. (N2K fans will know that this is aided by having an extra male and female terminator when you "break" the network.) After a relatively short search, Stan was able to find a user-installed connector (not molded) that had a poor connection, and thus was the item that brought the entire network to its knees.



A user-installable N2K connector used when shortening wires, passing them through small holes, or repairing a damaged connector.

Stan's advice for preventing similar problems on your boat:

1. Have a network diagram.
2. Avoid at all costs user-installed N2K connectors. When necessary to pass a N2K cable through a very small hole, use a [wago strip](#) inside a waterproof junction box to make the splice, rather than a user-installable connector.
3. Understand how to isolate portions of the network so that you



One of about a million Wago strip variations.

can find the offending component or connection. On my Alerion Express 38, my N2K network went kaput, caused by a defective B&G masthead sensor. By eliminating the sensor from the network, everything else worked perfectly (and B&G replaced the masthead under warranty...)

4. Finally, if you have mission-critical displays on deck, and the vessel would be imperiled without at least some of them, put half of the displays on one leg of the network, and the other half on a separate leg of the network. This allows you to disconnect half of the displays relatively quickly if necessary, yet leave the other half operational.

A single point of failure on a network is obviously to be avoided. Knowing what to do should an item or connection fail is a core skill of the navigator, boat captain, or electrical guru onboard.

The Cruising Club of America is a collection of accomplished ocean sailors having extensive boat handling, seamanship, and command experience honed over many years. "Safety Moments" are written by the Club's Safety Officers from CCA Stations across North America and Bermuda, as well as CCA members at large. They are published by the CCA Safety and Seamanship Committee and are intended to advance seamanship and safety by highlighting new technologies, suggestions for safe operation and reports of maritime disasters around the world.