

**Review of operations as at 25 March 2015 included as part of the audited Financial Statements for the year ended 31 December 2014**

**Digital Speakers**

During the reporting period the Consolidated Entity continued the development of its digital speakers technologies and its commercialisation into a high demand product; including but not limited to activities under development agreements with leading consumer, electronic, and semiconductor manufacturers.

Management's focus has been on completing the objectives of the Phase III of the previously announced four phase technology commercialization plan. This multifaceted phase strives to validate and advance the technology readiness levels of all critical aspects of its industry-transforming product. The main objective of the Phase III was to integrate, test and optimise all components of the product including the MEMS chip output, ASIC and package design. The main objective of Phase IV will be to make all the optimisation changes and complete the final, commercial product.

On March 3rd 2015, the company publicly released preliminary measurement results, specifically Frequency Response specifications. These results not only substantiated the technology's advantages over comparable analog speaker technologies, but exceeded the company's own performance objectives. The results demonstrated sound pressure levels (SPL) within the low frequency spectrum that were previously believed to be unattainable within a micro form factor; measuring 80dB (decibels) at 250Hz (at 10cm) for a standalone chip that is half the size of a standard micro-speaker. But this is just half the story.

The industry has for decades been relying on frequency response specifications to describe the quality of a speaker. However a speaker's fidelity is not solely dependent on the width or range of frequencies it can produce, but also on additional essential attributes. To accurately reproduce recorded content and sound truly "lifelike" a speaker must also:

- a. Have a "flat" frequency response (i.e. have small loudness variations between different frequencies within the audible range). This objective of reproducing all musically relevant tones, at the same volume is more commonly known "flat". In speakers flat is good, as the "flatter" the response the closer the speaker is to accurately reproducing the original sound. Conventional micro speakers have distinct double-humped shape with significant variation (typically 10-15dB) between the peaks and valleys. Even high-end, audiophile speakers have loudness variations of 1-3dB within their range.

When examining the preliminary performance results recently released by the company, one notices a perfectly linear frequency response “curve” – that is sloped at 6dB per octave. As has been previously announced the 6dB per octave slope, which is a native phenomenon to the digital sound reconstruction technique, is correctable (in real-time) via our software algorithms and would result in flatness variations smaller than 1dB.

**In essence what this means is that our speakers do not impose the physical constraints inherent in conventional speakers, rather our chips allow the music to be heard as it was recorded.**

- b. Have low harmonic distortion. Distortion is considered by experts to be perhaps the most significant problem affecting perceived sound quality. Typical analog speakers generate certain “amounts” of harmonic distortion. Harmonic distortion means the speaker is producing frequencies that are not present in the original recording (but instead are multiplications of the recorded frequencies). Typically, the distortion becomes larger at lower frequencies and can reach values of 15-20% in micro-speakers. For a reference, the human distortion detection threshold is considered at 0.25%. The company’s digital speakers have a **maximum distortion level of 0.1%**.
- c. Have fast response to transient events. This lesser known yet critical parameter determines how quickly or slowly a speaker can faithfully reproduce sudden waveforms (“transients”). A transient is a short duration, high level sonic energy peak, such as a hand-clap or snare drum hit. To accurately reproduce most any sound in the percussion family the speaker must have excellent transient response. The transient response performance of a conventional speaker heavily depends on its construction (very light and stiff membranes) this in addition to having very low impedance and high damping amplifiers. AudioPixels’ speaker construction and digital nature can react to changes in input signal **within 3 microseconds thus offering unprecedented and near perfect transient response.** *(For reference, the response of human hearing is of the order of 50 microseconds).*

As outlined, the performance specifications released not only demonstrate the previously unimaginable advantage of a 2-octave (frequency) gain when compared to similar class micro-speakers, but additionally validated the accuracy of “lifelike” tone reproduction.

Ultimately the primary value proposition to industry and consumers alike is that our digital micro-loudspeaker chip should enable manufacturers to be able to produce far more engaging and qualitative sound experiences, from devices that are simpler, smaller, thinner, lighter and more energy efficient.

### **MEMS - Manufacturing Readiness Assessment**

During this reporting period the company received and meticulously tested the first generation of functional MEMS chips fabricated by our primary MEMS vendor. All critical static and dynamic aspects of the chip were evaluated with nano-precision using the most advanced systems available for the evaluation of micro electro mechanical structures. Overwhelmingly the fabrication-run met the prescribed requirements and expectations; however the depth in which the assessment was conducted exposed a fabrication vulnerability that required additional engineering efforts. Such efforts included collaboration with world leaders in the field of atomic layer deposition culminating in demonstrable results that furnish the company with a number of viable solutions to achieve targeted yields when in mass production. This issue has been overcome.

### **MEMS – Electro Acoustic Assessment**

When tackling ground breaking technologies it is often necessary not only to develop the core technology and its manufacturability but also the means and methods of analysis and test. To ensure precise validation of the technology the company designed and built state-of-the art measurement equipment capable of applying varying methods and methodologies for the concurrent evaluation of electrical, mechanical and acoustic properties of the MEMS devices. Expansive testing conducted with utmost precision is necessary for industry corroboration of our radically different approach to loudspeaker technology; one that defies the convention of an industry deeply entrenched in acoustic principles originated nearly a century ago.

To date the chips have undergone many millions of measurement cycles, producing results that have met the development goals for the MEMS chip.

The novel measurement techniques used, enabled our engineering team to detect and validate a specific acoustic phenomenon that even further stretches the acoustic capabilities of the chip. The newly found transduction principle (patent pending) permits the recycling of acoustic elements (“pixels”) at a far more rapid rate, thus nearly doubling the effective active area of our chip, which in turn presents cost reduction opportunities that do not compromise the qualitative performance of the chip.

### **ASIC - Manufacturing Assessment**

Collaborative efforts with ICSense have yielded a successful tape-out run. The produced ASIC’s have completed extensive evaluation with overall performance exceeding the realistic objectives set for this first generation ASIC. The ASIC will soon be integrated into our tests systems to allow for evaluation of the ASIC’s performance using actual MEMS chips.

### **PACKAGE – Design Assessment**

Concerted activities between the company packaging and assembly partner and a world-leading advance Materials Company successfully completed the evaluation phase and has entered full development of the integrated chip assembly process and its commercial



packaging. Evaluation prototypes are in production, which will enable the joint team to assess and refine the production assembly process and overall package.

### **Overall Program Status**

Phase III is nearing completion as the company has amassed and validated nearly all essential prerequisites for Phase IV, which principal objective is the fabrication of a commercial product. Management has already begun laying the groundwork required for Phase IV.

### **Intellectual Property**

As pioneers in the field of digital speakers the company continues to explore numerous opportunities to expand its intellectual property portfolio, adding 5 new patent applications during the reporting period.

Further information concerning the operations and financial condition of the entity can be found in the financial report and in releases made to the Australian Stock Exchange (ASX) during the year.

Danny Lewin

CEO

25 March 2015