

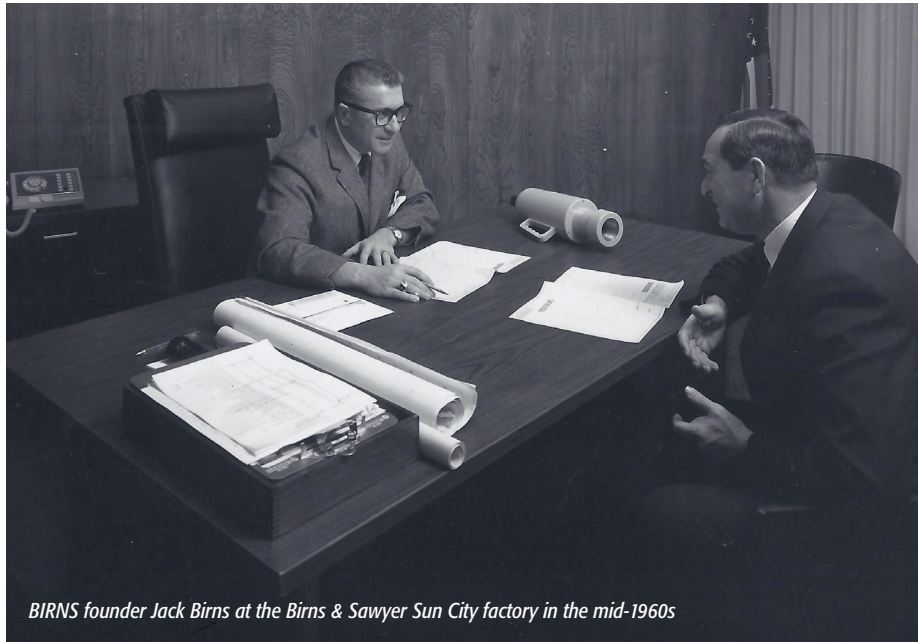
Six decades of marine

By Amy Brown, director of corporate communications, BIRNS, Inc., USA

BIRNS, Inc. celebrates a 60th anniversary milestone

The year is 1954, and Jack Birns has surprised his family by taking an abrupt detour from his successful career as an award-winning photographer for *LIFE Magazine*. After years of travelling the world and taking powerful images of civil war ravaged China and the rugged beauty of Asia during that turbulent period, Birns finally decided to leave the world of journalism. However, he elected to stay within the realm of imaging, and opened up Birns & Sawyer, a small family-run business in Hollywood, USA, that specialised in underwater camera products. By 1957 the product line expanded with the development of the first underwater motion picture camera housings with 400-foot (122-metre) magazines for highly classified projects for the US Navy. From there, the company was asked to create more new and exciting product lines for underwater use, including advanced subsea lighting systems for the US Navy for its new SEALAB programme.

Thanks to the success of those early lighting iterations, the company was called

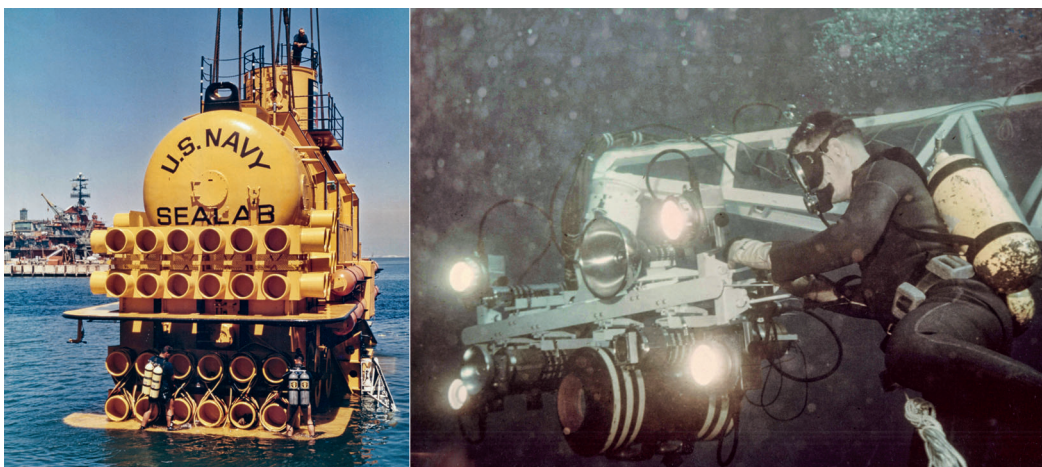


BIRNS founder Jack Birns at the Birns & Sawyer Sun City factory in the mid-1960s

upon to design and produce diving and vehicle lights for the growing offshore oil and subsea science industry. By the mid-1960s, Birns & Sawyer was producing underwater connectors for some of its diving lights, with bulkhead connectors and mating rubber moulded cable connectors. The company's lights and connector systems soon needed to withstand much greater depths, as in 1971, when it developed the BIRNS Deepie, tested to an

equivalent depth of 42,000 feet of saltwater (13 kilometres). In 1978, the company became BIRNS, Inc., to focus on the exciting opportunities that continued to unfold in the subsea lighting market. One of the many company innovations involving both lights and connectors launched during that period was the first self-contained underwater magnetic particle inspection system. The groundbreaking new BlackBIRN system allowed a single diver to detect oil leaks and cracks or weld defects in underwater steel structures, eliminating the need for dry-docking for such inspections.

While the company's lighting systems were setting benchmarks for quality and innovation, BIRNS also began receiving huge market interest in the top quality connectors the company was making for its lighting lines. Thus, BIRNS began providing the industry with connector systems on a subcontract basis by the 1980s, and then went on to develop some of the most advanced connector systems in the industry.



The SEALAB habitat featuring Birns & Sawyer lighting systems, with Aquanaut Wilbur Eaton

industry excellence

Many of the company's present capabilities emerged from its own needs as a connector user – as both a connector user, and a connector manufacturer, the company was, and still is, in a unique position to determine new ways to innovate and improve on this key component of many subsea systems.

HISTORY IN THE MAKING

The initial BIRNS rubber connectors were relatively simple systems, like those the company designed for the early square BIRNS Mark IX light (circa 1965), with a three-pin bulkhead connector and mating cable connector. Rubber connectors were typically used for medium power or signal applications, or for applications where weight or magnetic signature were

considerations. They were made of a durable elastomer that could not chip or dent, but still offered a minimal magnetic signature paired with strong corrosion resistance. By 1988 BIRNS was engineering epoxy connectors, robust options moulded of a rigid high-strength dielectric glass reinforced epoxy (GRE). They featured higher pin density options than the rubber versions, yet were still extremely lightweight and rugged.

BIRNS began making robust metal shell connector lines in 1990, and designed and fabricated advanced tooling in-house on custom CNC machines. The new metal shell series had highly sophisticated inserts to withstand cyclically applied open faced pressure to 10,000psi and voltages to



An early iteration of the Mark IX light used on the SEALAB II habitat, featuring a BIRNS bulkhead connector with three 14 AWG conductors

4000VDC between contacts a mere 0.025 of an inch (0.6 millimetres) apart. The contacts were designed per MIL-C-39029 and machined in the company's factory to

Connectors/Cables

tolerances of ± 0.00025 of an inch (0.006 millimetres). The rapidly growing company now had the capability to mould and/or bond to Teflon, polypropylene, nylon, PEEK, GRE, ABS, neoprene and polyurethane.

A NEW MILLENNIUM

Shortly thereafter, BIRNS launched the BIRNS Millennium line of deep submergence, high-density connectors for both solid and oil filled cables. These advanced six-kilometre rated connectors pushed the envelope for performance and precision engineering, and provided new opportunities for excellence in what was already becoming a highly competitive field. BIRNS poured R&D resources into creating the flagship of its connector line, developing a range of competitive advantages for the growing demands of the subsea connectivity market. These high performance connectors were both extremely robust and high open-faced pressure rated. They featured contacts with 50 micron layers of hard gold atop 50 microns of hard nickel per MIL-G-45204 Type II, Class 1 to provide a highly reliable finish that reduced voltage drop. The line also featured insulated solder pots with GRE partway up each shaft to provide a completely insulated termination, eliminating electrical interference between pins. Each solder pot had a scalloped end for ease of wiring and termination, with the scallops all pointed out from centre to further facilitate wiring access.

With this series BIRNS also introduced exclusive new technology to simplify insert replacement and protect its dual O-rings, by

adding a unique 15-degree angled moulded O-ring chamfer. The line featured heat-treated BeCu sockets, dual integral self-guiding stainless steel keys, positive stainless steel stops to preclude over-tightening and square threads to resist mechanical damage. Additionally, each connector had several locking set screws to reduce vibration during use. The series permitted the use of 22, 20, 16, 14, 12 and 10 AWG (American wire gauge) contacts in the same connector, without the need for cumbersome, incompatible 'Regular' and 'Long' sizes.

This versatile, high performance connector series has now advanced to its third generation, and is available in electrical, electro-optical, electro-opto-mechanical, coax and electro-coax options. It can be configured for high voltage – hybrid electro-optical options can include both high voltage ($\leq 3.6\text{kV}$) and low voltage ($\leq 600\text{V}$) conductors – along with a wide range of special configurations for a diverse suite of applications. The series is used worldwide for demanding subsea applications requiring the transmission of huge data streams while minimising electrical noise. Typical optical losses recorded in cable assemblies for the series are $\leq 0.1\text{dB}$ for single-mode and $\leq 0.2\text{dB}$ for multimode.

HYBRID ADVANTAGES

During subsequent years, BIRNS continued to develop new performance attributes in its metal shell connectors, which were used in especially challenging conditions, from extreme depth submergence applications to 2.5 kilometres in the polar ice for the IceCube Neutrino detector



Rugged BIRNS cable assembly for the IceCube Neutrino Observatory in the South Pole: a high-power BIRNS Primus connector with four 2 AWG contacts for the hot-water drill pump at depths of 1.5km to 2.5km in the ice cap, and BIRNS Millennium 3G connectors for its temperature and pressure sensors

project in Antarctica. An early sophisticated hybrid connector contract for the company came in 1991 when major marine geophysical equipment manufacturer, Halliburton Geophysical Services, USA, standardised on BIRNS electromechanical 30-pin connectors for its towed 3D/4D geoseismic streamer line, which sent huge volumes of multiplexed data through BIRNS connectors that also supported several thousand pounds. Subsequently, BIRNS was asked to develop a robust hybrid high voltage electro-optical cable assembly for the US Naval Facilities Engineering Service Center (NAVFAC ESC) for a new low frequency active sonar (LFAS) system. It included a BIRNS Millennium 3T connector pair with two multimode optical fibres, eight 2.5kV conductors and four 600V conductors.

CONTINUAL IMPROVEMENT

The company continued to grow and advance both its product lines and infrastructure, and in 2009 BIRNS' Quality Management System was awarded ISO 9001:2008 certification. To add to the company's impressive list of rigorous industry qualifications, all of BIRNS' expert electrical technicians and assembly and inspection personnel received and continue



Development of a custom electro-optical cable assembly with two multimode optical fibres, eight 2.5kV conductors and four 600V conductors for the US Naval Facilities Engineering Command/Engineering Service Center

to hold J-STD-001 Class 31 (Requirements for Soldered Assemblies) and WHMA-A-620-A Class 3 (Requirements and Acceptance for Cable/Harness Assemblies) certification. BIRNS' moulding facility received coveted NAVSEA PRO-020 certification, making it one of only seven such commercial organisations in the US. This elite qualification is from the US Navy, and is awarded to organisations deemed capable of overmoulding outboard cables for naval submarines. With a state-of-the-art hydrostatic pressure testing facility with numerous test vessels, BIRNS pressure tests its connectors and cables assemblies up to 20,000psi, and also serves as an independent testing resource for the industry.

Today BIRNS is a global leader in high performance connectors and custom cable assemblies that continue to shape the face of innovation in the market. BIRNS answers the call for more power, more data and more bandwidth in increasingly sophisticated systems with smaller footprints



Custom electro-opto-mechanical tow cable assembly with BIRNS Millennium 3T CPs with two single-mode fibres and 12 electrical pins

than ever before. The company is renowned for highly advanced connectors ranging from robust, deep submergence electrical options to complex custom electro-opto-mechanical (EOM) cable assemblies. These groundbreaking EOM hybrids are capable of combining delicate single or multimode optical fibres and high voltage and providing mechanical load bearing > 50,000 pounds (22,700 kilograms).

BIRNS has been pioneering in this industry for the last six decades, delivering powerful, elegant systems that provide high performance under pressure. As the exploration of the ocean continues to advance for everything from manned submersibles and towed data acquisition devices to ROVs and AUVs, so does the development of connectivity solutions for use in it.