Development of Connectivity Solutions for telecom payload applications.

Review of Co-Engineering program.

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Outline

- With the ever developing world of Telecom satellite payloads we see more requirements to meet a production based scenario, in parallel to the traditional bespoke payloads the need for more repeat builds determines us to re-evaluate how we do things and why.
- From an RF connectivity perspective, historically we have designed, routed and attached each RF cable in turn following a path between multiple different equipment's.
- If we are to encompass a production mentality we need to challenge many aspects of design, production, assembly and test, aiming to standardise and simplify where ever possible, in my world this is RF connectivity.
- How can we therefore improve the RF connectivity?
- One solution is to route multiple RF path at the same time, which means moving from individual RF cable assemblies to multiple RF cables assemblies in the form or multiway RF connectors and harnesses.

Outline

- The team assembled by Airbus Defence and Space included the equipment design, system architects, connector and cable designers and harness specialists.
- The goal to assess the product ionisation of a Telecom payload design team requirements
- This required a great deal of communication and co-engineering to ensure the final payload solution worked successfully and would do so for the lifetime of the payload, and could be produced effectively.
- Each member of the team brings unique skills and experience, managing the team successfully ensures the payload application works.
- The specification created by the team addresses harness requirements, and must address the real life scenario the payload team deals with, the Airbus equipment specialist, brings expertise supporting the connector and cable manufacturers to create products addressing multiple payload criteria.
- One of the major tasks facing the Airbus Defence and Space team was to ensure the solution was not single sourced, which could introduce additional commercial risk.

RF Connectivity elements

Connectors

- Looking at the market for RF connectors and particularly multiway RF connectors there are many options and variants available, each suppliers taking a slightly different view on the solution, based on their knowledge and current product portfolio.

Cable

- The cable partner needed to understand both the system needs and the connector parameter in order to carefully select the cable type, construction and materials.
- Question to be answered was how to use in harness in flight scenario.
- As with the connectors, the cable needs to match the connector characteristics to ensure best signal performance.
- The needs for manufacture, assembly, integration and routing are also addressed.

Cable assembly

- Every cable assembly is more than a sum of its parts, the process of attaching the connectors to the bulk cable is critical to the final result, only be working with both the cable and connector suppliers can the best performance be extracted from the bags of bits.
- Every connector is designed with ideal mating and matching characteristics

RF Connectivity elements

Harness assembly

- Each cable assembly provides the RF path, payload's are made up of multiple units and many RF signal paths, so when the cable assemblies can to be bundled together and routed to meet the payload accommodation requirements and without affecting the signal integrity there is significant advantages to production.

- The supplier has to have both connector and cable expertise in order to make sure the cable assemblies work efficiently, and further experience in harnessing has proved critical.

Co-Engineering – Working together towards single goal

It was clear to the Airbus Defence and Space team that despite the wide variety of RF connector available nothing quite met the system, production or commercial needs.

- Here we undertook to work with suppliers to provide a suitable solution by working with the supplier in a Co-Engineering approach.

- Each area of Airbus Defence and Space interprets this approach in a slightly different manner, for Telecom satellites we approached a number of suppliers, all of whom had similar products, and opened discussions regarding our needs and their solutions.

- To make the process work all parties need to invest with trust and openness to make the Co-Engineering work, on both sides there is a lot of work to do to achieve this, and understanding boundaries, both technical and commercial.

Co-Engineering - Process

- Co-Engineering can come in many forms, in this case I have posed the problem,
- Environment, mass, cost, heritage, the production envelope and RF needs,

- Suppliers bring vast understanding and knowledge of RF connectors and cables.
- We have worked together with Airbus Defence and Space creating the specification for the program needs and the suppliers develop suitable products, at this point it is important to describe some of the rules under which this development takes place and makes success possible.

- The ADS specification describes the
  - environment, RF needs and fundamentally the RF interface

- How the supplier realises this is their IP, as long it the product functions, can be fitted and interconnects with other products to the same spec that is the limit of technical disclosure

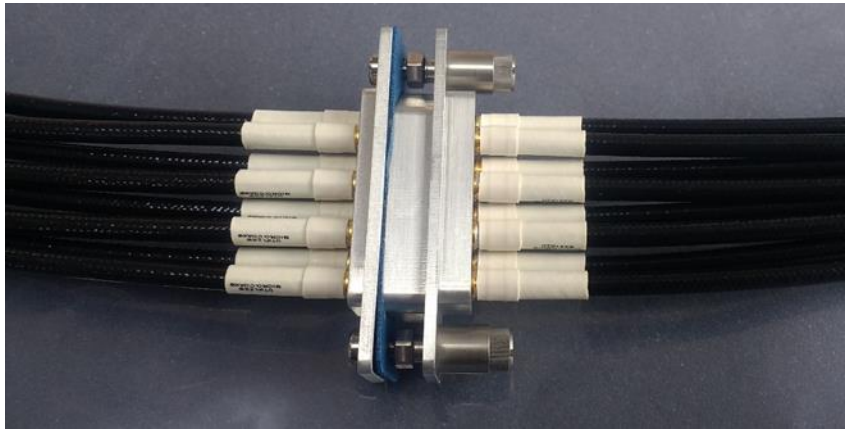
- How the connector is attached, how the cable is constructed etc , is not documented or ‘open source’, so each supplier can also bring their own ‘magic’ to the team

End result

- Implementation of the multiway harness has also impacted the production time, historically each threaded RF connector would need installing, routing, torqueing and re-torqueing, the multiway RF connector also needs installing and routing but is 2/4/8 times more efficient since it is now a group of cables and RF connections.

- Understanding the overall requirements for Telecom payload applications could Airbus Defence and Space work with various different suppliers' to successfully develop a flight multiway RF harness.

- Co-engineering is much talked about term but in the case of the multiway RF harnesses currently being developed by Airbus this is a real life, real time, real world scenario that has produced great results.



Multiway RF connector – Mated Male and Female

Conclusion

- I would like to extend my thanks to all the team members who worked together to make this project a success, without the support and cooperation from the suppliers design teams the connector designers and cable manufacturing teams and the experts within Airbus, we could not have created this multiway RF harness solution for production line commercial telecom satellites.