OEM’s increasingly demanding 10 year warranties over 10 year design-lives

Many nations have prioritised control of territorial waters and stepped up their investment in submarine and anti-submarine fleets. Older platforms are increasingly subject to life extension programmes whilst future submarines are being designed with ever more complex combat systems and operational capabilities.

This drive towards increased submarine capacity is accompanied by a marked shift in how the backbone infrastructure is considered. Changing demands are driving fresh thinking and a demand for high reliability in cable systems which then deliver the performance promise of the sonar and combat system over the whole operational life of the submarine.

Historically considered almost a commodity, inboard and outboard cabling has been left to Prime Contractors to scope and install. With a growing recent history of serious failures in service, OEMs are demanding greater importance be attached to the supporting architecture. Cabling increasingly recognised as the central nervous system of any platform.
What has effected this changed approach?

Lessons learned extend back over half a century and across multinational programmes with astute engineers now reaching out to subject matter experts to provide the specialist knowledge lost from many navies. With perhaps one of the most significant step changes relating to cable jacket materials.

The majority of submarine cables have either polyethylene or polyurethane jackets. Each material has unique advantages and disadvantages, their effective use depending on in-depth knowledge of those properties.

The depth of knowledge required for getting it right first time, nowadays has been significantly diluted since the 1960s, when the core technology was proven and established in UK submarines for the first time.

Invented in 1933, Polyethylene (PE), is a difficult to work thermoplastic, bringing a unique combination of excellent dielectric characteristics (particularly at high frequencies), high electrical resistance, low moisture permeation, and low water absorption - as evidenced by the man-made plastic pollution across the world’s oceans - PE does not degrade over time.

Cable grade polyethylene is inert in the ocean, it delivers order of magnitude better insulation resistance that other materials, and this performance does not degrade at higher operating temperatures. Crucially PE does not absorb water or moisture over time as other materials do, which is what makes it the only jacket material that can be relied on to deliver 30+ year sealing performance.

Despite the numerous benefits of PE, it is notoriously difficult to process, atomically bond and amalgamate - as widely reported by the USAs General Dynamics as early as the 1970s (Haworth, 1973) and remains a challenge today. Successful atomic amalgamation bonding has only ever been delivered by one specialist manufacturer for the naval defence market since the late 1960’s in the UK. Ever since, it has been the cable of choice for the Royal Navy and Commonwealth fleets and is reflected in their Defence Standards.

Where PE material chemistry could not be mastered, a thermoplastic Polyurethane (PU) jacket was used in substitution. PU is a viscous elastomer, which means it has greater than PE and this offers different performance and properties but it does not carry the inherent advantages of PE.

PU is not suitable as an electrical insulation material but has some outstanding properties for cable sheathing, making it a suitable jacket material for high performance electrical cables in challenging environments. PU sheathing is extremely wear-resistant and mechanically tough - it’s very difficult to cut or tear. It also has excellent ageing resistance against environmental humidity, ozone, UV radiation and microbes. A useful characteristic of PUR as a sheathing material is its anti-kink properties, making it an ideal choice for flexible and retractable cables.

However, PU is hygroscopic - it absorbs moisture at a rate of between 0.3% and 1% by weight, which increases as temperature rises. More rapid PU insulation resistance degradation in ships how an ideal choice for flexible and retractable cables.

Connectorisation

Recent generations of submarines have seen designers explore the use of connectorised electrical hull penetrators (EHPs) for through hull transitions to support flexible manufacturing practice of modular build.

With boats of this design in service and the number of flooded cable failures increasing disproportionately, there is a movement away from this technology. Connectors inherently introduce additional potential failure points which can be avoided by using tried and tested gland technology. Multi gland penetrators offering the service density that EHPs looked to deliver can be configured for modular build but with the reliability of a technology successful for three decades.

So it’s with an eye on through life cost that the astute designers of future platforms are drawing on a heritage of reliability, many thousands of installations with zero leaks. Encouraged to move away from a 10 year design life mentality, instead demanding 10 year warranties and a guarantee of performance over the long term. Rightly, manufacturers should be able to not only eradicate cable leaks, but plug previous defence budgets too.
SCIENTIFIC MANAGEMENT

INTERNATIONAL designs, manufactures and supplies unassailable “fit & forget™” cable harness systems for hostile environments supporting enhanced combat, communication and control systems offering high performance and long term reliability. The TelemetriX range enables rapid, secure and dependable interoperability between critical systems on submarine, surface, and airborne, platforms.

- WE ARE THE PREFERRED SUPPLIER FOR THROUGH HULL PENETRATORS AND CONNECTORS TO THE UK’S SUBMARINE AND SURFACE Fleets
- WE ARE THE ONLY COMPANY TO CONTINUOUSLY HOLD A UK MINISTRY OF DEFENCE CAPABILITY APPROVAL CERTIFICATE FOR MORE THAN 20 YEARS
- 10,000 INSTALLATIONS – ZERO LEAKS