I, Mark D. Pesce, make the following Declaration pursuant to 28 U.S.C. § 1746:

1. I currently reside at 50 Rose Street, Chippendale NSW 2008, Australia.
2. I am providing this Declaration in connection with the six pending *Inter Partes* review (IPR) proceedings currently instituted against five U.S. Patents owned by Worlds, Inc. identified in ¶ 45 below. I have been retained by Patent Owner Worlds, Inc. to provide my opinions in support of its Responses to the Petitions for *Inter Partes* Review.

Background and Qualifications

3. My career as a software engineer, inventor and entrepreneur began after I left the Massachusetts Institute of Technology in May 1982. While at MIT I studied computer science, biology and psychology, three disciplines at the core of virtual reality.
4. In 1984 I began working as a software engineer for a series of companies deeply involved in the emerging area of data communications and networking: GTE Telenet, which specialised in X.25 packet-switched networks, an immediate forerunner to the Internet; International Data Sciences, where I developed firmware for modems; Dynatech Corporation, where I developed firmware for CSU/DSUs, forerunners to today's DSL

modems; and Shiva Corporation, where I developed the software for our line of dial-up networking devices.

5. In 1991 I founded Ono-Sendai Corporation, a technology startup pioneering the development of consumer virtual reality systems. Before Ono-Sendai, virtual reality systems cost hundreds of thousands of dollars. Using a combination of off-the-shelf components and our own innovations, we brought the price of a complete system down to around one thousand dollars.
6. Ono-Sendai's key innovation was a low-cost sourceless orientation sensor, which allowed precise measurement of the three axes of rotation - yaw, pitch and roll - with a component that cost less than $1 in mass production quantities. Ono-Sendai was granted US patent 5,526,022 for this invention.
7. On the basis of that innovation, in 1992 Ono-Sendai was invited to work with Sega Corporation on the design of their Sega *Virtua VR* system, a low-cost head-mounted display designed to be connected to their Sega Genesis video gaming platform.
8. Leaving Ono-Sendai in the middle of 1993, I continued to pursue my own work in networked virtual worlds, and at SIGGRAPH 1993 was first exposed to the then-emerging global hypertext system known as the World Wide Web.

9. Working with Tony Parisi, I developed the first virtual reality interface to the World Wide Web. Known today as the Virtual Reality Modeling Language (VRML), I was invited by Sir Tim Berners-Lee, the father of the Web, to demonstrate our work at the First International Conference on the World Wide Web, at CERN, in May 1994.

10. Within a few months, I had put together a consortium of academic and commercial organisations interested in moving forward with VRML, and at the Second International Conference on the World Wide Web, in Chicago in November 1994, I presented the draft VRML 1.0 specification, co-authored by myself, Tony Parisi, and Gavin Bell (now Gavin Andresen).

11. In 1995 I formed the VRML Architecture Group (VAG), to serve as a steering body for the future technical development of VRML, overseeing an open, competitive standards process that culminated with the introduction of VRML 2.0, a fully interactive version of the language.

12. VRML 2.0 went through the ISO standards process, becoming VRML97, ISO/IEC 147772-1:1997. VRML97 was accepted into the MPEG standards process and became the 3D compositing layer of the MPEG-4 specification. Between its availability in all major Web browsers and inclusion into MPEG-4, VRML was until quite recently the most widely deployed technology for networked virtual worlds ever developed.

13. In 1995, I wrote the textbook "VRML: Browsing & Building Cyberspace", which sold over 100,000 copies in six languages. As a result of that book, I was invited to teach casually at San Francisco State University. In 1998 I received an appointment as Visiting Professor at the USC School of Cinema-Television, founding their well-regarded Interactive Media program.

14. In 2003, I moved to Sydney, Australia to found the Interactive Media and Emerging Technologies program at the Australian Film Television and Radio School. At both AFTRS and at USC I worked with a generation of media creatives and producers to apply the lessons of interactivity to their own works.

15. From 2005 to 2011, I served as panelist and judge on the Australian Broadcasting Corporation's hit series *The New Inventors*, celebrating the best Australian inventors and their innovations.

16. In 2006, I received an appointment as Honorary Associate in the Digital Cultures Program at the University of Sydney. In that role I teach casually and advise faculty on course and curriculum development.

17. Over the years I have written several other books, including: *VRML: Flying Through the Web* (1996), *The Playful World: How Technology is Transforming the Imagination* (2000), and *The Next Billion Seconds* (2011). I have published numerous book chapters, the most recent in *The Gameful*

World (2015), and have written hundreds of conference presentations, along with many submissions to academic journals.

18. I run a small consultancy in Sydney - the Digital Growth Partnership - with a range of clients in education, banking, government, and manufacturing. I have a thriving business as a public speaker, and host two podcasts, which I also produce: "This Week in Startups Australia" and "Lenovo ThinkFWD CIO Series". I am a sought-after commentator on technology for Australian print and broadcast media, regularly appearing on "The Project" and ABC News24.

19. My full *curriculum vitae* is attached to and is a part of this declaration.

Compensation

20. I am being compensated at my standard consulting rate of $450 per hour of time. My compensation does not depend on the outcome of this proceeding, and I have no financial interest in the outcome of this case.

Legal Standards to be Applied

21. I understand that in an *inter partes* review, the petitioner carries the burden of proving patent claim invalidity by a preponderance of the evidence on a claim-by-claim basis, based on either patents or printed publications. Each claim is analyzed independently. It is my understanding that when a party

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