Stanford's First Return on Equity Feels Like a Million Bucks

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not a Stanford faculty member, so signing over equity in a company feels like I'm writing a blank check for my alumnus donation."

The counterargument to this objection and others that the inventors lose significant royalties through this policy, explains OTL Associate Mary Albertson, is that "the truly signficiant money is usually from earned royalties a company pays Stanford for using the invention.

"The Associates at OTL who negotiate licenses on behalf of the University only accept equity in lieu of a higher up-front payment. For example, if a company could not pay $20,000 up front for a non-exclusive license, I might accept a smaller license issue fee and a chunk of equity.

"If the equity could be assigned a cash value, the value going to the Graduate Fellowship Fund is negligible compared to the value inventors see in earned royalties if the invention is successful."

Kathy Ku adds, "We cannot even determine whether a company in which we take stock will go public, let alone if it will generate an increased cash return on initial value." Ku also points out that "there are good arguments on both sides of the [equity distribution] issue. It's not a moral issue."

Other institutions have tackled the issue of equity differently. For example, MIT has been willing to accept equity through technology licensing since 1987 and distributes the equity to inventors if they have not received it through their private consulting agreements.

Johns Hopkins University prohibited taking equity in a company until 1992 and now avoids conflict of interest by locking up equity in an escrow account until a specific trigger date, generally two years after the first commercial sale of a licensed product. And after a recent time-consuming and financially draining lawsuit, the University of Arizona has ceased to accept equity altogether.

Stanford hopes that it has found an ideal solution — one that allows the University greater flexibility in negotiating licenses and simultaneously limits the potential for conflict of interest. In fiscal year 1993-94, OTL accepted equity in nine companies. Current and potential graduate students, keep your fingers crossed. ♠

OTL's Webbed Feat

According to the book *More Internet for Dummies* (even OTL had to start somewhere!), the World Wide Web is "the zoomiest, coolest Internet facility around." Wishing to remain one of the zoomiest, coolest licensing offices around, OTL has set up a home page on the Web.

The page contains information about OTL's operations and staff, the licensing process, and Stanford's policies relating to it; forms; descriptions of available technologies; links to other technology transfer sites; and, last but certainly not least, *Brainstorm* (text only). We hope to soon have the page set up to allow interaction (disclosing inventions, for example) between OTL and its clients. The address (URL) is:

http://www-leland.stanford.edu/group/OTL/

We invite you to have a browse!

"Father of Computer Music" Still...

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playable scores would take a long time." But since his new model is able to play MIDI files --- computer files containing musical scores stored in a standard notation — that is no longer true.

"Now I see enough pieces available on the World Wide Web that I think the repertoire will build up rapidly," he says.

Mathews sees three ultimate uses for the Radio Baton. The first is as an instrument on which composers at studios like CCRMA can play their own music. The roughly two dozen working Radio Batons in existence are almost all being used in this way.

Secondly, Mathews believes "there will be a lot of performers who want it to play accompaniments; particularly vocalists, since they can control the batons while singing, and the Radio Baton can provide full orchestral accompaniment."

Finally, Mathews hopes the Radio Baton will "eventually provide a new way of appreciating music. The normal music lover will have the option of conducting music."

Despite this hope, Mathews says, "I don't have a feeling as to whether this will be a big consumer item. [Commercialization] is such a chaotic process." But while the model he's making now is intended for professional musicians, he believes the technology could also be sold just as a controller for a computer.

"Sound Blaster boards have very good synthesizer boards on them, and they are widely available," says Mathews. "The only components missing in current multimedia systems are the controller and the program, both of which I know how to make. There's an instantaneous market."

Mathews currently has orders pending for three Radio Batons. ♠

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IN THIS ISSUE

Stanford University
Technology Transfer
Office of Technology Licensing

"Father of Computer Music" Still Conducting Himself Well

By Eric Grunwald

You've had a long, grueling day at the office, and as you drive towards home you know exactly what you need to relax. You pass the health club, bars, and video stores without so much as a glance. You grunt as your spouse greets you and move on to the living room, where you turn on the stereo and pull a small podium to the center of the room.

You choose a floppy from a stack on the shelf and insert it in the disk drive in the side of the low, white box on the podium. You take your place behind the podium, press a button, adjust some knobs, and grasp in each hand a baton with a soft foam ball at the end.

You tap the stem of one of the batons on the edge of the podium for silence, raise your arms to signal the orchestra, and bring the batons down, striking the box. *DA-DA-DA-DUM!* Beethoven's Fifth fills the house.

"This is a much more participatory way of enjoying music," says Max Mathews, a Research Professor at Stanford's Center for Computer Re-

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PHOTO: PATTE WOOD, CCRMA

Professor Max V. Mathews, widely considered the "father of computer music," shown here with the Radio Baton and Conductor Program. Somewhere between an instrument and a computer, the technology allows you to be a conductor even when you don't have an orchestra handy.

Stanford's First Return on Equity Feels Like a Million Bucks

By Amy Forrest and Eric Grunwald

Stanford's first significant cash return on equity (stock) taken as a term of a license agreement has recently resulted in The Shah Family Fund, established by Dr. Haresh Shah, his family, his colleague Weimin Dong, and the Department of Civil Engineering.

Shah and Dong developed software at Stanford in the late 1980s that aids risk managers in assessing risk from natural disasters. OTL licensed it to Risk Management Solutions, Inc. (RMS) in 1990, and Stanford received equity in RMS as partial consideration for the license.

RMS was recently acquired, and as their license preceded the existence of a new University policy for equity distribution enacted last year, Shah and Dong (now Senior Vice President for Research at RMS) were to have received personal shares of the returns on the sale of the stock.

Committed to the future of engineering research, however, they requested that Stanford place all the returns ($916,000), including their personal shares, in an endowed fund to be used primarily for fellowships for graduate students in engineering. Shah and his family have also pledged an additional $300,000 to bring the total to over $1 million.

OTL has historically declined equity in order to avoid both real and perceived conflicts of interest; that is, putting a Stanford researcher in a position in which his personal financial interests might be in conflict with his obligations to the University, sponsors, and students.

"If a University researcher is doing research in which he has no direct financial stake," explains OTL Director Kathy Ku, "or if an inventor is inventing something in her garage which is not related to her University responsibilities, no one's going to care. It's really the confluence of the two – the use of University resources for personal gain – that

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Stanford University
Technology Transfer
Through Licensing
Office of Technology Licensing

STANFORD TECHNOLOGY BRAINSTORM

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Stanford Technology BRAINSTORM is published quarterly in order to provide information about OTL and general information of interest to the licensing community, both within and outside Stanford.

OTL's services are available to any Stanford faculty, students, or staff who invent technologies which may benefit the public or be of commercial value.

To learn about a specific technology or to disclose one of your own, contact us at the above address.

"Father of Computer Music" Still...

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search in Music and Acoustics (CCRMA) and the inventor of the "Radio Baton and Conductor Program" (referred to by Mathews simply as the Radio Baton).

The Radio Baton consists of the box and batons, a computer program, and a computerized musical score. With each baton tracked in three dimensions by the electronics in the box, the user controls six continuous functions of time while playing a score.

In the score, each function is assigned to a musical parameter such as tempo, loudness, the balance of various voices, even the shape of a particular note. "For example," says Mathews, "one parameter can control the loudness of the oboe, another the rapidity of the attack on the violins."

And these assignments can change over the course of the score. "When the oboes are important, all the functions can control the oboes. Later, they can all be on the violin." Thus the user can control the important elements of a piece of music without having to worry about playing the right notes.

The path to the Radio Baton has been a long one, an outgrowth of Mathews's development of computer music itself. In 1955, after getting a Ph.D. in electrical engineering from MIT, he went to the Acoustical Research Division at AT&T Bell Labs.

As well as having a strong interest in computers, Mathews says he also loved music. "I had studied violin in high school and continued to play," he says, "although always as an amateur and not an exceptionally good one, either."

At Bell, under the direction of John Pierce (now also at CCRMA), Mathews developed research techniques to test new kinds of telephones by simulating them on the computer, converting speech to electronic signals and back again.

One day he and Pierce were at a concert. It must not have been a good one, for they looked at each other and said, "Gee, a computer can do better than this." Pierce encouraged Mathews to adapt his research techniques to produce music, and in 1957 Mathews wrote a program called Music I.

"I believe that was the first use of a computer to play music," he says, hastening to add that "the music that the program played was actually terrible." But he kept at it. "We knew the computer had great potential," he says.

A few years later, Mathews was up to Music V, which he says "contains most of the elements that people use today for synthesizing music."

Computer music continued to grow as a field, and soon a young researcher from Stanford named John Chowning visited Mathews at Bell Labs. Chowning then wrote Music X, followed by the FM Synthesis algorithm, Stanford's second largest royalty generator (see *Brainstorm*, Summer, 1994).

Mathews says the invention of FM – "a simple method of synthesizing good sounds" – was one of three important events leading to the Radio Baton. Another was the development by various entities (e.g., Yamaha Corp.) of custom integrated circuits that could synthesize sounds.

Finally, the large mainframe computers on which Mathews had begun now evolved into desktop models that were "cheaper, smaller, and powerful enough to make music faster than it is played," thus enabling live performance by a computer.

So the tools to make the Radio Baton were there, and soon the opportunity presented itself to Mathews in the form of a position as the first science adviser to the Institute for Research and Coordination of Acoustics/Music (IRCAM).

Founded in Paris in the 1970s, IRCAM is, according to Mathews, one of the world's two leading venues (the other is CCRMA) for research in computer music.

At that time, performers often played taped music as accompaniments to their solos. But tapes were inflexible, requiring the soloist to follow them. "Pierre Boulez [IRCAM's director] wanted technology to allow him to conduct the tape – to have the accompaniment follow his solo," says Mathews. So for the past ten years, Mathews has worked on developing that technology.

The Radio Baton has gone through several stages. The first two were mechanical, with a drum head as the percussive panel. One worked via connectors underneath, the other with strain gauges at each of the four corners.

After Mathews had come to Stanford in 1985, one of his associates from Bell Labs, Bob Boie, suggested using radio technology he had developed as sensors for robots. Not only did this innovation do away with the Radio Baton's moving parts, it also allowed the leap to continuous, three-dimensional tracking of the batons.

A patent on the fundamental concepts issued on Christmas Day, 1990, and last year Mathews founded his own company and took a non-exclusive license to the patent from Stanford.

With the help of Tom Oberheim, the original inventor of Oberheim synthesizers and now president of Marion Systems, Mathews is finalizing the latest model.

Due out May 1, it will be smaller – the electronics are on a single circuit board – and have ports for a synthesizer board and a floppy disk drive.

As for available scores, Mathews says, "I used to think that building up the repertoire of

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A Sampling of Licenses Granted by OTL in the Last Quarter

Docket(s)	Title(s)	Uses	Licensee(s)	License Type
S74-043	"Cohen-Boyer Recombinant Technology"	DNA Cloning – Production of proteins Total number of DNA licensees: 306	PathoGenesis Corp.; Asgrow Seed Company; Texas Biotechnology; LeukoSite; Diagxotics; National Biosciences; Bioserve Biotechnologies; Vector Labs; Amresco; Kikkoman Corporation	Non-exclusive
S87-076	"Method for Selecting Peptide..."	Autoimmune disease	T Cell Sciences	Option
S91-041	"NF-AT Transcription System"	Drug screening	Affinity BioReagents	Non-exclusive
S92-179, S93-134	"...Electrochemical Detector," "...Wavelength Spectrometer"	Capillary electrophoresis	Applied Biosystems/ Perkin-Elmer	Option (Field of Use)
S93-116	"Antibodies to Human B7..."	Autoimmune diseases	LeukoSite	Total Exclusive
S93-168	"Inhibitors of Protein-Protein..."	Drug screening	Terrapin Technologies	Field Exclusive
S93-192	"Total Access System"	Computer control	Audion, Inc.	Option
S94-145	"...Suppression of Materials..."	MRI	General Electric	Non-exclusive

Stanford's First Return on Equity Feels Like a Million Bucks

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produces concern."

For example, when a university accepts equity in a company to which it grants a license, the recipients of royalties from license agreements – the inventors, departments, and schools – have a stake in that company's success and could therefore be tempted to skew research for the benefit of that company.

Conflict of interest may also arise when inventors accept stock in the company for consulting, work on company projects in university labs, employ students for company projects, or withhold information from other faculty to benefit the company.

Despite these risks, the Alumni Consulting Team (ACT), a group of Stanford Business School alumni organized in 1992 to study OTL, recommended that OTL consider accepting equity as a term for a license.

As OTL Associate Brian Kissel — a member of the ACT — explains, "Since our objective is to ensure the development of Stanford inventions, OTL's willingness to accept equity levels the playing field by allowing small companies that might not otherwise be able to afford a license to take one by paying some equity as partial compensation."

Taking equity, however, has its own difficulties. Explains Kathy Ku, "Stock in a privately-held company takes at least five years to come to fruition, so annual cash payments are always preferable. And since equity doesn't have immediate cash value, it is difficult to distribute and we can't use it to finance patent prosecution."

A solution that administrators hope will be a lasting one was suggested by Dr. Stanley Falkow, a professor of microbiology and immunology and an inventor of several inventions licensed by OTL. He suggested that all returns on equity accepted by OTL be placed in a fund administered by the Dean of Research and, when liquidated, finance graduate students.

Thus under a policy enacted in January, 1994, OTL may — after provostial approval — accept equity as a term of a license, and the returns are placed in a Graduate Fellowship Fund administered by the Dean of Research. "The OTL Graduate Fellowship Fund is a wonderful idea," says Ku, "because it enables Stanford to receive a benefit from equity without inviting conflict and to share this benefit with a wider community."

Reaction to the Graduate Fellowship Fund has not been uniformly positive, however. For example, one former member of Stanford's Department of Electrical Engineering who was an inventor on some successful Stanford patents says he is in favor of the concept of a Graduate Fellowship Fund.

"However," he says, "inventors that are no longer at Stanford should be allowed to retain a share of equity obtained from licensing their invention. I am

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