SpaceWire Backplane

ESTEC Contract No 4000104085

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Key objectives

1. Trade off different backplane architectures and technologies to produce a SpaceWire backplane specification for **ECSS standardisation**.
2. The SpW-Backplane specification shall
    a. use a **standard backplane connector with clear path to a space qualified version**
    b. define a **variable/expandable number of slot/boards** for the backplane.
    c. define a number **SpaceWire interconnections and high speed serial links to co-exist on the backplane**.
    d. specify **fault tolerant power distribution**
    e. use an **appropriate number of SpW links, HSSL and discrete I/O per module**
    f. host **general I/Os**
    g. ensure good signal integrity for high speed signals up to **2.5Gbit/s and beyond**.

The need for a SpWBP specification

User needs for a SpW backplane specification:

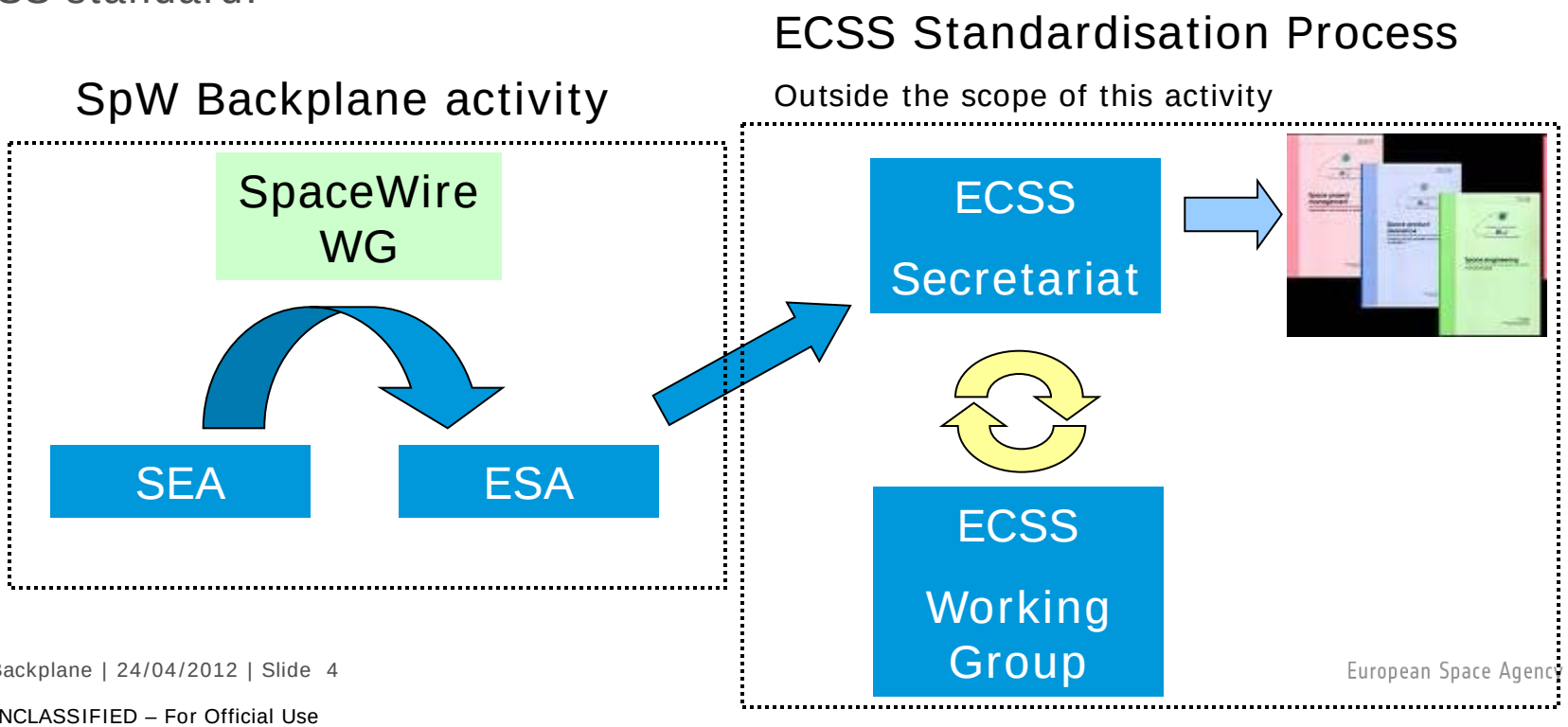
1. Reduce **NRE** development costs for avionics systems.
2. Satisfy use of both SpaceWire and next generation HSSL.
3. Highly reliable and scalable architecture.
4. Standardised way of implementation
5. Interoperability between equipment vendors?

Meeting these needs may be achieved by:

1. Prototyping and agree on a common denominator for the SpaceWire backplane.
2. Fund activities to aid prototyping and development of standardisation proposals.
3. Formalise a SpW Backplane standard within the ECSS framework.

ECSS SpW Backplane draft specification
review process

1. First draft of specification to be reviewed by members of the SpW WG
2. Time frame is foreseen between two WG meetings
3. Inputs from SpW WG should raise the maturity level
4. Goal is to define a draft specification which shall be used as baseline for a ECSS standard.



ECSS SpW Backplane draft specification
contents

Clauses suggested to be included

a. Connectors and signal configuration
   - SpW pins, user pins, reserved pins etc.

b. Module and backplane physical dimensions (form factor).

c. Power distribution

d. Routing topology
   - **Should not impose a strict passive or active backplane.**

e. Design rules in line with other ECSS quality assurance standards.

f. Test criteria
   - Mechanical and electrical


ECSS-Standard-ST-Number
ECSS Standard Issue Date

EUROPEAN COOPERATION
ECSS
FOR SPACE STANDARDIZATION

Space engineering, product assurance, management

SpaceWire backplane specification

This document is a preliminary proposed ECSS draft standard to be drafted during a study before circulated for review and comments.

It is therefore subject to change without notice and may not be referred to as an ECSS Standard until published as such.

ECSS Secretariat
ESA-ESTEC
Requirements & Standards Division
Noordwijk, The Netherlands

Adopt Concepts from Existing Terrestrial Standards?
"Newer" standards

1. **PICMG AdvancedTCA 3.0 R3.0**
    a. The PICMG 3.0 "core" specification will specify board, backplane and shelf mechanicals, power distribution and the connectivity required for system management.
2. **PICMG AdvancedTCA 3.4 PCI Express**
    a. Define how PCI Express and PCI Express Advanced Switching transport is mapped onto PICMG 3.0
3. **PICMG AdvancedTCA 3.5 RapidIO**
    a. Define how Serial RapidIO transport is mapped onto PICMG 3.0
4. **PICMG EXP.0 R1.0**
    a. Define the connector, electrical, and mechanical requirements of 3U/6U System Boards, Peripheral Boards, Switch Boards, and Backplanes using PCI Express as peripheral interconnect with CompactPCI interoperability features.

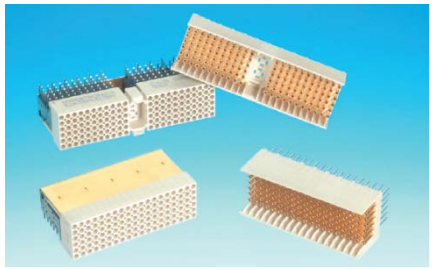
Adopt Concepts from Existing Terrestrial Standards?
"Newer" OPEN standards

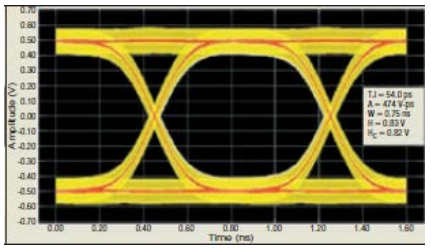
1. **ANSI VITA 46.0 (VPX) and 46.3 PCIexpress over VPX**
    a. PCIe on VPX Fabric connector
2. **ANSI VITA 65 – OpenVPX (VITA)**
    a. Approved in June 2010
    b. Adapted for military/aerospace that needed ruggedized systems
    c. Specifies a minimum set of backplane configurations – also suitable redundant architectures.
    d. Gives clear information about data rate, routing topology and fabric topology that has to be used on the backplane.
    e. Contains a number of sub specifications for ruggedized solutions.

Which backplane connector?
Impedance matched connector or not?

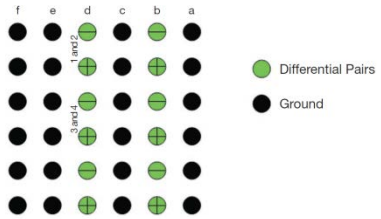
For SpW links from 200 Mbps upto 400Mbps

- Impedance matched connector may not be necessary.
- SpaceQ cPCI connector looks promising (to be tested) to fullfill SpW needs. (Hypertronics K2A)
- Need careful diff. signal to ground pin arrangement to avoid crosstalk and signal distortions.





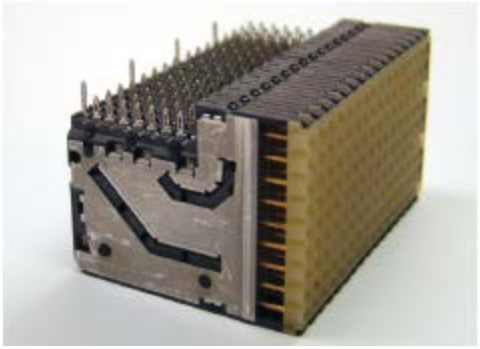
1.25Gbits w. NEXT

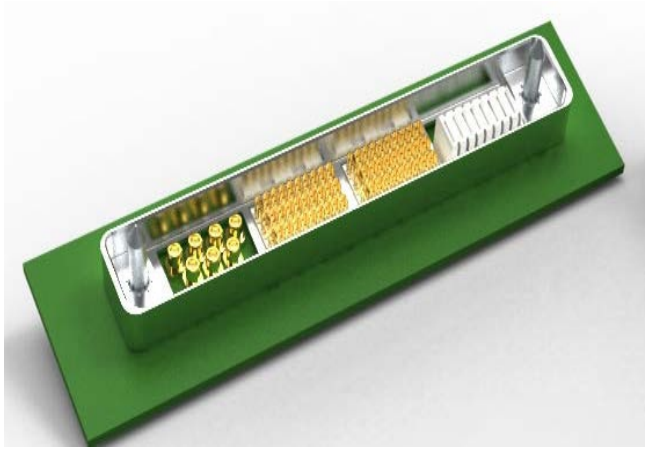


Which backplane connector?
Impedance matched connector or not?

For SpFi links from 2.7Gbps and beyond:

- Impedance matched connector is needed
- No good Space Q alternative yet.
- Some promising candidates are emerging
    - E.g. Hypertronics KVPX, Tyco HSR
- Little information is available
- ITAR restrictions are a concern

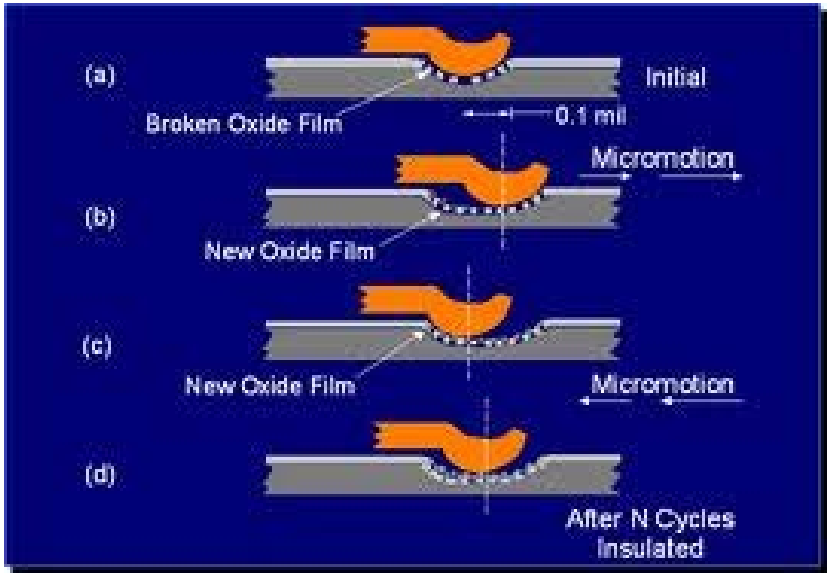




Other requirements for the connector

Impedance matched and high density,- but

a. Must show no pin fretting when subjected vibration
b. No corrosion during long term exposure
c. Support number of mate and de-mate cycles.
d. Acceptable insertion force levels.
e. Space approved materials



Thank you!