SPACEWIRE AND IEEE 1355 REVISITED

Session: 6. SpaceWire Standardization

Long Paper

Dr Barry M Cook, C Paul H Walker

4Links Limited, Bletchley Park, Milton Keynes MK3 6ZP, England

E-mail: [Barry, Paul] @4Links.co.uk

The ECSS SpaceWire standard includes a list of changes from the standard from which it was derived, IEEE 1355. Several of these changes are improvements, for example fixing the initialization state machine, adding Time Codes, and adding a network layer.

What the list does not include are a number of aspects of 1355 that are being requested by user missions. In some cases, the need is sufficiently strong that the missions have developed and are already using adaptations from the SpaceWire standard. This paper will consider these needs, with particular reference to where they were covered by IEEE 1355 or by the transputer link technology on which 1355 was based.

1355, in common with FireWire, USB, and PoE, carried power down the signal cable, and this was abandoned by SpaceWire. Several SpaceWire developers have found that power management is important and could be assisted by having power down the signal cable. The US Air Force Research Laboratory, for their PnP-Sat, have adopted a different connector and cable configuration, with the 28V bus carried in the cable, with individual power management for each cable.

Whereas the 0V and 5V pins of the 1355 connector formed a virtual earth shield between the two directions of signals in the cable, the absence of the power pin on the SpaceWire Micro-D introduces an asymmetry such that crosstalk between the two directions, and unwanted RF emissions, are inevitable. To overcome this problem, and the additional problem of traversing bulkheads, NASA have commissioned a special twinax connector for certain applications of SpaceWire.

While 1355 allowed any length of packets, the transputer technology severely constrained packet length, and ensured that buffer sizes exceeded the packet length. While the lack of constraint has many advantages, users are asking for means to multiplex a number of slow channels over one fast SpaceWire link. A simple solution is to constrain the packet length and to use store-and-forward buffering whenever there is a change in link transmission speed.

The authors would not suggest reverting to IEEE 1355, for which most of the design decisions had been made fully 20 years ago this year. But we would suggest revisiting the 1355 standard and the transputer technology behind it, to see how SpaceWire might still benefit from marrying the original concepts with today’s technology.