The New American University and the Role of "Technology Translation": The Approach of Arizona State University

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ABSTRACT

This chapter provides a conceptual overview of Arizona State University's mission, and explains how the university's "technology translation" efforts support that mission. The chapter offers a rationale for why effective technology translation and commercialization are economically and socially relevant. A case study illustrates how a program established by Arizona State University's technology commercialization group has led to significant returns for the university and the local community. The authors conclude that public and private institutions in both developed and developing countries can implement the concepts and strategies for technology commercialization described in the chapter.

1. BACKGROUND AND INTRODUCTION

Arizona State University (ASU) is becoming recognized for having adopted one of the most forward-thinking university models in the United States, a new model of excellence and access, where connection to community is an expectation. Since one of the co-authors of this chapter, Michael Crow, became president of ASU in July 2002, the university's stature as a leading transdisciplinary research institution has grown significantly. Along with investments in transdisciplinary research infrastructure and new faculty, ASU has completely overhauled its technology commercialization capabilities and implemented programs that have improved the economic and social vitality of the state of Arizona in the southwestern part of the United States.

In the 2002 inaugural address to ASU faculty and administrators, Crow[1] unveiled a vision and strategy for a dynamic, inclusive university that assumes a share of responsibility for the economic and cultural development of the society it serves. The university would commit itself to outcome-focused excellence, both in the use-inspired research agenda it pursues and in the diversity of its student body. The university would become—to put it simply—a New American University.

As a New American University, ASU has been structured on fundamental design imperatives (Box 1). The spirit of these design imperatives is embodied throughout ASU's programs and strategic plans.

2. THE ROLE OF THE NEW AMERICAN UNIVERSITY

In order for ASU's research to be transformative, the university must have the staff, institutional and resource capacity to identify cutting-edge innovations and find creative ways to convert them into products that improve the quality of life. Within the framework of the New American University, the term technology transfer is abandoned in favor of technology translation. The

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Box 1: Design Imperatives for the New American University

1. **Leveraging Place**: Addressing the challenges of the region
2. **Societal Transformation**: Transcending physical location to affect society locally and globally
3. **Knowledge Entrepreneur**: Embodying a culture of academic enterprise, breaking from traditional and organizational constraints
4. **Use-Inspired Research**: Seeking research opportunities that meet community needs and enhance quality of life
5. **Focus on the Individual**: Looking beyond the academic background of incoming students to seek greater diversity of the student body
6. **Intellectual Fusion**: Adopting a research agenda that is solution-focused rather than discipline-focused
7. **Social Embeddedness**: Building an interactive and mutually supportive partnership with the community
8. **Global Engagement**: Establish programs and practices with global application through the development of innovative approaches to universal societal problems.

Source: ASU[9]

latter more appropriately captures the university's role, which is not simply innovating and transferring but, more importantly, framing innovations within the context of social and economic relevance.

Technology translation is predicated on building strong partnerships with the community and commercial entities so that the technology needs of the business and investment community are well understood. These partnerships are built around the university's core-technology competencies so that opportunities for technology development can be identified more effectively. Indeed, through technology translation, ASU provides a partnering experience more in line with the expectations of a commercial enterprise. In order to pursue this more market focused approach to building links with industry partners, ASU established a private enterprise so it could bring technologies to market more efficiently. In November 2003, ASU created Arizona Technology Enterprises, LLC (AzTE).[2] Figure 1 provides an overview of AzTE's technology-translation process and structures, which are discussed in the following sections. The translation process begins with the design of process elements that position AzTE between the market and the university. It is in this space where the work of translation can occur.

2.1 *Arizona Technology Enterprises*

AzTE is a private nonprofit, wholly owned subsidiary of the ASU Foundation.[3] The ASU Foundation was established to manage ASU's endowment and to make strategic investments for the benefit of the university. AzTE is responsible for evaluating, protecting, and translating ASU's technology portfolio. AzTE handles all of ASU's licensing, spinout company formation, consortia development, and joint venturing activities with commercial partners. Fundamentally, AzTE was founded on the notion that strong partnerships can only be established by being flexible, removing obstacles to doing business, and focusing on speed to market as a key driver in a university's dealings with its partners. AzTE's autonomy as a private organization, with most decisions being made internally, enables it to operate with the speed and efficiency of a market-based commercial enterprise.

The individuals who make up AzTE's business-development team have industrial backgrounds and strong product-development expertise. This expertise gives the company significant insight into the commercial drivers and hurdles of technology adoption in the private sector. The skills and network of AzTE's core team are supplemented by a board of directors, which is composed of venture capitalists, industry executives, technologists, and ASU leadership, as well as members of other ASU entrepreneurial programs (such as ASU Technopolis,[4] an education and networking program offered to the local business community). AzTE's strong network enhances its ability it to build relationships with industrial and financial partners.

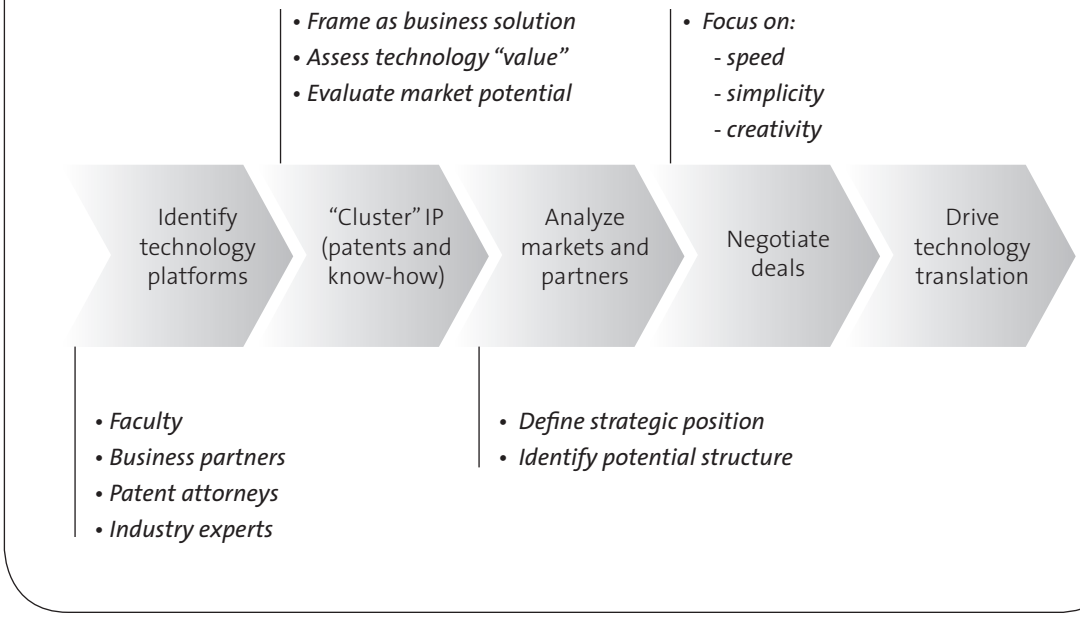
AzTE provides to its spinout enterprises and commercial partners myriad services, including technology assessment, strategic business development, creative deal structuring, and capital formation. AzTE also offers advice on business strategy and is often instrumental in acquiring capital and management for ASU's spinout companies. Moreover, through the extensive network of ASU, the AzTE team, and its board of directors, AzTE acts as a source of business-development contacts for its partners.

In order to further develop promising technology platforms that may not have sufficient funding to achieve market viability, AzTE established the Catalyst Fund. Capital from the Catalyst Fund is invested by AzTE to conduct proof-of-concept experiments, develop prototypes, and provide seed funding to emerging ASU ventures. The Catalyst Fund has also been used to co-invest with industrial partners to develop ASU technology platforms. The company has found that small amounts of strategically allocated capital can exponentially improve the chances of a technology reaching the market.

2.2 *AzTE's market-focused model*

In addition to helping faculty incubate technologies in the existing ASU research portfolio, AzTE spends a significant amount of time meeting with industry-leading– and venture-capital companies to better understand their technology needs. By maintaining an ongoing dialogue with the business community, AzTE can continually connect these partners with sponsored-research and

Figure 1: AzTE Technology Translation Process



translation opportunities at ASU. This outside-in approach has significantly benefited the university. The approach provides a better understanding of societal needs and helps the university decide how to fill those needs. Moreover, these interactions have significantly contributed to the selection of ASU by many leading institutions as a partner of choice for technology acquisition.

2.3 *Knowledge entrepreneurship*

AzTE has developed programs that offer students many opportunities to gain unique, practical experience in technology-based transactions. In addition to hiring graduate students in business administration to work in AzTE's offices, AzTE has established the Technology Venture Clinic (TVC). The TVC is a multidisciplinary clinic that utilizes students from ASU's Sandra Day O'Connor College of Law, the W. P. Carey School of Business, Fulton School of Engineering, and the College of Liberal Arts and Sciences. TVC students evaluate ASU technologies, perform market research, identify commercialization opportunities, and assist with transaction negotiations. In exchange for their service, TVC students receive credit toward graduation. Privately funded by a leading corporate law firm in Phoenix, Arizona, Rogers & Theobald, LLP, the activities of the TVC offer unique experiences for its students and provide highly skilled assistance to the university's technology commercialization efforts.

In addition to the TVC, AzTE developed the Lisa Foundation Law Fellowship. Sponsored by a private foundation, the fellowship is offered each year to two top ASU law students with an interest in intellectual property (IP) law. With the guidance of an IP law firm, Steven G. Lisa, Ltd. (Chicago, Illinois), Lisa fellows learn how to draft and assess patent claims, search for prior art, and bolster claims of existing ASU filings. Like the TVC, the Lisa Foundation Law Fellowship gives a unique experience to students while providing an invaluable service to the university.

2.4 *External technology acquisition*

There are few institutions (either public or private) with an internally generated technology portfolio that, standing alone, can solve the world's most pressing health care and technology challenges. In order to develop an entity that can sustainably commercialize technology, be continually transformative, and create long-term value for the university and the community, AzTE strives to identify technologies developed by other institutions that can bolster the quality and value of ASU's technology portfolio. Bundling ASU IP with external portfolios is part of an ongoing dialogue between ASU and its commercial partners, and it has lead to joint development projects between ASU and other institutions, such as the Sun Health Research Institute (a leader in Alzheimer's research) and the Mayo Clinic. AzTE has begun to manage technology portfolios from other institutions that can be strategically bundled with ASU technologies to create new licensing and spinout opportunities. For example, one of AzTE's recent spinout companies was based on a sensor portfolio developed at Northern Arizona University.[5]

AzTE acquires access to external portfolios using a variety of structures including:

- management-service agreements to provide commercialization service in exchange for fees and/or on a contingency basis
- joint-commercialization agreements, whereby AzTE takes the lead on commercializing joint inventions
- acquisition or optioning of specific technologies of interest from another institution
- taking donations of technology portfolios from a public or private entity

Bundling technologies from other public and private sources that are synergistic with ASU's portfolio is an important part of AzTE's continued success. That is why AzTE is continually looking for opportunities to bring portfolios together where their combined effect is worth more exponentially than the sum of their individual effects.

2.5 *Speed, simplicity and certainty*

Technology translation and commercialization is sometimes called a contact sport. Transactions can take up to 18 months to consummate, and the proportion of patented innovations that

Table 1: Progression of an AzTE Transaction

TIME	ACTIVITIES
Month 1	• hold introductory meetings • provide potential partner with nonconfidential information on technology and value proposition • respond to due diligence questions • evaluate partner's interest in moving forward and ability to maximize technology value
Month 2	• sign confidentiality agreement • provide confidential information on technology • assess value market opportunity and transaction economics • engage in detailed discussions between potential partners and inventors
Months 3 & 4	• develop term sheet with business terms • negotiate agreements • consummate transaction

actually make it to market is relatively small. It is therefore essential for any organization engaging in technology commercialization to adopt a disciplined approach to deal making. AzTE strives to move from first contact to consummating a deal in four months. Table 1 illustrates the progression of an AzTE transaction.

The AzTE transaction team has developed three key guiding principles that govern all of its business negotiations, regardless of deal size or structure: "Speed, Simplicity, and Certainty."

- **Speed.** AzTE's autonomy and culture allow it to move quickly to consummate transactions. This is essential in today's dynamic technology marketplace. Speed in deal making is crucial for establishing strong partnerships. If a party is unable to move swiftly through the due diligence- and documentation processes, it may lack commitment to the project, or there may be insufficient buy-in at higher levels within the organization. This can affect a project's success.
- **Simplicity**. Early-stage technology transactions and joint-development projects are inherently complex. Given the numerous risks involved (for example, a technology not achieving its commercial endpoint or a partner's change in priorities), the odds of most early-stage technology transactions achieving success are low. Because of this, it is important that the structure of a transaction be kept as simple and flexible as possible. Many transactions fail because parties are unable to agree on terms that, in the end, do not fundamentally matter to a project's success.
- **Certainty.** The promise of value can be elusive if the counterparty to the transaction is difficult. Successful technology development transactions are based on successful relationships. Indeed, effective deal making requires the discipline to prefer a lower offer from a party with whom one might succeed, to a higher offer from a party that is less likely to see the project through.

2.6 *Faculty engagement in the technology assessment process*

For many faculty researchers, a significant portion of the time they will spend with the AzTE team involves the process of evaluating their inventions. As a result, AzTE has developed a technology evaluation process that, in addition to evaluating the commercial relevance of a disclosure, is designed to provide an opportunity for faculty to get to know the AzTE team and gain insight into how evaluation decisions are made. ASU researchers work alongside the AzTE team to evaluate the technology. The team shares with the researchers all of the technology and market due diligence performed. If a technology does not meet the university's investment criteria after being thoroughly evaluated, the technology is generally returned to the inventor along with all due diligence materials compiled during the evaluation process. Including inventors in the process has helped to minimize disputes over whether an investment decision was fairly determined. Additionally, close interaction between the AzTE team and researchers has taught inventors to better appreciate market needs and expectations, which has increased the quality of invention disclosures filed by ASU faculty and researchers.

3. BENEFITS OF TECHNOLOGY TRANSLATION

3.1 *Private sector benefits*

Between the research institutions that create innovations and the customers who eventually use them sit the technology adopters. These are the industrial companies, development companies, and other enterprises that adopt early-stage ideas and convert them into useable products and services that address market needs. A number of trends are providing significant opportunities for universities with effective technology commercialization programs to build strong partnerships with these technology adopters. A few of these trends are discussed below.

Only about 15% of the market capitalization of companies that make up Standard & Poor's 500 share index (a division of the McGraw-Hill Companies, Inc.) can be tracked to balance sheet net asset value.[6] This means that approximately 85% of these companies' market values can be attributed to intangible assets. The growing appreciation of the importance of intellectual assets has prompted leading companies to manage their patents with a level of scrutiny that was once reserved only for "brick and mortar" assets. Many companies are hiring senior level intellectual asset managers. Such a manager would continually evaluate whether the company's IP strategy is aligned with its business strategy, and whether the acquisition of additional technology portfolios is necessary for success. Some of the factors influencing technology-focused companies to look beyond their internal R&D efforts to find the next big thing include:

- **Market Competition.** In order to become more competitive in the global marketplace, today's companies are more likely to in-license core technology platforms so that they can get to market quicker and access greater opportunity.
- **Technology Convergence.** Cutting-edge technology platforms are complex and require multidisciplinary expertise. For example, the next generation of flexible display technology will require in-depth expertise in engineering, material sciences, microelectronics, and nanotechnology. Such a diversity of disciplines is prohibitively expensive for many companies to develop internally.
- **Innovators' Dilemma.** Many larger companies have difficulty innovating in a way that significantly changes their business. As a result, many internal R&D programs focus on incremental improvements to existing product lines. To remedy this problem, companies look outside of their internal programs to identify disruptive, "game-changing" technologies.
- **Lack of R&D Productivity.** Better tools and access to information have enabled companies to more efficiently assess the return on their internal R&D programs. Internal development projects that are not productive can be terminated in favor of acquiring technology elsewhere.

3.2 *Public sector benefits*

Companies in developed nations struggle with the economics of selling products in developing regions. Because universities are not as pressured by the competitive, profit-focused aims of the private sector, they can deploy significant resources to tackle some of the most vital challenges in these societies. Moreover, well-run technology translation programs can implement strategies to enhance the adoption of licensed technologies in developing countries. The following are some examples of strategies that ASU and other research institutes have pursued:

- reserving *carve-out rights* in licensing agreements to continue to allow the university to use and provide, for charitable purposes, private access to the technology
- favoring commercial partners that are willing to commit to providing technology access in developing regions over those who will not
- encouraging partners to set up regional joint ventures with companies capable of bringing technologies to market in developing regions
- providing to partners financial flexibility in the form of reduced royalties and other discounts to help make product development and marketing in developing countries more attractive
- providing field-of-use licenses and regional/geographic use licenses to ensure that the best commercialization partners are selected for geographic regions

Public and private research-granting organizations recognize the importance of technology translation for ensuring that funded research programs result in products that improve the quality of life throughout the world. Many granting agencies require that grant applicants provide in their applications a technology adoption and commercialization plan along with the research plan. As part of this trend, AzTE participates in ASU's application and acquisition of grants from public and private sources. In 2004, AzTE participated in developing the Intellectual Property Sharing Plan for a US$43 million grant, which ASU received from the U.S. Army, to establish the Flexible Display Consortium, a university/industry consortium developed and led by ASU to create the next generation of flexible display technologies. Box 2 provides a summary of IP management terms that public research institutions can adopt when structuring a public/private consortium.

3.3 *Local economic development benefits*

University technology translation and market-based commercialization can significantly affect the local economy. Consider the following example of a recent ASU transaction that is helping to grow the economy in Phoenix, Arizona.

Agilent Technologies, Inc. is a premier measurement-instrument and technology company with revenue in excess of US$5 billion per year. In November 2005, Agilent Technologies purchased Molecular Imaging Corp. (based in Tempe, Arizona), an ASU spinout company that has become a leader in atomic-force microscopy (a technology widely used to measure properties of materials at the nanometer scale).

In 1993, an ASU professor, Dr. Stuart Lindsay, developed his groundbreaking measurement technology. With the assistance of ASU's technology commercialization office, Dr. Lindsay and his team founded Molecular Imaging. Through a sponsored-researcher relationship with ASU, the company continued to leverage the university's research capability and infrastructure to develop its products. To build the company, Dr. Lindsay attracted entrepreneurial talent and capital to Arizona from across the United States. In fact, many employees were offered research positions at ASU. Discussions with Agilent during and after negotiations revealed that it valued the strong partnership between Molecular Imaging and ASU. Partly because of this, Agilent declared its commitment to keeping the Agilent business unit in Tempe and to growing the business locally. Agilent's investment in Arizona will yield significant benefits, including new-technology partnering opportunities, partnership opportunities for local businesses, and more technology-related jobs. Soon after the acquisition closed, AzTE began working with some of the founders of Molecular

Imaging on the next promising entrepreneurial spinout venture. AzTE is also in discussions with Agilent regarding additional technology licensing opportunities. Despite the obvious benefits of the deal to Agilent and Molecular Imaging shareholders, this transaction serves as a billboard for the power of technology translation and its impact on local economic development.

4. CONCLUSION

The importance of effective technology translation is profound. Since the enactment of the Bayh-Dole Act in 1980,[7] products derived from the research community have accounted for more than $40 billion[8] in market value alone, even without considering the positive impact on the economy. In the three years of AzTE's existence, the company has started 13 other companies, entered into over 80 commercialization transactions, and generated more than US$8 million in revenue. During the last 24 months, three of the 13 companies were sold to acquirers located in Arizona that plan to continue to grow these companies locally.

From a research institution's perspective, an effective technology translation program not only generates significant revenue for research, but also develops an entrepreneurial culture among university researchers and private researchers. For the international community, technology translation can be an important catalyst for economic development and a significant source of partnerships with the business community. Although President Crow's model for the New American University may not be adoptable completely for all institutions, its principles of social engagement and creative technology partnering can be adapted for use by other public and private institutions and can yield significant returns for those institutions in developing regions throughout the world, while benefiting people in those regions. ■

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9 ASU. 2005. *Arizona State University: A New American University*. Arizona State University, Tempe, AZ. www.asu.edu/president/newamericanuniversity.

Box 2: Summary of Terms- IP Management Plan for Public/Private Consortium

1. Selected Definitions

"Background Technology" means all Member Technology and UNIVERSITY Technology that may reasonably be expected to be required to conduct a Center Project.

"Center Projects" means projects identified in the annual plan created and amended from time-to-time, as referenced in the Cooperative Agreement, that details projects, milestones, principal investigators, and resources committed for Center activities.

"Center Technology" means all Technology that has been conceived: (1) by one or more Center Members or UNIVERSITY on a Center Project using the center facilities, or personnel of the Center or UNIVERSITY or personnel of a Member that are dedicated to the Center or (2) by one or more Center Members or UNIVERSITY using government funds allocated to the Center for Center Projects.

"Improvement(s)" means any Technology that constitutes an improvement, modification, or derivative of an item of Center Technology, but which is not itself Center Technology.

"Member Technology" means all Technology conceived, owned, or controlled by a Member that is not Center Technology.

"Technology" means all intellectual property rights, discoveries, innovations, know-how, works of authorship, and inventions, and derivative works, whether patentable or not, including computer software and code, as intellectual creations to which rights of ownership accrue, including, but not limited to, patents (including U.S. or other international or foreign patents or patent applications, whether provisional, non-provisional, or continuing, or any addition, division, continuation-in-part, substitution, renewal, reissue or extension thereof), trade secrets (as defined in the Uniform Trade Secrets Act), maskworks, and copyrights and copyrightable material.

"University Technology" means all Technology conceived, owned, or controlled by University that is not Center Technology.

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2. Ownership

(a) Ownership of Center Technology. Inventorship of Technology is determined in accordance with U.S. patent laws. Each Member whose personnel are inventors of a particular item of Center Technology jointly owns that item in undivided shares. UNIVERSITY is deemed to be in inventor on any case where Technology was developed with Significant Use (that is, a use that materially contributes to the generation, creation, or development of Center Technology) of center facilities unless use of Center Facilities was separately paid for at full cost.

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Box 2 (Continued)

(b) Ownership of Member Technology and UNIVERSITY Technology. All Member Technology and UNIVERSITY Technology shall continue to be owned by such Member or UNIVERSITY and, except for specified circumstances, there is no obligation to license such Technology to others.

(c) Special Rule for Subcontracts. All Members with ownership rights in Center Technology solely by virtue of performing a subcontract for experimental, developmental, or research work, grant the licenses below regardless of the terms in any such subcontract.

(d) Ownership of Improvements. Members or UNIVERSITY who independently conceive of an Improvement on Center Technology that has been publicly disclosed shall own such Improvements, except to the extent the Improvement constitutes Background Technology of a Member or UNIVERSITY disclosed solely for the purpose of granting non-commercial uses on Center Projects.

Improvements by Members or UNIVERSITY based on Center Technology that has not yet been publicly disclosed shall be owned by the Inventing Members or UNIVERSITY, subject to the grant of license described below.

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3. Licensing

(a) License for Research and Educational Use of Center Technology. UNIVERSITY and all non-Inventing Members (other than Channel Members) are granted a royalty-free, nontransferable, nonexclusive right to make, use, and have made on their behalf items of Center Technology solely for internal research and development purposes as required by such Member to perform research and development under a Center Project. Provided appropriate steps are taken to protect the Technology, UNIVERSITY shall have the same rights with respect to not-for-profit teaching and other educational purposes.

(b) Licensing for Commercial Uses.

(i) Non-Inventing Members. Non-Inventing Members have the right to negotiate with any Inventing Member for commercial use of an item of Center Technology on terms as they shall mutually agree. Commercial use licenses of non-Inventing Members extend to Affiliates of the Members. Subject to certain legal limitations that products be manufactured substantially in the U.S., Members may negotiate with the Inventing Members for an exclusive or co-exclusive right to any Center Technology provided all other Members agree to terms of such license.

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Box 2 (Continued)

(ii) Non-Member Third-Parties. Inventing Members may negotiate with non-Member third parties on such terms as they shall mutually agree for commercial use of Center Technology 18 months after the Center Director circulates a disclosure of such Center Technology to all Members.

(iii) Royalties. All remuneration received by any Inventing Member for licensing an item of Center Technology, less an administrative fee, is shared equally among all Inventing Members of such Center Technology.

(c) Licensing of Background Technology. Members are not obligated to license Background Technology, except that with respect to certain Background Technology identified by a Member to be included in Center Projects, Members and UNIVERSITY are granted a non-exclusive use for non-commercial activities on Center Projects identified in the Annual Program Plan. Members are not prohibited from negotiating licenses to such Background Technology on such terms as they shall agree.

(d) Licensing for Improvements to Center Technology. With respect to Improvements of UNIVERSITY or Members on Center Technology that have not yet been publicly disclosed: (a) All Members and UNIVERSITY are granted a royalty free, nontransferable, non-exclusive license solely for non-commercial purposes to conduct activities on Center Projects; and (b) all Members and UNIVERSITY have the right to negotiate in good faith for a non-exclusive license to use Improvements for commercial purposes.

With respect to Improvements of UNIVERSITY or Members on Center Technology that has been publicly disclosed, neither UNIVERSITY nor the Member(s) are required to license the Improvement except to the extent of any non-commercial license required under Section 3 above if the Improvement constitutes Background Technology.

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4. Disclosure of Center Technology

Members must promptly disclose to the Center Director: (a) all Center Technology on a Center Invention and Discovery Disclosure Form, (b) patent filings, and (c) details of licenses entered into for Center Technology.

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5. Management and Prosecution of Center Technology

Inventing Members of Center Technology appoint a Member to manage and facilitate the filing, maintenance, and prosecution of patents and copyrights (the "Designated Prosecution Member"). If the Inventing Members cannot agree on a Designated Prosecution Member, the determination is made by the Center Technology Committee. Costs related to filing, prosecution, and maintenance

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Box 2 (Continued)

of patents and copyrights are shared equally by Inventing Members. Each Member is responsible for the prosecution for patent application for its own Background Technology.

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6. Follow-on Center Members

With respect to Center Technology (and Background Technology or Improvements subject to the licenses described above) developed prior to a new Member becoming a Member, the new Member: (a) is granted licenses solely for internal research and development purposes under a Center Project, and (b) may negotiate for licenses with respect to commercial use for such Center Technology.

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7. Infringement

Members have a duty to notify the Center Director of suspected infringement of Center Technology. With the consultation of Inventing Members and the Center Director, the Designated Prosecution Member determines the proper course of legal action. The expenses and any settlement shall be shared equally, less an administrative fee. In certain cases, Inventing Members need not participate in legal actions. Inventing Members cooperate to defend validity challenges by third parties.