
Preliminary Recommendations

Facilities Work Group



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Arizona Biosciences Facilities Work Group

INTRODUCTION

The Flinn Foundation commissioned *Arizona's Bioscience Roadmap* in April 2002 and released the study results in December 2002. This Roadmap laid out a set of strategies and actions to position Arizona in selective fields of the biosciences, both in research stature and commercialization and consequent economic impact of this research. Four strategies and nineteen proposed actions were contained in the Roadmap.

In early 2004, Flinn formed selective Work Groups for several of these key economic actions related to the commercialization of this research and insuring its contributions to the state's economy in the future. Among the actions selected for further review and positioning for action were those related to financing biosciences firms (capital formation); facilities for biosciences firms; and entrepreneurial support in the formation of biosciences firms. This report discusses the deliberations of the Facilities Work Group — and the suggested actions to move forward in the short and long term.

Pat Grady, Director of Community & Economic Development for the City of Phoenix, and Bruce Wright, Chief Executive Officer of the University of Arizona Science and Technology Park, co-chaired this Work Group. Additional staff support was provided to the Work Group by Sandra Johnson, Associate Director at the Flinn Foundation as well as by the Battelle Memorial Institute, retained by the Flinn Foundation to assist in both the development of the *Arizona's Bioscience Roadmap* and in its implementation. The Work Group's complete membership is attached at the end of this report (Appendix A).

While building Arizona's research base is a prerequisite to creating a set of industries in the biosciences, ways also must be found to commercialize that research. This means creating new firms, attracting and recruiting firms to the state, and helping existing firms to expand. Because the business model for business formation and survival of biosciences firms is so different from that of other technology-driven firms, including software, communications, computer hardware, environmental and advanced manufacturing, there is considerable reluctance, even in mature regions that have reached a critical mass of biosciences firm formation to address the needs of many of these firms for wet lab space. Consequently, specific steps to build private-public partnerships to address the space needs of bioscience firms will be needed customized to where Arizona is now positioned in these firms' stage of development.

The *Arizona's Bioscience Roadmap* stated that Arizona must provide sufficient wet-lab space for research, startups, and established firms. The Roadmap identified the need for three types of biosciences space:

- Research organization research space
- Biosciences incubator/accelerator startup space
- Multi-tenant biosciences space


Outlined below is a continuum of space needs that St. Louis’s Coalition for Plant and Life Sciences developed that may be useful to consider as projections and needs for Arizona biosciences firms are identified.

Facilities	Approximate Sq. Ft. per User
Pre-Incubator/Translational Space	500–1,500
Incubator Space	500–5,000
Accelerator/”Graduate” Space	3,000–15,000
Multi-Tenant Space	5,000–50,000
Full-Scale Manufacturing Space	35,000 and up

Source: The St. Louis Coalition for Plant and Life Sciences

The next table explains the space needs of bioscience firms within each category of the above chart.

Description	Stage of Business Activity	Approximate Sq. Ft. per User
University Research Space/“Surge” Space	<ul style="list-style-type: none"> • Expansion and/or temporary space to handle new research projects of limited time/duration or to accommodate university’s space needs during on-campus construction/renovation. • When a university activity is being expanded or created but is behind the capital planning cycle of the university, creating need for space to get it up and running until a new building opens. • Space in which to conduct experiments and tests that for various reasons may be more appropriate in an off-campus location. • Space in which to locate administrative offices and functions related to the external activities of the University, e.g., technology transfer, sponsored programs, clinical trials liaison, industry liaison, etc. 	
Pre-Incubator/ Translational Space/ “Skunk” Works (May represent part of the space of an incubator facility)	<ul style="list-style-type: none"> • Aimed at companies in the virtual stage, not at university laboratories. Needs to be off campus or isolated somehow from university IP policies so that companies control what is done there under non-university funding, even if they are faculty companies. • Small amounts of space in which to undertake feasibility and pre-prototype/prototype development around which a firm may be formed, including proof of concept, initial business plan development and initial fundraising. • Commercialization, due diligence, reduction to practice work around IP of the university/large firm to assess commercial potential. • SBIR/STTR work of faculty determining whether a product can be developed. • Contract and sponsored research from industry; support for full time faculty and support personnel to undertake work in a more appropriate off-campus setting because of its “downstream” nature. • Also includes entrepreneurs in the community with an idea that needs to be flushed out into a concept plan with initial technical feasibility. 	500 – 1,500
Incubator Space	<ul style="list-style-type: none"> • Space for firms to launch and develop their business and product and further develop business plan. • Management and logistical support provided intensively to client-tenants. • Provide assistance in raising venture capital for client-tenants. • Includes usually minimum of 30,000 square feet per facility for lab and offices. 	500 – 5,000
Post-Incubator/ Accelerator/ Expansion/ “Graduate” Space	<ul style="list-style-type: none"> • Space for businesses that come out of incubator but are still in development. • Multi-tenant in nature and may represent growth space for firms once they leave the incubator. • May provide some management and logistical support to tenants (but at a lower level than is typical in an incubator). • Includes usually minimum of 30,000 square feet per facility for lab and offices. 	3,000 – 15,000

Description	Stage of Business Activity	 Approximate Ft. per User
Multi-Tenant Space	<ul style="list-style-type: none"> • Space for incubator and accelerator graduates. • Space for firms already in business but do not need to go through an incubation period. • Multi-tenant space with wet lab and other physical and distribution systems that enable bioscience firms to do business, including R&D. • R&D divisions of established companies — including out-of-town companies. • Includes usually minimum of 75,000 – 100,000 square feet per facility for lab and offices. 	5,000 – 50,000
Pilot Production Space/ Scale Up / Contract Research Space (May or may not be housed in one of the other space solutions listed)	<ul style="list-style-type: none"> • Generally space for firms after incubation to undertake manufacturing feasibility and clinical trials to assess how and whether an R&D breakthrough can be manufactured. • Used for solving technical issues associated with producing larger quantities of product. • Firms generally only use the space for a limited time period for their testing and continue to remain in their R&D and other space at the same time. • Space in which GMP (“good manufacturing practices”) can be undertaken in small batches to meet FDA and other requirements regarding quality control. • Helps move product toward manufacturing but requires a critical mass of firms to insure full use of the facility. • Size of facility is based on the economics of having various combinations of bioprocessing scale up capabilities, the demand for these various combinations and an analysis of the service fee income that the manager can make under various scenarios of utilization of facilities by bioscience firms. 	5,000 – 10,000
Full-Scale Manufacturing Space	<ul style="list-style-type: none"> • Space to mass produce products; requires manufacturing lines and facilities dependent on the nature of the product. • Some biosciences firms moving from R&D build own manufacturing facilities and others contract for this effort. • Need not necessarily be located adjacent to or part of the R&D operation of a firm, again dependent on nature of product, volume, etc. • Usually single firm facility with some exceptions depending on product. 	35,000 and up

Research Organization Space

Arizona's Biosciences Roadmap set as a goal or objective moving Arizona to a growth rate in Federal National Institutes of Health (NIH) funding equal to that of the rate of the top ten states. This translated into increasing Arizona's success in securing NIH funds by its research organizations from \$117 to \$217 million by 2007. But to accomplish this requires that Arizona have sufficient research labs, facilities and equipment first, followed by research support and enhancement to increase faculty and clinician base. Adequate facilities can attract researchers to secure the additional funds. A cursory Battelle review of activity around the nation found billions of dollars being invested in additional research facilities in both the private and public sectors from a \$200 million plus medical research facility in Evanston, Illinois and a \$130 million interdisciplinary research building in Chicago to a \$100 million medical school building in New England. The *Arizona's Bioscience Roadmap* estimated that approximately \$400 million in one time funds would need to be found for such facilities to generate \$100 million annually in NIH funds—the target level established for Arizona by 2007. The table below shows the kinds of space, facilities and labs necessary for every \$100 million in NIH funding and is based on Battelle's national benchmarking of the exemplary university research centers to which Arizona aspires. It also shows that these one-time investments have a relatively short payback period, essentially recouped in less than five years:

Estimate of One-time Requirements and Costs in Space, Research Groups and Start-up Packages for Supporting Additional \$100 Million in NIH Funding at Universities		
Estimate of	Key Assumptions	Requirements
Space Needs	\$225 of research funding per sq. ft.	444,444 sq. ft.
Space Costs	\$300 per sq. ft. for construction of basic research labs not including core labs	\$133 million
Core Research Labs	May include structural biology, micro-array facilities, animal facilities, etc.	\$25 – \$50 million
New Research Groups	\$900,000 in NIH annual funding per research group	111 research groups including senior PI, assoc. faculty, post-docs, research fellows
Start-up Package Costs	\$2 million for start-up packages	\$222 million, including equipment, supplies, etc.
Total One-Time Costs		\$380 – 405 million

Recent actions by the Arizona Legislature and Governor have aggressively moved Arizona forward in securing some of the necessary funds and authorization to meet the Roadmap time table and requirements for adequate bioscience research facilities. This will enable Arizona to better secure and leverage significant Federal NIH and other funds. However, as suggested in the Bioscience Roadmap additional research and equipment funds as well as missing facility infrastructure will still be necessary for the Roadmap's implementation to be successful.

Biosciences Industry Space

In addition to research space, as discussed previously, there are needs for additional space for firms, which are broken into three categories for the remainder of the discussion:

- Startup or incubator space
- Multi-tenant or accelerator space
- Private sector single tenant manufacturing space

TGen's new facility, now under construction, does include accelerator space as does the University of Arizona Science and Technology Park, which has existing multi-tenant space available. Incubator space is being proposed as part of new research space being planned at Northern Arizona University, but, while discussions are underway regarding biosciences incubator space in both Phoenix and Tucson, such space is not now available.

Biotech space has construction costs up to three times as high as conventional office space -- \$250 to \$750 per square foot vs. \$85 to \$100 for office space. Biotech labs have specific needs: heavy duty airflow systems; chemical resistant interiors; backup electrical systems, and other features. They need hooded vents, gas lines, deionized water, ventilation systems and upgraded mechanical and electrical systems. Firms need flexible space to expand and contract as funding is available, in addition to short leases and the ability to sublet space.

Physical and System Needs for Biotech Space

- **Air handling:** HEPA filters; biosafety level 3 requires negative pressure and filtered exhaust
- **Water supply:** Sufficient capacity; purification systems; temperature controls
- **Power:** Steady, reliable and uninterruptible; dedicate power and backup systems
- **Communications:** Data security lines and high speed transmission
- **Specialized Needs:** Sufficient HVAC capacity; electrical connections; animal facilities; EMI vibration and noise controls and abatement

Source: Meeting the Needs of the Biotech Lab User, AGI and Jennings Strouss, 4/2003

Because Arizona does not yet have a critical mass of firms it is likely over the next several years as Arizona builds a more robust research engine, as TGen matures, and as the state attracts entrepreneurs and bioscience opportunities from outside the state, there will be an increased demand for private wet lab space. While there is no definite and precise inventory of the gap in bioscience space (because of variations within segments making up the biosciences as to space needs and requirements) there is already anecdotal information of early stage firms having difficulty finding the kinds of ideal space they desire in Arizona, both in Phoenix and Tucson. Actually, this is a positive sign for if these concerns were not being raised, the question of the maturity of the emerging biosciences cluster in Arizona would need to be considered.

It's not easy to find someone willing to build wet-lab space and then make it available to barely funded startup companies with short-term leases.

– Dr. Michelle Hanna, CEO, RIBOMED

This suggests that two kinds of space for private biosciences firms need to be examined: incubator space for startup firms and accelerator/multi-tenant space for post-incubator, small to mid-size firms. To address such multi-tenant space needs will require a partnership of government, private developers, and research organizations. Experience throughout the U.S. shows that most regions “jump start” their efforts to create new bioscience enterprises around

their academic health centers and research universities committing to guaranteeing a portion of wet lab space for their own use, providing a “credit-worthy” tenant, so that other startups can also share in the space or facility. This approach has been used by universities and academic health centers throughout the U.S. to address both incubator and accelerator or multi-tenant space.

The kinds of space such partnerships develop includes incubator space for startups, “accelerator” space for later stage firms, and multi-tenant and single-tenant space for firms as they grow and expand, in more sizeable amounts. Multi-tenant and, ultimately, more single firm space for biosciences firms will need to be addressed in concert with private sector actions. Established firms moving to Arizona will need major research, development, and technology buildings to move into quickly. Much as states and regions developed “shell buildings” ready for immediate occupancy when a jurisdiction landed major manufacturing facilities after WWII, the 21st Century equivalent may be a biosciences multi-tenant building or at least one with a sufficient shell and infrastructure to be quickly adapted to the needs of various bioscience firms.

Incubators: Incubator space for bioscience firms is for idea development at a firm’s business formation stage. Incubators offer shared space including wet labs; logistical support from conference rooms to secretarial support; and management assistance in business planning, marketing and product development.

Accelerators: Accelerator space for bioscience firms is for firms with or near product introduction and entering the marketplace and needing more space that can be flexibly expanded or contracted as market conditions dictate. While logistical support may be needed, the firm is not likely to need other support as it does during its incubation period.

WORK GROUP DISCUSSIONS AND DELIBERATIONS

The Facilities Work Group met from February through June 2003. The Group first met jointly with the Capital Formation Work Group to discuss the Roadmap’s findings and conclusions. At their second meeting Facilities and Capital Formation Work Groups met separately. At this second meeting further discussion occurred regarding facility needs, as well as a discussion of how other states and regions are addressing the issue of facility development and financing. At later meetings of the group discussion of the types of facilities needed, the market demand for such facilities, and sharing of these results of the analyses contained in this report occurred. The facilities group was also briefed by David Fordon, President of Salt Devco on the Generation 7 master plan proposal for development along the Pima Road corridor. The final meeting addressed conclusions and actions contained in this report. This report summarizes those conclusions and recommendations and the deliberations of the Work Group.

FINDINGS REGARDING BIOSCIENCE FIRM EMPLOYMENT GROWTH AND ESTIMATED IMPACT ON SPACE/FACILITY REQUIREMENTS

Battelle projected the economic impact of the *Arizona's Bioscience Roadmap* on the Arizona economy, including firms and associated jobs. These estimates are based on an assumed level of investments being made, as stated in the Roadmap. From these projections Battelle distributed the firms created or recruited to the state in the coming decade among the various segments making up the biosciences. Battelle did not assume an even distribution in the development of new establishments (and their employment). It was felt that such growth and distribution is likely to be more connected to the interest in and developments stemming from the implementation of the three near-term platform areas (Bioengineering, Cancer Therapeutics, and Neurological Sciences), and the impact of TGen. Hence, the mix of new start-ups and relocated firms were assumed to lean primarily toward the Research and Testing, Drugs, and Medical Devices and Instruments subsectors. Examples of existing medical devices and instruments firms in Arizona include W.L. Gore and Associates in Flagstaff and Medtronic in Phoenix. Examples of research and testing firms include Aventis/Selectide in Tucson and Ribomed in Phoenix. Examples of drugs and pharmaceutical development include Watson Pharmaceuticals in Phoenix. In short, these projections are based on the idea of building a critical mass of firms, or clustering, in which, once a base is established, there is more likelihood of exponential growth and development.

Battelle started from the point of the current employment and establishments and their distribution. Space requirements are presented in ranges and can only be projected at gross, not net square feet of space. These ranges are derived from using varying densities of employees within the space of:

- 250 feet per employee (4 per 1000 sq. ft.).
- 285 feet per employee (3.5 per 1000 sq. ft.).
- 333 square feet per employee (3 per 1000 sq. ft.).

Specifying forecasts built upon forecasts is inexact, at best, and hence should be viewed with some caution.

Summary of Space Forecast Results

It is estimated that Arizona will have to build out, on average, between 50,000 and 70,000 sq. ft. of new space/facilities each year over the next ten years to support new start-ups and relocations in the state, depending on the density of employees within the space.

To support existing establishment employment growth, between 125,000 and 170,000 sq. ft. of space will be required annually. Some of this space, however, may already exist in previously built out facilities.

Total space demand over the 10 year period equals approximately:

- 1.8 million sq. ft. at 250 sq. ft. per employee.
- 2.0 million sq. ft. at 285 sq. ft. per employee.
- 2.4 million sq. ft. at 333 sq. ft. per employee.

Estimates by Type of Establishment and Subsector

Space Requirements Forecast by Arizona Bioscience Subsector by 10 Year Totals and Annual Average (1000's of Sq. Ft.)

New Establishment Space Requirements	10 Year Total	Annual Average
Drugs	117–156	12–16
Medical Devices & Instruments	303–403	30–40
Research & Testing	107–142	11–14
TOTALS	600–702	53–70
Existing Establishment Space Requirements		
Drugs	309–412	31–41
Medical Devices & Instruments	405–539	40–54
Research & Testing	546–727	55–73
TOTALS	1260–1678	126–168
Total Establishment Space Requirements		
Drugs	426–568	43–57
Medical Devices & Instruments	708–942	71–94
Research & Testing	653–869	65–87
TOTALS	1787–2380	179–238

Space Requirements Forecast by Arizona Bioscience Subsector by Timeframe (1000's of Sq. Ft.)

New Establishment Space Requirements	First 5 Years	Second 5 Years
Drugs	52–70	65–86
Medical Devices & Instruments	142–190	160–214
Research & Testing	49–65	58–78
TOTALS	244–324	283–377
Existing Establishment Space Requirements		
Drugs	172–229	137–183
Medical Devices & Instruments	225–300	179–239
Research & Testing	304–405	242–322
TOTALS	701–934	559–744
Total Establishment Space Requirements		
Drugs	225–299	202–269
Medical Devices & Instruments	368–490	340–453
Research & Testing	352–469	300–400
TOTALS	945–1258	842–1121

The Medical Devices & Instruments subsector will require the most “start-up” and relocation space—accounting for over half of the 10-year total of space for new establishments. The Drugs and Research & Testing subsectors will require roughly the same amount of new establishment space over the 10 years of the Roadmap. The existing Research & Testing subsector, due its ongoing growth, will lead the demand for additional space—requiring just under half of the 10 year total of space for existing establishments. This growth in existing R&T establishments will also account for approximately the same amount of space on an annual basis, as all new establishment employment combined. The demand for existing firm space will be slightly higher in the first five years of the Roadmap. However, some of this space may already exist, so the second five years may require more “newly built” space.

New Arizona establishments (start-ups and relocations) will require between 244 and 324 thousand sq. ft. in the first 5 years of the Roadmap; requiring up to an additional 377 thousand sq. ft. over the second 5 years. Overall, the second five years of the Roadmap will require somewhat more new establishment space due to the increasing level of start-ups stemming from the various research efforts occurring in the early years of the Roadmap.

These are estimates made at the “macro” level and will require a further full market analysis as suggested in recommendations section of this report.

BEST PRACTICES IN ADDRESSING SPACE AND FACILITY ISSUES IN THE BIOSCIENCES

States and regions are addressing the space and facilities needs of bioscience firms, as outlined above, as part of research park developments; as part of university expansion projects; and as private-public partnerships that may involve use of public bonding, operating and tax credit support, depending on the jurisdiction. The Work Group examined a number of approaches being used elsewhere to address space and facilities needs for biosciences including:

- **Quasi-public investment in the leasehold costs of biosciences space: The Connecticut Bioscience Facility Fund.** Managed by Connecticut Innovations (CII) this Fund began with \$30 million of state funds and \$10 million from the proceeds of CII’s equity investments. The state later provided an additional \$20 million in 2001. The Fund has committed more than \$20 million and financed more than 225,000 square feet of space since 1998.
 - **Example:** An investment from the fund was used to help package an overall project in a build to lease facility for a major pharmaceutical firm for interim (four year) use while its new research campus was under construction. The 20,000 of square feet will either be used by the firm long term or will provide made ready to use space available for other bioscience firms in Connecticut.
 - **Example:** An investment of \$5.2 million from the Fund was part of a series of investments made by CII in a Connecticut startup including a direct equity investment. This firm is now valued at over \$300 million and employs more than 175 employees in a 70,000 square foot facility in New Haven’s research park.
- **Use of state tax credits to help offset bioscience space costs: State of Arkansas Biotech Facilities Tax Credit.** One of several tax credits adopted as part of an overall tax package enacted in 1997, the State of Arkansas to it provides a 5% credit against total costs for construction, expansion, improvement, renovation or purchase of biotechnology facilities and equipment in an effort to grow and enhance the biotech industry in the State. The credit may be used to offset the first \$50,000 of income tax liability and 50% of any remaining income tax liability. It also includes a carry forward of unused credit for up to nine years. The State of Arkansas also has other tax credits for workforce development and training, R & D, and construction of biofuels manufacturing facilities.
- **University/academic health center underwriting of the costs of incubator/multi-tenant space: BioSquare: An Example of University Speculative Real Estate Development.** BioSquare is a \$700 million development to provide 2.5 million sq. ft. of research, office, conference, hotel and retail space within a 16 acre urban research park in

the Boston University medical complex and Boston Medical Center. Two buildings have been completed with the anchor building (200,000 sq. ft.) occupied by university labs, core analytical labs, and animal care facilities. The second building of 192,000 sq. ft. is a multi-tenant building that has been formed as a “condo” to allow for occupancy by a medical center affiliate research foundation and by private sector tenants. Private tenants can obtain both free and for fee unique and high cost resources and services ranging from imaging, access to a transgenic mice lab and to a contract GMP facility. This multi-tenant space is designed to house spin-off firms from the medical center and includes 12,500 sq. ft. of Class A wet lab and office space to accommodate 6–7 incubator firms.

- **University/academic health center underwriting of the costs of incubator/multi-tenant space: Audubon Business and Technology Center – Columbia: An Example of a Public-Private Development Partnership.** The Audubon Business and Technology Center is located within the Audubon Biomedical Science and Technology Park and is an eight floor, 100,000 sq. ft. research facility. It has 19 tenants and is 100% occupied with 30% of the tenants licensees of Columbia University. Columbia U. invested an additional share equal to its shell construction investment to build out the interior space of the building including development of the incubator. Of this space, 10,000 sq. ft. is set aside for expandable generic wet lab space for faculty spin-offs and early stage startups. Approximately 50% of the biotech space was left as build to suite space. All of this has been now been built out.
- **University/academic health center underwriting of the costs of incubator/multi-tenant space: Virginia Biotechnology Research Park and Incubator: An Example of a Public Development Partnership.** This research park is a joint venture of the Virginia Commonwealth University, the City of Richmond, and the State government. It is a ten year old venture in downtown Richmond, adjacent to Medical College of Virginia campus. When fully build out, the park will have 1.5 million sq. ft. A key factor in the park’s success to date is the participation of the State through the creation of a statewide research park authority which created the vehicle for the issuance of bonds covering a majority of the park’s development and construction costs. Four buildings are owned by the authority and the park’s incubator was financed with \$5 million from a state general obligation bond.

Other approaches in place among states and regions to address the need for wet lab space include:

- **Underwriting through either public sector subsidy or pass-through as a tenant surcharge an insurance pool to enable developers to receive guarantees on leases regardless of whether biosciences firms fail.** It should be noted that in most regions of the country building biosciences clusters, once a critical mass is achieved, there is little difficult reusing bioscience wet lab space or finding new tenants. But the private development community and their financiers continue to believe that restaurants and other service establishments, with high turnovers, are safer real estate investments because of perceived ease of reuse of space.
- **Using public loan guarantee programs to backup the construction of early stage bioscience firm space.** One major drawback to these efforts is that public loan guarantees generally are provided to a firm, not a developer, and only mature biosciences

firms are interested in purchasing their own facilities, making these programs less than ideal to meet the needs of small, young, growing bioscience firms.

- **Direct public subsidy of some differential of rental costs of bioscience firms.** Some jurisdictions are basically providing a grant to the bioscience firm to underwrite the leasehold improvement portion of their space, expressed as so much money per square foot.

Bioscience space and addressing an adequate supply is a problem even in America's more mature bioscience regions such as San Diego and Maryland. In San Diego, even to this day developers prefer to not make the leasehold improvements until they have a signed bioscience tenant in hand. But because of the strong growth of this cluster they are now constructing buildings with the essential infrastructure in place for air, water, and other critical systems to be more easily installed.

ARIZONA'S PROGRESS TO ADDRESS SPACE NEEDS FOR BIOSCIENCES

The conclusion of the Work Group is that this *Arizona's Bioscience Roadmap* action to offer sufficient wet lab space for the biosciences industry is important and needed. ***If this action is not addressed, it will be more difficult for Arizona to build a critical mass of bioscience firms and for Arizona's research base to contribute to the State's economy in terms of jobs and products.*** However, as will be pointed out in the next section Arizona is not yet at a mission critical position, except for the university research space issue which is moving forward. There is time to address efforts to provide incubator, accelerator, and private multi-tenant space over the next two years.

Considerable progress has been made since the *Arizona's Bioscience Roadmap* was released in December 2002. Among accomplishments include progress in addressing a considerable portion of the space needs for the biosciences, particularly in the area of research space.

First, the Arizona legislature has approved \$440 million in special financing arrangements to enable the state's three public research universities to move forward with construction of a significant number of new research and clinical facilities that will enable the universities ultimately to capture more Federal NIH and other funds into the state. However, all these funds are not for biosciences-related facilities and ways still must be found to address equipping these facilities and securing additional research funding support. And efforts must continue to complete plans to address all research space needs in the years ahead.

Second, plans are moving forward for the construction of a permanent facility for The Translational Genomics Research Institute (TGen) and The International Genomics Consortium (IGC). Their combined headquarters facility, with City of Phoenix support and underwriting, will offer 170,000 gross sq. ft. in a six story building. A private sector developer will lease one floor of this building as accelerator multi-tenant space, offering 30,000 sq. ft. for this purpose.

So at least in the foreseeable future research space issues are being addressed. One key remaining issue is translational clinical space to encourage collaboration among faculty, clinicians, and industry.

Regarding incubator startup space, Flagstaff/NAU is addressing both their research and incubator requirements by including a permanent incubator facility in one of the new research buildings at NAU. In Tucson, incubator and accelerator space will be provided in the short term at the Arizona Center for Innovation at the University of Arizona Science and Technology Park. In Phoenix a number of discussions are underway to address the need for incubator and accelerator space at ASU. However, a key missing ingredient in each case is a source of operating subsidy for managing a biosciences incubator. It is estimated that \$20/25,000 in subsidy per month for up to 18 months is needed before a biosciences incubator can meet its operating costs if there is no underlying debt to be paid back. If there is debt service such costs could be triple or more this amount.

Finally, as a critical mass of firms is formed and such firms either graduate from incubators and accelerators or are attracted to the state at a more mature stage, there is a definite need to address private sector wet lab space in the State. There remains a need for Arizona to address over the mid to long term through private and public partnerships, the need for additional private sector single tenant and multi-tenant space if Arizona is to accommodate this industry and its growth.

RECOMMENDED ACTIONS TO ADDRESS BIOSCIENCES SPACE AND FACILITIES NEEDS

The Facilities Work Group noted a number of efforts underway, but not yet completed, to address various elements of what would make up a comprehensive plan to address space and facilities needs of biosciences researchers and firms over the long term. Because some of these elements are not yet resolved, the Work Group felt that the best approach was to offer a set of both immediate and short term actions as well as a long-term action:

IMMEDIATE AND SHORT TERM ACTIONS:

Action One: Complete a Full Market Analysis of Space Needs and Demands.

While the projection of space needs for biosciences contained earlier in this report provides a good estimate of a band of demand, it will be necessary to complete a full demand analysis for biosciences space addressing variations in needs and requirements among these segments (e.g., devices, research and testing, etc.). This is a task that might be undertaken by the private sector in partnership with the public sector.

Action Two: Finance Bioscience Leasehold Improvements through A Pool or Fund.

One specific need is for financing of specialized laboratory tenant improvements (e.g., leasehold improvements), which are hard to finance given their specialized use and cost. If this issue can be addressed, private developers are much more likely to consider, build and obtain other financing for building shells housing bioscience firms.

Among options to address this problem include:

1. **Use an insurance pool** whereby developers could receive a guarantee to be paid for the life of the lease. This pool could be financed by an initial loan repaid as the fund is replenished through a surtax on all bioscience properties leased, paid by lesser or lessee.

A permanent revolving fund could then be established that would be replenished by the surcharge paid on leased space.

2. **Establish a real estate oriented limited partnership corporation** specializing in bioscience leasehold improvements investments, much like a specialized or modified REIT. Like a venture fund, it takes equity in return for financing the leasehold improvements. This would be a privatized version of Connecticut's efforts.

Action Three: Identify funding sources and provide operating support for incubator space and incentives to encourage accelerator space in each of Arizona's major cities, operated in close coordination with public research universities in each region.

Efforts are moving ahead in Flagstaff and, to some extent, Tucson to be able to offer wet lab incubator space as well as accelerator space. In Phoenix accelerator space is also being addressed and various discussions are underway regarding biosciences incubator space but without final resolution to date. In all three regions, however, a key constraint on offering and operating such space is the need for a source of operating subsidy, at least in the early months and years of a biosciences incubator as outlined previously.

Action Four: Encourage private developers to develop multi-tenant and single tenant space suitable for bioscience firms as demand continues.

In concert with Action Three that can reduce the risk facing private developers in obtaining financing for building of multi-tenant bioscience space, developers must be educated about the opportunities and needs of bioscience firms. Pension funds, philanthropic endowment investments, and state and local loans might all be used to stimulate and encourage private sector efforts to build wet lab space in Arizona. As Arizona's biosciences cluster matures outside investors might be also encouraged to look at the State and its facilities needs as strong investment possibilities.

Action Five: Encourage the Arizona Board of Regents and the state's public research universities to develop streamlined procedures and policies that enable bioscience firms to obtain easy and more seamless access to university facilities, labs, and specialized equipment.

Surveys throughout the country and deliberations of the Work Group concluded that making it easier for Arizona's biosciences firms to partner with its universities are important ways to build a critical mass of firms and take greater advantage of the state's investments in public technology infrastructure. Putting into place more seamless procedures and policies, making available on the web inventories of such facilities and equipment, and developing streamlined user agreements would further assist Arizona's existing, growing firms as well as attract firms of whatever size to reside in Arizona.

LONG TERM ACTIONS:

One key long action to address the space and facility needs of bioscience firms as the cluster grows in Arizona is outlined below. The experience even of mature regions such as San Diego and Maryland demonstrates that the private sector market place will not adequately address these space and facility needs on its own, due to the risk adverse nature of the life insurance and

related industries that primarily finance such space and whom insist on primarily credit worthy tenants; most young, small biosciences firms will not meet such criteria.

Action One: Establish a Smart Shell Biosciences Facilities and Equipment Program and Revenue Authority for Arizona.

Arizona needs to, over the long term, significantly address a need to develop multi-tenant clean room and wet lab facilities for emerging bioscience firms. There is also going to be a need for more equipment both in the state's public research universities as well as in incubators and accelerators, including pilot plants, prototype development facilities, and related equipment.

Traditionally the private sector has been reluctant to develop speculative "smart shell" facilities for start-up companies. The financial risk has been too high. Wet lab space can cost many times the cost of regular space. The absence of sufficient wet lab space will seriously impede the State's efforts to develop a vibrant biosciences sector. Several university-related startups in Tucson recently relocated to San Diego due to the lack of suitable wet lab space.

The public and private sectors should form a partnership to create a Smart Shell Facilities and Equipment Program and an Authority which can issue revenue bonds to help support the necessary technology infrastructure for the biosciences industry in Arizona. Or local industrial development authorities authorizing statutes could be updated and modernized to undertake similar revenue issuances as outlined in this section. Capitalized initially with \$20 million over its first three years, with further investments of up to \$50 million in five years based on use and demand, this revolving fund can be used in conjunction possibly with state and local revenue bonds to cover such uses as leasehold improvements (see action one under short and mid-term), bioscience incubators and accelerators, biosciences-focused research parks, shared equipment and related facilities and labs, and help capitalize a risk insurance fund or pool for encouraging private developers to develop and operate multi-tenant and single tenant wet lab facilities.

Fifteen percent of the Fund could be set aside to help finance lab upgrades and facility improvements. This technology infrastructure fund and authority might be operationalized under an existing statute of the State authorizing a similar structure and program. If successful in its first five years, further financial support might be provided in years six through ten.

SUMMARY AND CONCLUSIONS

Arizona must continue to address ways to meet the expected demands of bioscience firms for wet lab and office space. This should be done in ways that encourage maximum participation, financially and otherwise, by the private sector. The Work Group has identified a set of short term and long term actions to address this area.

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