SpaceWire Backplanes
A hardware designers viewpoint
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Presentation content

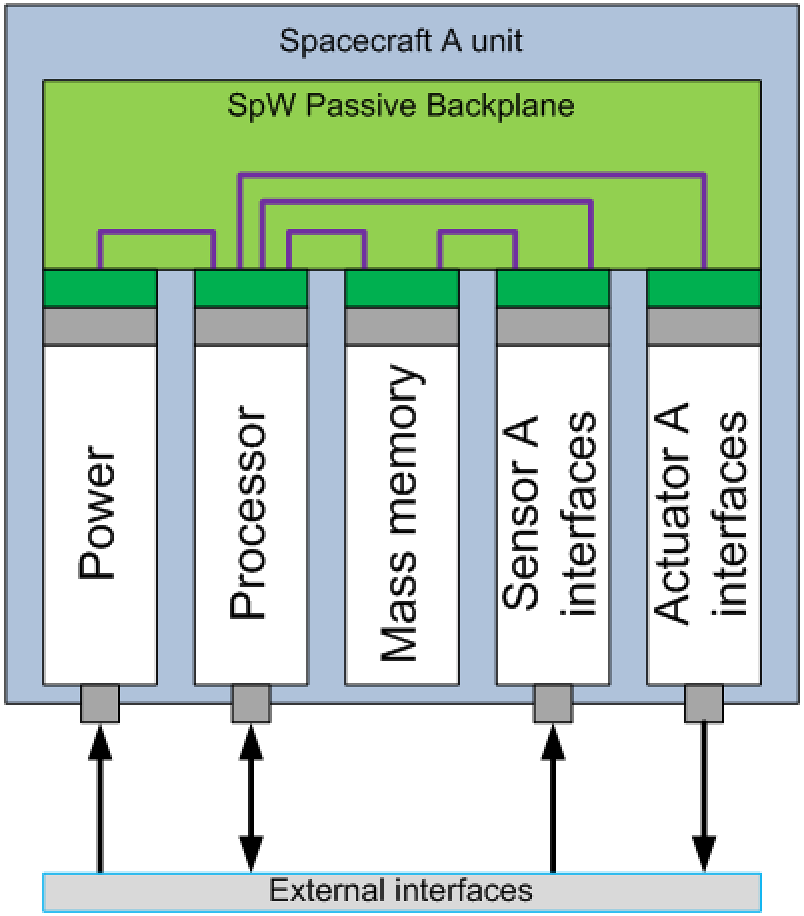
- Are SpaceWire backplanes a good idea?
- What are the pro’s and con’s of passive and active backplanes?
- What has been done so far to prove the concepts?
- How can we take the concepts forward?

Are SpW backplanes a good idea?

Yes, because (in no particular order):

1. SpW is a well specified and supported standard!
2. Common hardware interface for all modules
3. Potential compatibility between vendors
4. Reduces interconnection count to a board
5. Support devices available (Router etc.)
6. IP Cores available
7. Test equipment available
8. Software interface specification easier?
9. Scalable architecture
10. High rate data transfers (compared to 1553, UART, CAN, SPI, RS422 etc)

SpW passive backplane



What is on a SpW passive backplane?

- A set of connectors mechanically supported by the PCB
- Tracks between connectors

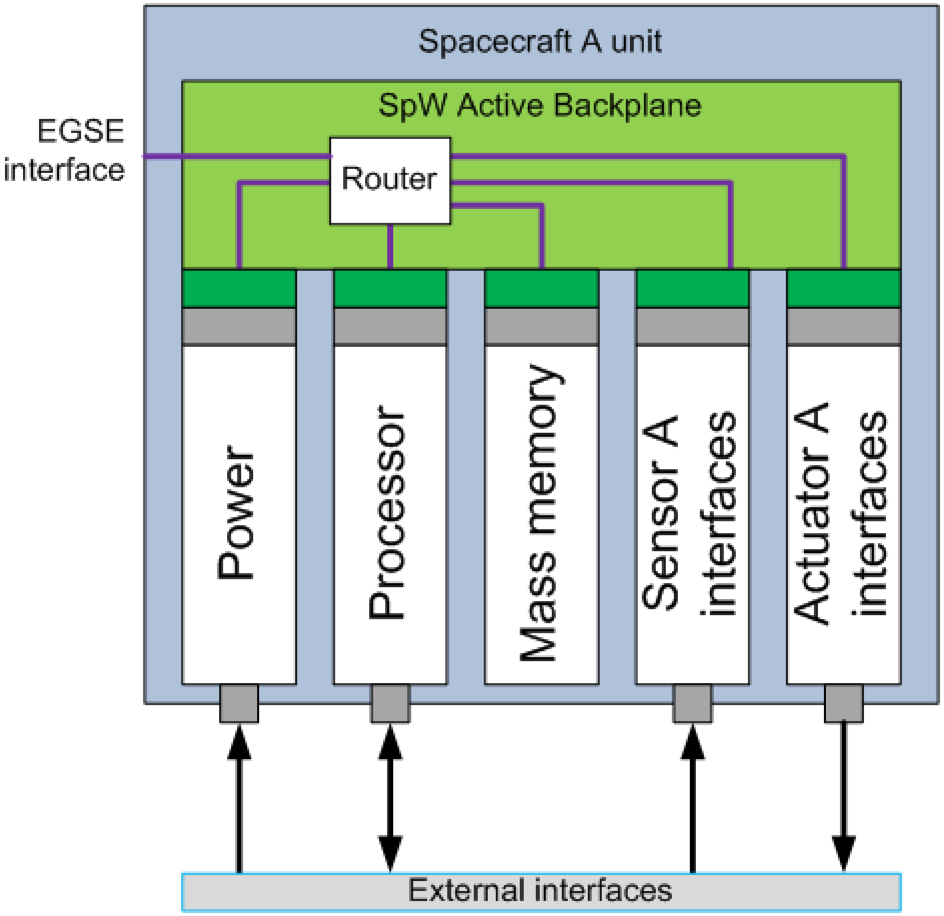
Advantages of a passive backplane

- Simple low complexity PCB design
- Easily tailored
- No power dissipation hence thermal design simpler
- Lower mass

Disadvantages of a passive SpW backplane

- Routing is fixed (or connectors need a high pin count)
- High number of SpW links (N-1) per module to provide full connectivity between N modules
- Access from EGSE to each module restricted?
- Redirecting packets to EGSE at unit level not possible?
- Modules are tied to a particular slot?

SpW Active Backplane



What is on a SpWAB?

- As a minimum, one or more set of routers to provide a SpW network
- Also possibly, power switching and current limiters
  - Switches permit modules and routers to be powered in any combination
  - Current limiters prevent failure propagation from one module to the other system components (e.g. power supply, routers, modules)

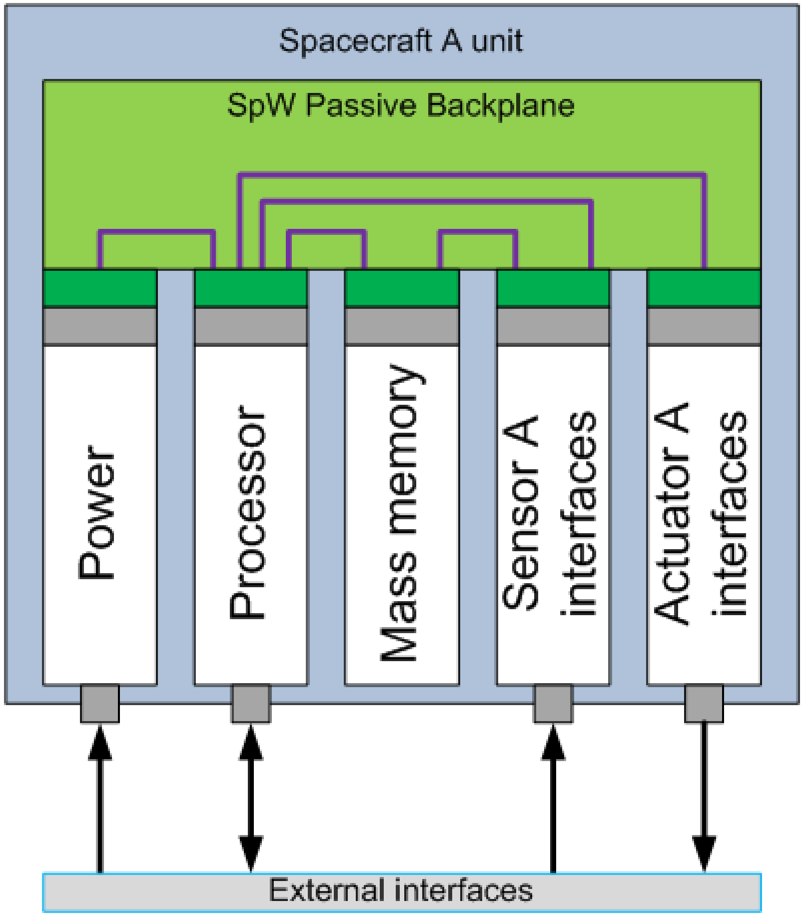
Advantages of a SpWAB

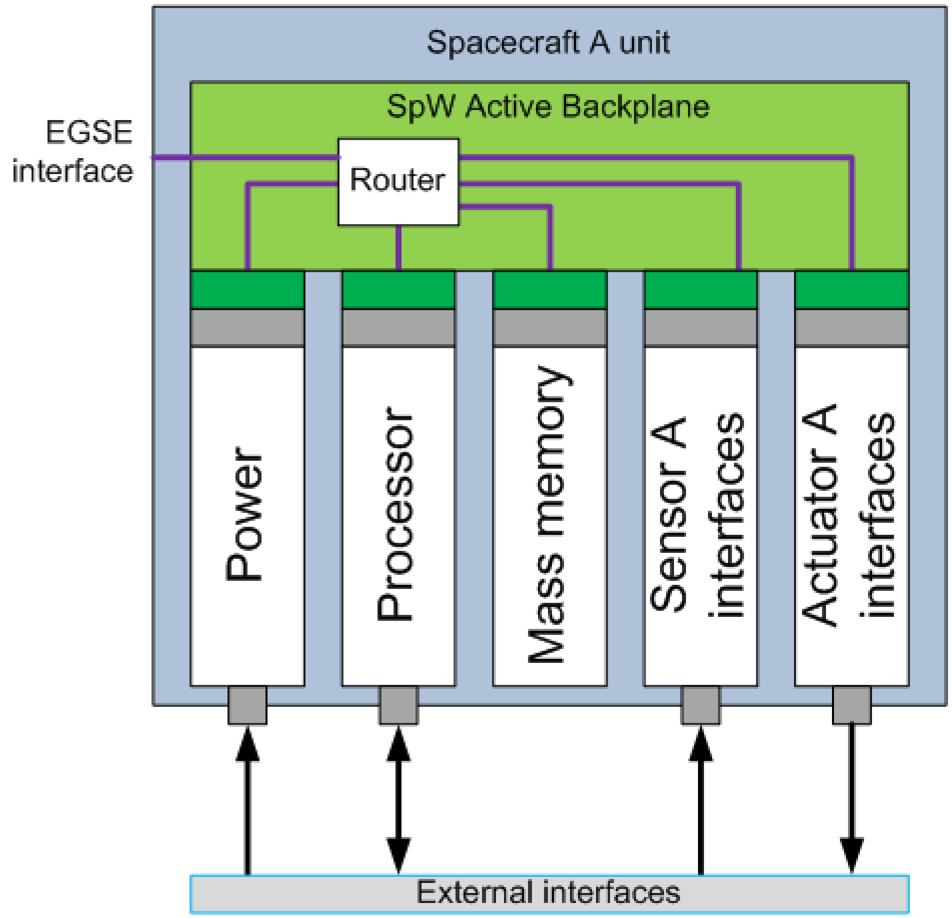
- Decouples the SpaceWire network architecture from the Module design (a single SpW port on a module can communicate with any other module without reliance on routing through another module)
- Improved monitoring of modules for FDIR (watchdog, status)
- Scalable to suit module count and data rate requirements
- EGSE access to all modules independently via backplane
- Presents a fixed low pin count interface to each module so potentially lower connector mass

Disadvantages of a SpWAB

- Power dissipated in backplane makes thermal design harder
- Increased complexity of PCB layout
- Electronic part footprints may dictate connector spacing or increase backplane board size

SpW passive and active backplanes





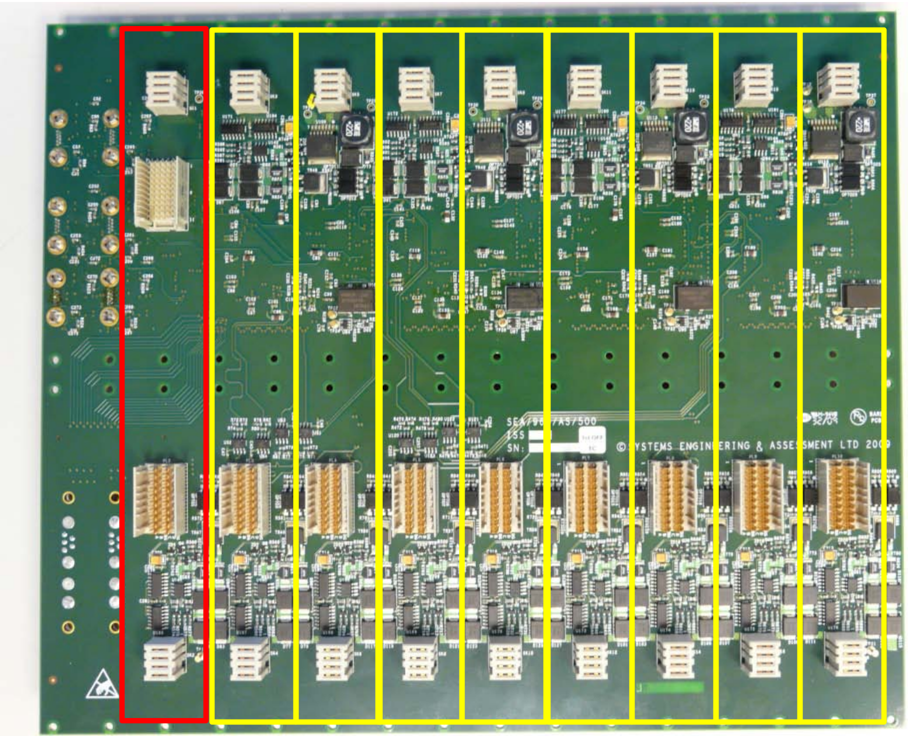
Is active better than passive?

- The answer depends on:
  - Required architecture (passive good for simpler architectures)
  - Number of modules
  - Need for scalability
  - Importance of EGSE access to all nodes
  - Redundancy approach (dual redundancy or “m from n”)
  - Whether module power on/off control and power rail protection is needed
  - Whether a “flexible” architecture is needed

MARC demonstrator rack

MARC a working example

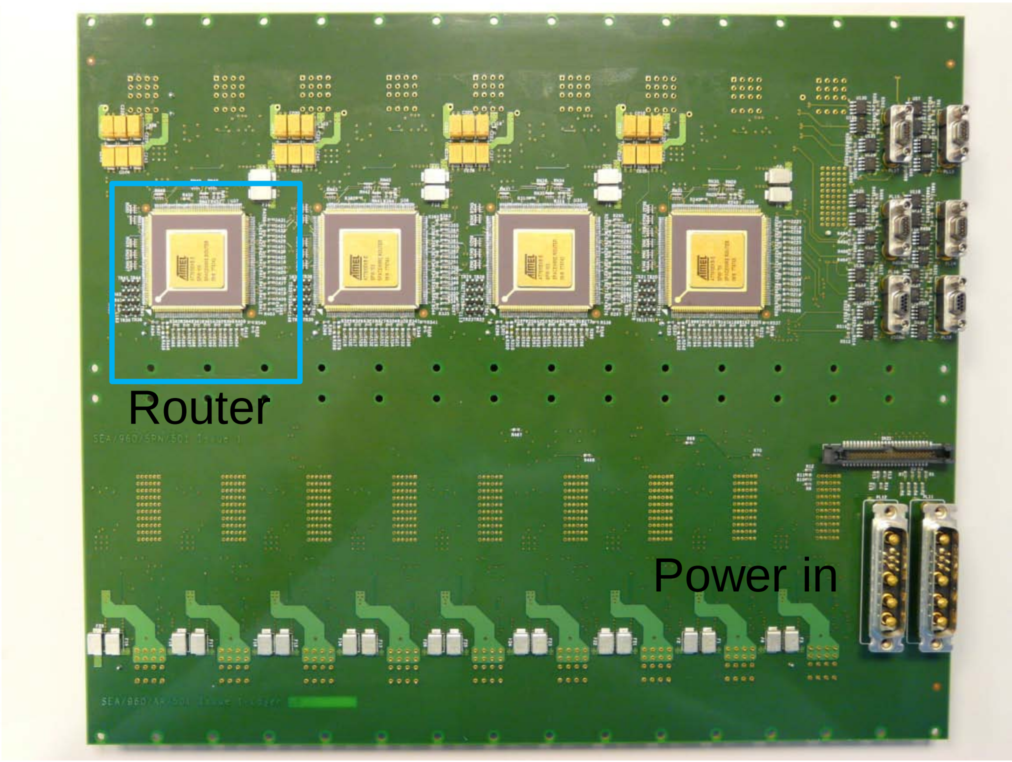
Front - Module mating face



Reconfiguration controller

Module slots (8)

Rear of backplane



SpWAB migration to flight

The Routers exist but we need 3 principal developments to migrate the MARC SpWAB design to flight:

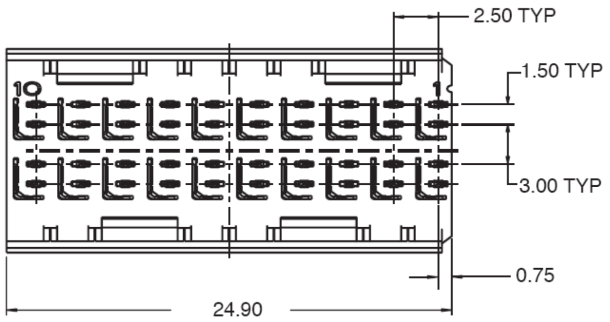
1. Compact Point of Load converters incorporating over-voltage protection
2. Small Latching Current Limiters with isolated redundant switch controls and a means to monitor the current and voltage
3. Develop a connector with a mix of controlled impedance and standard contacts that can support at least two SpW links

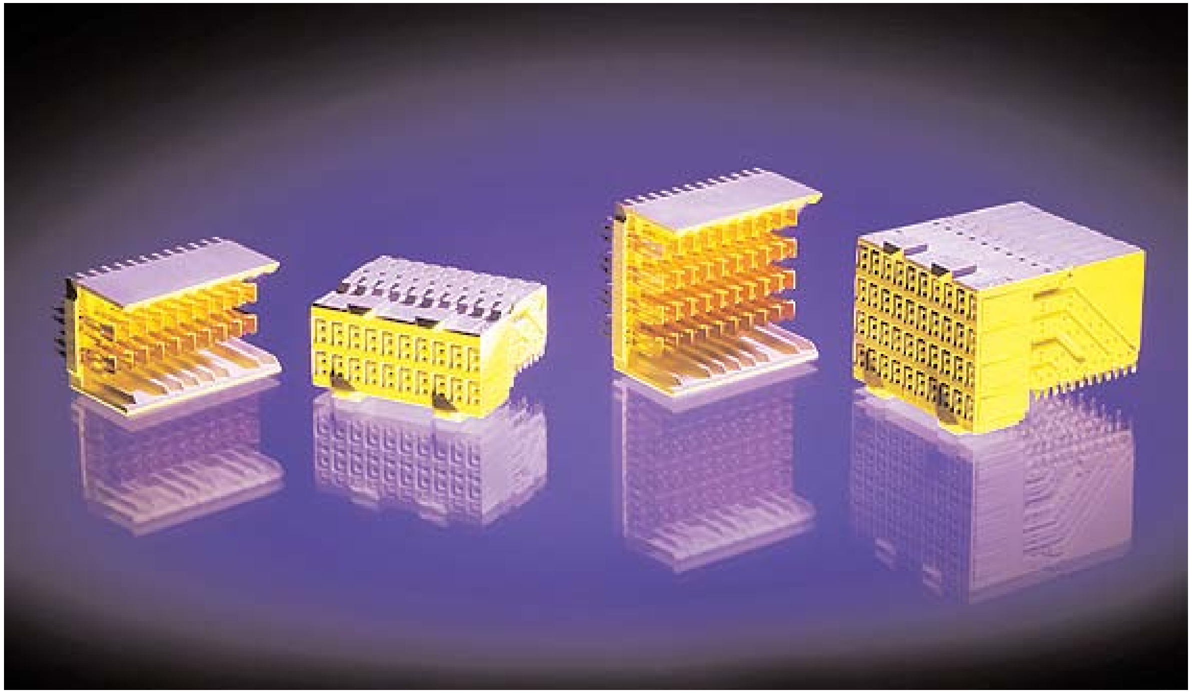
Questions?

Any questions?

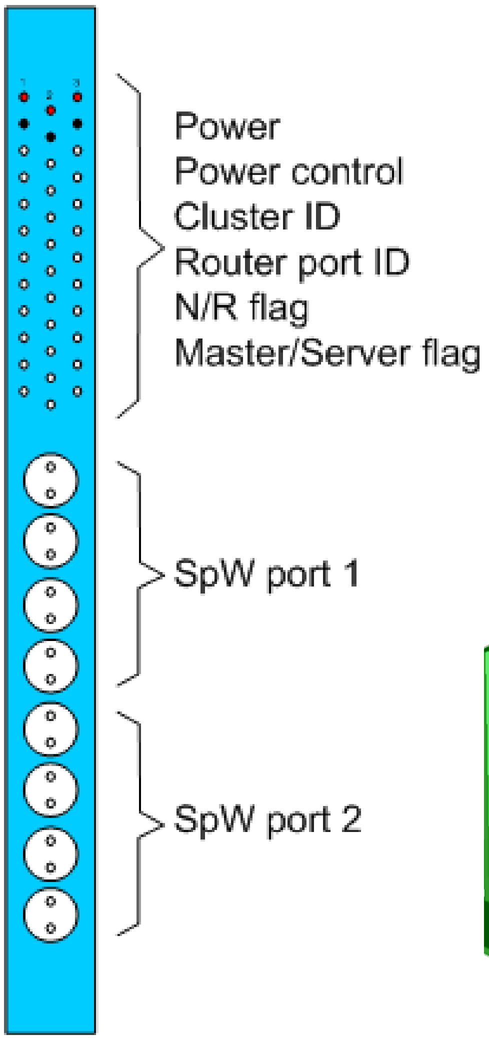
Commercial grade backplane connectors

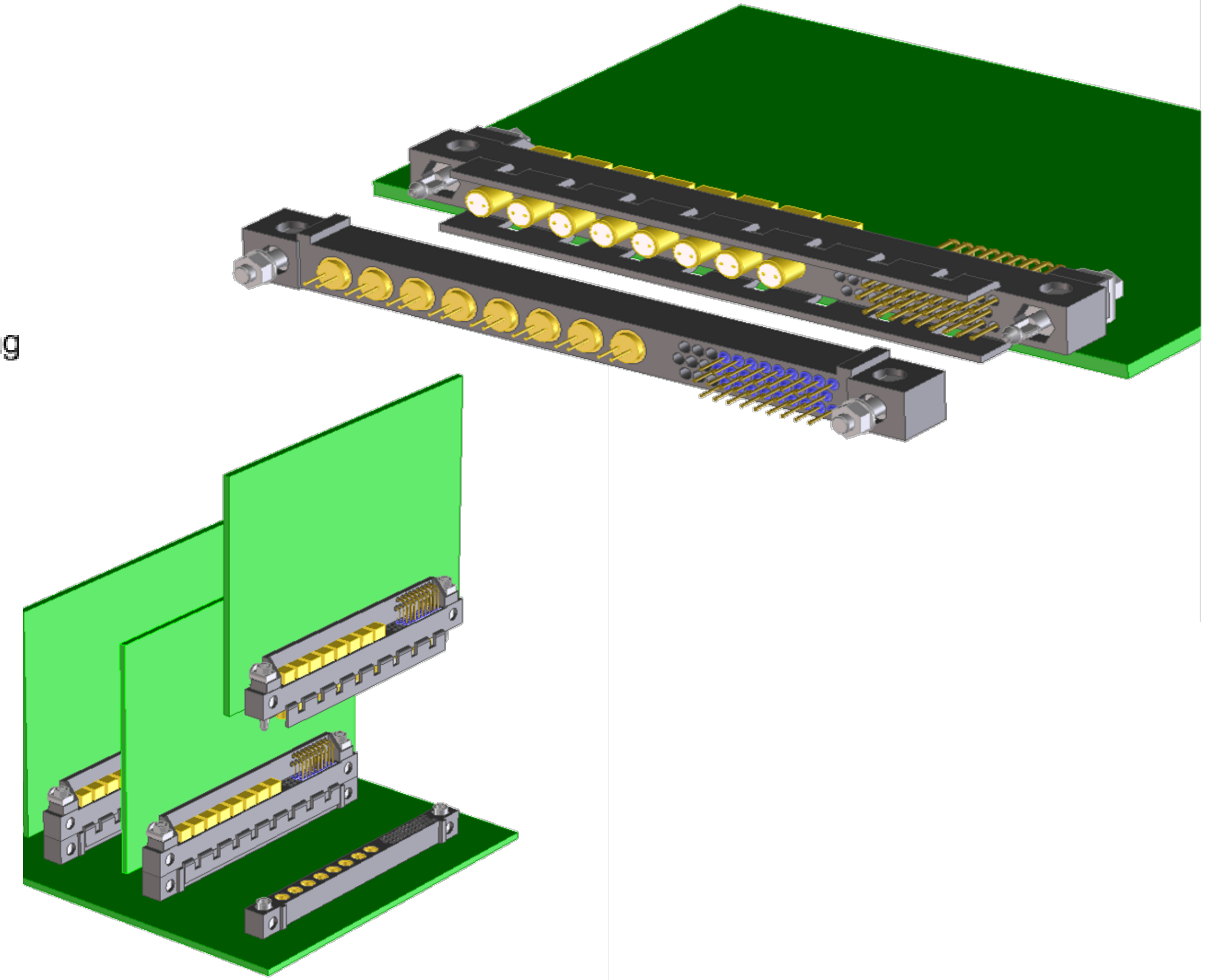
- Ideally we need a controlled impedance connector to avoid SpaceWire signal degradation
- COTS connectors (not suitable for space): Tyco AMP HmZd offer solutions up to 10GHz





Flight connector concept





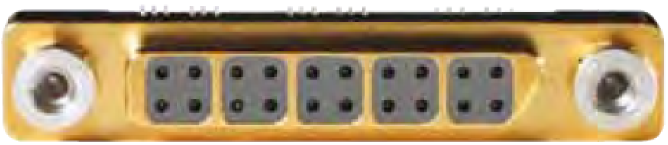
A new high speed connector

sRIO XAUI FIREWIRE PCIe USB ETHERNET CameraLink

AirBorn

HIGH-SPEED CONNECTORS

MULTI-GIGABIT HYBRID



High speed solutions for mission critical applications.

Configurable

AirBorn connector

AirBorn

Rugged Cable I/O

1 thru 10 High Speed Modules
0 thru 50 Signal Contacts

MMHS