Zen and the Black Art of the Boomer and Sparker System

Since the 1940s the use of an electrical spark to produce an underwater acoustic pulse has become an industry standard in the retrieval of sub-bottom profile data. Although conceptually simple, continuing demand for improved safety and technology for this type of equipment have spawned successively more advanced designs of Power Supply. From the very early EG&G and Teledyne units of the 1960s and 1970s to the second generation units of the 1980s and 1990s which gave rise to the adoption of solid state chargers and discharge devices, all have contributed towards reduced size, increased reliability and automatic discharge circuitry for enhanced safety.

With the CSP range of power supplies having been firmly established in the subsea survey market, it is now time to take a fresh look at the way in which a sparker system works and at the data it produces. Many power source manufacturers have noted that the design of power supplies is often divorced and isolated from the development of the sound sources to be driven by such power supplies. Consequently, once integrated into systems, the two units may provide reduced performance at the power source and/or transducer 'end'.

Integrated Approach

To address the above points, it is normal practise when designing a commercial sparker array to ensure that it will function with as wide a range of commercially available power supplies as possible. However, what would be the consequence if, instead of designing separate power supplies and sparkers, the sparker were to become a component of the Supply Output Stage and the circuit be treated as one electrical network? Upon initial analysis, this may appear to be a simple proposition and yet it poses questions of cumulative complexity.

Established Theories

There is no shortage of available literature concerning the properties and concept of the underwater spark as an acoustic source, the crossover points of research establishing rules and general assumptions as to the theoretical model and practical operation of sparker systems. A common factor is that data records are often obtained using a mixture of both commercially produced and 'home-made' equipment. In such cases, the chances of observations and assumptions being made from an acoustic perspective may be high when, in reality, such observations should actually relate to electrical anomalies within the system. What is the relationship between the output `electrical' energy and the acoustic energy?

Engineering vs Geophysics

Within an industry such as the contemporary geophysical survey sector there are often wide divides in disciplines between designer, operator and ultimate analyst. These divisions encourage a tailoring of products to appeal to all and satisfy all expectations. Of course, it is impossible to impress everyone, but if we can bridge the gap between engineering and geophysics by adopting the refinement of acoustic signature as a goal, then the product should be a better survey system. Most enquiries from operators are directed towards the resolution and penetration capabilities of boomer and sparker equipment. These questions are fraught with ambiguity and the diverse geology of the world's ocean renders any answer at best to be an educated guess - a fact that may be substantiated by any geologist or geophysicist. However, an engineering perspective may suggest that these issues should be directly related to input power and pulse rate.

Objective Aims

It is too easy to hype one's own products and criticise others. This strategy is not unique to our industry and is fundamental to contemporary business practise. What we would rather do is stress the value of continuous assessment and development. Feedback from clients forms the basis of technical reviews and product improvement programmes. We should be ready to expand this philosophy from the generic product to generic concept, moulding commercially available products from what we think the market may require to what it really requires.

The Future

Present research trends and environmental concerns with airgun and other acoustic sources have produced a renewed interest in Sparker techniques, the most radical change being expectations in terms of data quality and environmental safety. To address this, our organisation has taken a fresh look at fundamentals and is progressing towards power sources with higher energy ratings and dedicated sparker arrays. Research has revealed the possibility of improved pulse signature without the spurious second pulse exhibited by some systems.

Data Retrieval

There is little to be gained from improving the sound source without considering the method of reception. For this reason, extensive research has been carried out with regard to hydrophone transducers. For general survey work there is no substitute for the streamer, but what if the field requirement is not general and greater directionality is required? For these requirements a new type of transducer is required with selectable elements to allow for a more controlled footprint area. This system is currently being field approved and will make an invaluable addition to any Boomer or sparker system.

Open Mind

It is easy to look upon a tool as a singularity and one of closed independent purpose. However, if the field of usage is widened, then any piece of equipment will become more cost-effective. This is especially true of the boomer system. Its clean acoustic pulse offers an

excellent compromise between traditional Pinger and Chirp data, increasing the penetration level of the former and exhibiting a cleaner record than the latter. Current research is also delving into further uses for Boomer systems within dedicated civil engineering roles.

The Present

Although innovation is important, so is the down-to-earth practicality of a survey system. A specification sheet may provide a comprehensive system overview but how does this transpose to the back deck of a vessel and a less-than-perfect ship's power generation system? It is within these conditions that a system is truly tried and tested. The somewhat battered condition of many of the units returned to our service department gives testimony to the punishment that all survey equipment receives in operation. What is perhaps most pleasing is that most faults that are found relate to operational wear and not to intrinsic component failure. It is the question of reliability that is crucial to the long-term success of any product. For this reason, two approaches are taken; firstly to ensure that the product is supplied fully tested, both electrically and operationally, and secondly to teach the techniques to keep the equipment that way.

Many CSP units have been in regular operation for over a decade and for this reason long-term maintenance is being researched. New service and repair guides are being written to simplify the fault diagnostic process and to ensure minimum equipment downtime. It is also an indication of progress that much of the theory of high voltage analogue equipment has been dropped from many technical training courses. Greater emphasis now being placed upon the safety aspects of working with high voltage equipment.

Conclusion

Producing equipment for the hydrographic survey industry has always been a specialist branch of the electronics industry as a whole. It is also often perceived as being a 'black art' with its own inherent principles and often quite abstract designs. All manufacturers should develop for the future as well as ensuring the longevity of their existing products. Ultimately, it is the integrity of the product that matters most, whether this is the product itself, the service to support it or the data that it exists to produce.

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