



# UNIVERSITY of WASHINGTON

## Student Technology Fee Committee

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### DXARTS 3D Audio Lab

Proposal 2004-104-1

ID Permanent <http://techfee.washington.edu/proposals/view/2004-104-1/>

Link Department DXArts

Non- By Appointment

core First No

AccessApplication? Student Yes  
Initiated?

#### Abstract

This proposal comes from a group of students from various departments all of whom are involved in audio research and/or sonic art. The Center for Digital Arts and Experimental Media (DXARTS), in partnership with CARTAH and the School of Music Computer Center (SMCC) has, over the past decade, cultivated a broad range of tools for high-end professional level audio research, production, post-production, and presentation. This proposal will expand the palette of audio tools into the third dimension by creating an audio laboratory with a high-end 3-dimensional speaker array to compliment the 3D microphones already in use. Located in the new million dollar lab space renovation in Raitt Hall, this 3D Audio Lab will give students the ability to create professional level experimental sonic art and undertake new research into sound in space to study how we perceive sound in 3D space. This can lead to new ways of making music and as well as add to the general knowledge of perception and cognition.

#### Background

The Center for Digital Arts and Experimental Media (DXARTS) is a completely new program begun in 2001. It will begin offering BFA and PHD degrees in Fall 2004. In advance of that time the program is already offering courses and supporting independent research projects for students from diverse departments. Among these students are the authors of this proposal. The program builds on the work done at both the Center for Advanced Research Technology in the Arts and Humanities (CARTAH) and the School of Music Computer Center (SMCC). Over the past several years DXARTS/CARTAH and SMCC have assembled an increasing range of audio tools for high-end research, production, post-production, and presentation. This has enabled students to pioneer new sonic art forms and create award-winning audio works. The goal of this proposal is to provide students with the resources necessary to allow us to make full use of the capabilities of the tools already available. The expansion of the palette of resources available to students will give us a complete range of audio tools for the production and presentation of world-class works of auditory digital art.

As students involved in audio research the production of audio-based art works, a paramount creative tool available to us in the last few years has been the Soundfield Microphone, two of which were purchased in 2000 with the support of the Student Technology Fee. The Soundfield mic is a unique microphone that can record a 3-dimensional sonic image which can be reproduced by any array of speakers. A simple explanation is to call it a mic that records in surround-sound. But beyond the two dimensional surround-sound normally associated with movies, the Soundfield mic also records in the 3rd dimension: up and down in addition to left, right, front and back. We students have used the Soundfield mic extensively since it was purchased for various projects including sound-spatialization and physics of sound experiments, music compositions, and sound for student films and video art. But none of us has yet been able to make use of the third (up and down) dimension in our work because we have no workspace with a 3-dimensional array of speakers in which to experiment and test our 3D sounds. The purpose of this proposal is to create a 3D audio lab featuring a 3-dimensional speaker array. This speaker array, in conjunction with the

auxiliary equipment necessary for it to run, is the ideal complement to the Soundfield microphone, and thus will allow us as students to create and present works which before were impossible.

For example, Noel Paul, a Music/DXARTS student and one of the primary authors of this proposal, has used the Soundfield mic since his undergraduate years, first in Juan Pampin's course on Sound & Space (Music 572) and subsequently in several independent audio and video projects. He recently completed an experimental short film with sound that made use of the Soundfield mic in 3-dimensions. In order to create unusual shifting sonic spaces, the Soundfield mic was attached to a Steadicam rig and then moved through a sonic environment composed of many speakers scattered around a labyrinthine system of rooms and corridors. Speakers were placed on the floor, hung from the ceilings, up the stairs and around the corner, etc. But all of this up/down vertical detail of sound was effectively flattened in by the inability to mix what was recorded in full 3D.

Ewa Trebacz, another student working extensively with surround audio, has recently had major international performances of her work on Polish National TV, in Germany, and in The Netherlands. Works by artists such as Noel, Ewa, and other current and future students will be significantly enhanced by the proposed laboratory creating greater opportunities for important high-profile career-making exposure.

## Benefits

The ability to record, mix, and present 3D audio works is on the cutting edge, in advance of much of the digital art world. The items specified in this proposal, in conjunction with existing equipment, will allow students to create works which would otherwise be impossible.

The 3D Audio Lab, currently being furnished by the DXARTS renovation of Raitt Hall, will be divided into two units: the main room and the control room. The main room will be used for 3D Audio Projection, recording, and research. It will be digitally connected to the control room via light pipe (fiber optics) and have its own digital mixer, the Behringer DDX3216 (w/2 ADAT interfaces) to serve as a control surface for the 3D speaker array. The mixer will be connected to the speakers through high quality 24-bit digital to analog converters. DXARTS will provide computers and other equipment mentioned below.

The control room, separated from the main room by inch-thick canted glass, will be mainly used for near-field surround-sound listening, mastering, and as a control unit for the main room, for both recording and playback.

The primary component of the 3D Audio Lab is the 3-Dimensional speaker array. The speakers we propose are among the best in the world. They exhibit unparalleled frequency response (34Hz – 35kHz!) and use the highest quality component parts, fine tuned for highly accurate spatial projection. The 3-D speaker array will consist of 12 ADAM S2.5-A speakers (modified with special mounting brackets provided by Adam-Audio at no extra charge) and 2 subwoofers (SUB1). These speakers will be attached to the wall using a \$4000 flexible mounting system which DXARTS will provide. This mounting system will allow speaker positions to be easily adjusted for various array set-ups. The normal array will take the form of a 3-Dimensional hexagon, with 6 speakers near the floor and 6 corresponding speakers near the ceiling.

The control room's speaker set-up will consist of another 6-speaker hexagon and one subwoofer. These speakers are slightly less powerful but still exhibit the same high-quality sound. They will be primarily used in more typical playback set-ups (2D surround, quad, stereo, and mono) for the purposes of mastering, monitoring, and recording.

This new 3D Audio Lab will allow students to create unparalleled sonic works of art, run sophisticated experiments such as speaker-array auto-calibration, and make precise 3D audio recordings in a high quality studio environment.

## Student Access

The 3D Audio Lab, like all of DXARTS resources, will be available to the general student population through approved CARTAH projects. Proposals are made through CARTAH's web site ([www.washington.edu/cartah](http://www.washington.edu/cartah)) and CARTAH accepts nearly all student-initiated proposals. In addition the lab will be available to DXARTS students doing independent projects. Students doing CARTAH or independent DXARTS projects involving use of the 3D Audio Lab will have access to it during normal office hours (M-F 9:00-4:30) or by appointment on evenings and weekends, and will be aided by graduate students trained in the use of the lab.

## Available Resources

DXARTS has three full time technical support staff members, five faculty members, and numerous graduate student assistants and teaching assistants, who are all available as consultants for any DXARTS or CARTAH project. DXARTS has a large mobile sound system (used for concerts, installations, and other events) which can be set up in a 3d array. This mobile sound system is used for DXARTS concerts and events in Meany Hall, in which student works are routinely featured, both on the Mainstage and in the Studio Theatre, as well as in other off-campus DXARTS events. DXARTS has an annual supplies budget of over \$25,000, which will be used in part to maintain and upgrade current and proposed equipment.

DXARTS will equip the 3D Audio Lab with a Mackie Digital 8 Bus (d8b) mixer, two Macintosh G5s (donated by Apple), and a PC, all digitally connected and capable of multi-channel

recording and playback. DXARTS will also provide various other equipment and software to round out the functionality of the 3D Audio Lab: including DAT and ADAT recorders, the Soundfield Mic studio hardware, a MOTU firewire audio interface (MOTU 828), a reverb unit, MIDI timepiece, synthesizer, racks, cables, and furniture.

## Installation Timeline

The proposed items will be purchased and installed as soon as funding becomes available and as soon as renovation is complete in the new lab space in Raitt hall.

## Departmental Endorsement

DXARTS is a new program, but is a direct outgrowth of the work done at CARTAH. This proposal is supported by Richard Karpen, the Director of both DXARTS and CARTAH, and was produced by students in direct consultation with all the faculty and staff and other students of these programs.

## Student Endorsement

Noel Paul

Graduate Student, MUSIC/DXARTS

noelpaul@u.washington.edu

"I've used the 3D-recording Soundfield Mic extensively, and much of my music contains 3rd-dimensional sonic information and detail which I've never even heard. I am interested in discovering new ways of making music and film-sound utilizing 3D audio, and the proposed 3D Audio Lab is integral to these experiments."

Lisa Darms

Graduate Student, ART/PHOTOGRAPHY

lisadee@u.washington.edu

"My visual art combines flat graphical elements with digital video footage to create visual spaces that exist somewhere between two and three dimensions. I'd like to be able to explore these inter-dimensional interactions with my sound as well."

Michael Chinen

Undergraduate, CSE

mchinen@cs.washington.edu

"I am interested in representing space with computer-generated audio, so that physical phenomenon, especially motion, can be perceived independently from vision. With a 3-D speaker array, we would have the power to represent the three-dimensional space quite naturally. One of the things I am interested in exploring is the representation of space that goes beyond what we perceive normally with vision. My research plan involves the addition of an extra dimension using pitch/frequency to see how useful and coherent four-dimensional space would be. The applications for this research are diverse, including ear training, sonification, and musical composition."

Ewa Trebacz

Graduate Student, MUSIC

trebacze@u.washingotn.edu

"Most composers spend much of their time in headphones working in a stereo environment, imagining what their music will sound like live. This is especially true with 3D electronic music. I would love to have access to a 3D Audio Lab so that I could test and fine tune my music in a context more like actual performance."

Casey Wescott

Undergraduate, General Studies in Computers, Mathematics and Physics of Music.

kcbert@u.washington.edu

"There are a variety of applications for a three dimensional sound system, both musical and scientific. A three dimensional sound system, for example, will enable me to conduct a variety of psychoacoustic tests accurately. One such experiment will test the effects of sound elevation on nonlinear distortion of the inner ear."

William 'Pete' Moss

Graduate Student, MUSIC

petemoss@u.washington.edu

"Three dimensional audio has become very important in modern art music. UW needs a dedicated place for recording and experimenting with 3D audio so that student composers can gain more experience and practice in dealing with these technologies. Reducing these dimensions down to one or two is a common way of working when these technologies are not available, but doing this is not working with the thing itself. It is important to work directly with 3D audio so that we can better understand the interactions that happen in real life and gain experience in working with this medium, so that it can be extended and refined in the future."

## Items

Below are the items making up the current proposal. The asterisk (\*) beside items signify that they were approved by the committee. This however was not implemented correctly for our database before 2005, so earlier years may not show this.

Click an item's title to view details on that item, or [show all item details](#).

Title	Type	Price	Qty	Subtotal
<a href="#">ADAM S1A Speaker</a>	audio/video-hardware	\$1,200.00	6	\$7,200.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> High fidelity speakers for a flat surround-sound system in the control room.				
<b>Justification:</b> These speakers will be used in the control room for monitoring, recording, and mastering.				
<a href="#">ADAM SUBp Subwoofer</a>	audio/video-hardware	\$1,600.00	1	\$1,600.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> High fidelity subwoofer for control room.				
<b>Justification:</b> This item will be used in conjunction with the 6 ADAM S1A speakers in the surround-sound set-up in the control room, adding precise low-frequency projection to the speaker array.				
<a href="#">ADAM S2.5-A Speaker</a>	audio/video-hardware	\$1,650.00	12	\$19,800.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> 12 high fidelity powered speakers to be set up in a 3-dimensional array in the main room. These speakers reproduce sound with high fidelity across an amazing frequency spectrum and exhibit highly accurate spatial imaging.				
<b>Justification:</b> This item will be used for playing back 3D sonic art, recording, and sound-spatialization experiments and research.				
<a href="#">ADAM SUB1 Subwoofer</a>	audio/video-hardware	\$2,800.00	2	\$5,600.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> High fidelity subwoofer pair for use with the 12-channel 3D speaker array in the main room.				
<b>Justification:</b> This item will add precise low-end projection to the 3D sound imaging in the main room.				

<a href="#">Behringer DDX3216 Digital Mixer</a>	audio/video-hardware	\$1,000.00	1	\$1,000.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> High-end digital audio mixer for the main room.				
<b>Justification:</b> This item will serve as a control surface for the 3D speaker array in the main room.				
<a href="#">ADAT Interface Mod for Behringer DDX3216</a>	audio/video-hardware	\$150.00	2	\$300.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> These ADAT interfaces are optical (fiber optic) input/outputs for use with the Behringer mixer in the main room.				
<b>Justification:</b> This item will ensure a highest-quality signal path for sound routing between the Behringer mixer in the main room and the Mackie Digital 8-Bus mixer (provided by DXARTS) in the control room.				
<a href="#">Swissonic AD24 mk2 DAC</a>	audio/video-hardware	\$800.00	2	\$1,600.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> High quality Digital to Analog signal converter.				
<b>Justification:</b> This item is used to convert the digital audio signal into an analog signal in order to drive the speakers in the 3D audio rig.				
<a href="#">Fiber Optic Cables</a>	audio/video-hardware	\$30.00	4	\$120.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> Fiber optic cables to connect the Behringer mixer in the main room to the Mackie Digital 8-Bus mixer (provided by DXARTS) in the control room.				
<b>Justification:</b> This item is necessary to send signals back and forth from one room to the other.				
<a href="#">XLR Speaker Cables</a>	audio/video-hardware	\$60.00	21	\$1,260.00
<b>Location:</b> Raitt Hall - 117				
<b>Description:</b> High quality XLR cables (copper) to drive the speakers and subwoofers in both rooms.				
<b>Justification:</b> These items will be used to connect the 18 speakers and 3 subwoofers in both rooms to the mixers and DACs (Digital to Analog Converters).				
<b>Requested Total:</b>				\$38,480.00
<b>Approved Total:</b>				\$0.00
<b>Funding Status:</b>				Fully Funded

## Comments

 Add Comment

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No comments have been posted for this proposal yet.



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