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QSound

Company at a Glance

Headquarters: HQ in Alberta, Canada. Offices in London, UK, Tokyo, Japan and Hong Kong, China.

Year company started: 1988

Privately or publicly held: Public (NASDAQ: QSDN)

Number of employees: 30



Company History

QSound has established itself as one of the world's leading audio technology companies and has developed proprietary audio solutions that include virtual surround sound, positional audio and stereo enhancement for the mobile devices, consumer electronics, PC/multimedia, and Internet markets. QSound Labs' cutting-edge audio technologies create rich 3D audio environments allowing consumers to enjoy stereo surround sound from two, four and up to 7.1 speaker systems.

In the early 1980's, the inventors began experimenting with multiple microphones, discovering that sound could be made to appear to come from different directions, similar to the way in which the human ear detects sound.

After initial analysis of audio tape recordings, a series of experiments were conducted. Armed with the results of this crucial early work, QSound assembled a team of scientists and audio professionals. Software tools for sound analysis and modeling, test signal generation and statistical data analysis were custom developed in house, exploiting the newly available power of purpose-designed DSP (digital signal processor) IC's and desktop computers.

QSound then entered into an intense research phase, modeling sound wave propagation from loudspeakers, extrapolating promising theories for further exploration. Due to the imperfections and inefficiencies produced by taking a legitimate binaural model, and adapting it to speakers through additional crosstalk cancellation, the QSound team concentrated directly on the target environment: the human perception of sound location as presented through stereo speakers.

Human listeners were presented with carefully designed test signals which had been passed through the initial process algorithms and delivered through stereo speakers in several controlled environments. The listeners' responses were captured using a custom data entry system consisting of multiple hand-held electronic keypads and a central data collector.

As the system operators adjusted various characteristics of the test signals and process algorithms, analysis of the data was performed using a combination of software and skilled human judgment. As trends emerged, the processes were refined, retuned, retested and further refined. In all, over 550,000 listening tests were performed, using a variety of subjects in order to produce averaged results leading to algorithms effective for virtually any listener.

The result was arguably the world's most natural-sounding, effective, and inherently efficient positional 3D audio algorithms for stereo speakers. This initial algorithm development became the basis of the first commercial applications developed by QSound and became the foundation for what was to become the most complete suite of 3D algorithms available.

Today, this patented audio technology is used to enhance a wide variety of consumer electronics products, mobile devices, PC/multimedia devices, CDs, DVDs, video games, movies, television programs, streaming Internet audio, MP3s and more.

Company Objective

QSound's objective as a company is to provide an enriched audio experience across all functionality in today's multimedia devices such as mobile phones, consumer electronics and PC / multimedia devices and the internet. QSound provides advanced audio solutions which have been optimized by ARM and QSound to delivery the industry's most efficient audio solution for ARM based platforms (ARM Cores v4, v5E, v6 and beyond).

Primary Business Model

The company's primary business model consists of licensing Q SOUND software technologies. Licensing is based on one or several components: Software licenses, per unit royalties, non-recurring engineering fees and / or consulting fees. QSound licenses its technology to:

- Semiconductor / component / platform / multimedia framework companies which manufacture and sell Q SOUND enhanced chips to original equipment manufacturers ("OEMs")
- Semiconductor / component / platform / multimedia framework companies that include Q SOUND as an option for the OEM, who can then, at their choosing, license the technology directly from the company
- OEM's for specific products

Company Offerings

Q SOUND Portfolio of Technologies

The company's technological efforts concentrate on the development and ongoing enhancement of a complete suite of proprietary technologies to cover all aspects of enhanced audio and audio synthesis requirements in the mobile device, multimedia computer and consumer electronics industries. The Q SOUND portfolio can be summarized as follows:

microQ for mobile devices: mQSynth™ Polyphonic Wavetable Synthesizer for ring tones and music playback
mQFX™ Digital Effects

- **QXpander®** 3D stereo sound stage expansion.
- **QSizzle™** dynamic high-frequency enhancement.
- **QRumble™** dynamic low-frequency enhancement.
- **QVerb™** reverberation (reflecting sound like choes).
- **QCompressor™** dynamic range control.
- **QEqualizer™** static multi-band equalization.
- **QLimiter™** anti-saturation dynamic range control.
- **QLoudness™** Fletcher-Munson equalization loudness curve.

mQ3D™ Positional 3D Audio Engine for interactive games **QSurround® Mobile** for headsets, Mobile TV, etc.

microQ for JSR234 - Java solution mobile devices

A more detailed description of these products can be obtained by visiting the QSound products page at <http://www.qsound.com/products/overview.htm>.

QSound products addressing the non-mobile markets such as consumer electronics and PC / multimedia are:

QHD for TVs, Stereos / Speakers, PCs, media players, home entertainment, etc. contains: **QXpander®** earphone/speaker 3D sound stage expansion. **QSizzle™** active mid/high-frequency spectral enhancement. **QRumble™** active low-frequency spectral enhancement. **QVerb™** reverberation. **QLimiter™** anti-saturation dynamic range control. **QSurround 5.1** multi-speaker surround system.

QSurroundHD for *3D audio and surround virtualization* for speaker and headphone.

A more detailed description of these products can be obtained by visiting the QSound products page at <http://www.qsound.com/products/overview.htm>.

Target markets?

Mobile devices, consumer electronics, PC/multimedia and Internet markets.

What is unique about the QSound offerings?

ARM Optimization

QSound Labs has done extensive work to optimize its microQ software to achieve one of the most efficient audio solutions in terms of memory footprint and CPU performance. ARM has undertaken further optimizations of QSound's highly regarded and efficient software. The focus of the optimization is centered on the core components of microQ:

- mQSynth™ Polyphonic Wavetable Synthesizer
- mQFX™ Digital Effects
- mQ3D™ Positional 3D Audio Engine

The improvements achieved range from 15-35+ percent less mega cycles per second (mcps) using v2.4.5 of the microQ audio engine on the ARM architectures v5E and V6.

More Choice

Since the pioneering development of the positional 3D audio process for speakers, QSound Labs has gone on to create the most comprehensive suite of 3D audio processes available, with superior solutions for every conceivable scenario. By offering such a wide suite of audio processes we can leverage this experience to help reduce the cost and resources required for our customers.

Better Audio Performance

All QSound 3D audio processes are fine-tuned by skilled audio engineers for the most natural, pleasing sound experience possible. QSound 3D audio is characterized by superior focus and correct frequency balance (without coloring the audio), worthy of professional audio applications. QXpander, for example, is a high-fidelity spatial processor - no more, no less. QXpander is designed to maintain the frequency content of the original signal, and to respect the intentions of content creators by preserving the integrity of the original image information, within which individual elements (instruments, voices) maintain their relative positions, focus, and coherence.

Competing processes can tire the listener with heavy-handed filtering that serves mainly to distract from muddy spatial performance and smeared imaging. In contrast, the sound stage produced by QXpander is more natural-sounding than plain stereo, and perceptibly alleviates listener fatigue, permitting comfortable and satisfying long-term use.

More Robust Algorithms

QSound's speaker-targeted 3D processes are much more forgiving in the area of speaker/listener geometry than crosstalk cancellation systems. This means a much larger effective listening area and a great deal more flexibility in the placement of the speakers. Standard stereo audio gives the listener a very small "sweet spot" for true stereo listening. QSound offers a similar sweet spot for the best expanded audio effect but will also enhance the listening experience for each other person in the room regardless of their position relative to the speakers.

An additional benefit of the extensive acoustic design effort underlying QSound algorithms is their robustness in bandwidth-limited situations such as mobile audio applications. Though high frequencies are limited by low sampling rates, and compact multimedia speakers limit bass response, QSound algorithms continue to create excellent effects.

Higher Efficiency, Scalability

The efficiency of QSound's algorithms is first due to the fundamental method of their derivation. The approach taken by competing 3D processes, i.e. the application of crosstalk cancellation to binaural synthesis, is by nature inefficient. Furthermore, the efficiency of all QSound 3D algorithms is due to a thorough understanding of the relative importance of various independent factors contributing to the net result. This has made it possible to derive a family of lower overhead versions each exhibiting the most effective possible performance within their respective budgets.

Finally, QSound is a customer and technology focused company whose designers have a reputation for implementing a given algorithm by the most efficient method. Signal processing routines are written in hand-tuned assembly code by specialists adept at squeezing maximum value from each CPU cycle.

Flexibility and Speed of Implementation

QSound's extensive software engineering experience means that algorithms are readily available on numerous platforms including popular DSP's and leading personal computer CPU's. Custom ports or custom features may be quickly provided and our customer support is highly acclaimed. In digital processing environments an algorithmic solution generally provides the most flexible and cost-efficient solution.

Company History with ARM

How long has the company been working with ARM?

The strategic collaboration between QSound and ARM began in 2006, however, QSound has been delivering its software solutions into ARM based products and environments for many years.

ARM technologies your company supports:

ARM7, ARM9 (Optimized by ARM)
ARM9E, ARM11 (Optimized by ARM)

Why have you chosen to work with ARM?

QSound established a strategic collaboration with ARM because ARM is the top semiconductor IP supplier in the world providing low-cost, power-efficient processor designs. These designs benefit from QSound's audio enhancement expertise of which QSound and ARM have similar technology objectives of providing highly optimized and efficient architectures. Furthermore, ARM technology has and continues shape a new era of next-generation electronics products in growing markets including Home, Mobile, Enterprise, Embedded and Emerging and QSound audio technologies have a key role to play in these markets.

The primary benefits QSound has achieved by working with ARM are related to engineering and marketing initiatives. On the engineering front ARM and QSound have undertaken optimization of QSound's microQ technology for ARM based environments making microQ the industry's most optimized audio solution.

Specialist area as an ARM Partner?

QSound Labs is ARM's audio partner of choice.

What one experience comes to mind during your initial work with ARM?

The starting point, this truly defined ARM as a company who are the heart beat of the mobile industry, with a true understanding of customer requirements and future needs. Bringing QSound technology to the team at ARM instantly provided the sense that a clear opportunity was available, on a platform basis, to generate a truly industry leading portfolio. The process was one of diligence and complete support.

Please site any end products that your ARM technology is being shipped with?

QSound has delivered numerous products that are based on ARM architectures given the majority of mobile phones and a plethora of consumer products based on ARM architectures. Products using QSound can be seen at <http://www.qsound.com/spotlight/users.htm> "Who's Using QSound?"

For more information on QSound Labs and the ARM Connected Community go to <http://www.arm.com/community/>

QSound can be found at <http://www.qsound.com>

Technology Overviews

- [Java Application Overview \(304Kb PDF\)](#)
- [microQ Technology Overview \(441Kb PDF\)](#)
- [mQFX Technology Overview \(572Kb PDF\)](#)
- [QHD Technology Overview \(515Kb PDF\)](#)
- [QSurround 5.1 Technology Overview \(357Kb PDF\)](#)
- [QSurround Mobile Overview \(373Kb PDF\)](#)

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QSound - Interview



**Mark Williams, Engineering Manager,
QSound Labs Inc.**



UK

What is the scope of your role?

I am the Engineering Manager here at QSound Labs. This involves managing projects (lots of them) and people (not as many). I also try and keep my hand in on the programming side (my background is as a software developer).

Synopsis of your career path?

Well, my career path is short in reference to the number of places that I have worked at primarily due to the number of years that I have been working at QSound (13 years). I started working as a programmer at a pan-European start-up company in the ASIC software and design house - ES2 (I knew Robin Saxby of ARM before he was knighted). I returned to Calgary, Canada to do a Masters degree in Computer Science after working at ES2 for just over two years. Immediately following the degree I took a "research assistant" position in the "Human Performance Lab" at the university doing a programming job - productising a CAD/CAM system for scanning, manipulating and manufacturing prosthetic legs. Though a worthy job, the allure of doing audio DSP work at QSound appealed to me and I applied for a position. The appeal of working at a place like QSound is that the work is interesting and varied. So I have done everything from low-level DSP development to application writing. I took the position of Engineering Manager to take on different challenges to those that I had as a software developer.

What attracted you to working in the IT industry?

Fame and Glory? Realizing quickly that I wasn't going to get either, I was relieved that my expectations of a stable job with good employment prospects lived up to expectations.

What skill in your job couldn't you do without in your role?

Logical thinking; computers are logical so in order to get along with them it is best to think the same way.

What is your greatest professional achievement?

Fitting a quart in a pint bottle - in the audio world and especially in the embedded environment the challenge is to make the code smaller/faster or both as graphics will always hog resources. QSound has been successful in part due to its ability to resolve these two conflicting resource goals. I in my time here have helped achieve the "unachievable". That is very rewarding.

What 1-2 key lessons would you pass onto a colleague or recent college/university graduate about working in your business?

- 1) Interesting work has more value than better paid boring work. Not that I don't get paid well, but the appeal of working at an interesting job has kept me here for all these years.
- 2) Stay flexible in your skills. This is especially true if working in a small company.

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