

Report
of
The Washington Advisory Group, LLC
on
Research Capability Expansion
for
The University of Texas System
The University of Texas at Dallas

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The Washington Advisory Group, LLC

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**Report of the Washington Advisory Group on
Research Capability Expansion for
The University System of Texas
At Arlington, Dallas, El Paso, and San Antonio**

INTRODUCTION

The Washington Advisory Group (WAG) was engaged by the administration of the University of Texas System (UT System) to examine the research capacities and the potential for expansion at a number of UT System institutions, including The University of Texas at Arlington (UTA), The University of Texas at Dallas (UTD), The University of Texas at El Paso (UTEP) and The University of Texas at San Antonio (UTSA).

In particular, we were asked to review background information provided by the universities as well as information gathered independently, and to visit each of the four for a series of face to face meetings with senior administrators, research active faculty members and others. Based on our review of background information and our interviews, we were then to recommend strategies and tactics for using current resources more effectively, and for significantly expanding their research capabilities. In doing so, we were instructed to be mindful of the current state revenue shortfall and the fact that, even when the economy improves, it is not realistic to expect substantial increases in state appropriations. The Scope of Work is attached as Appendix 1.

This project was undertaken by a team of individuals whose biographical sketches are attached in Appendix 2. While, it was not feasible to assemble a team with specific expertise in each of the research areas covered by the UT institutions, the team members' backgrounds, experience and expertise are sufficiently broad to conduct the reviews and assessments contemplated by the UT System.

The Four Universities

Each of the four UT universities that are the subject of this report aspires to be in the uppermost tier of American research universities. To provide some context for this aspiration, we note that there are roughly 250 research universities in the United States, defined by a joint mission of undergraduate and graduate education linked to fundamental research and scholarly activity in scientific, engineering and other fields.¹ Despite numerous stresses, the American research university system by and large fulfills the dual role of training the next generation of scientists and engineers and maintaining the United States in a world leadership position. The success of this system derives, in part, from the following attributes:

- *Science, technology and education are generally recognized as public goods.* There is general recognition on the part of federal agencies², and, more recently, on the part of state governors and legislatures, industrial leaders, philanthropic foundations, the media, and the public, that fundamental university conducted research and the

¹ In 2001, there were 264 research institutions in the country with at least \$5 million in total research expenditures. Source: *TheCenter* at the University of Florida data on American research universities available at <http://www.thecenter.ufl.edu>.

² This is evidenced, for example, by congressional initiatives to double the research budget of NIH, NSF, and by support for Defense Department scientific research.

training of scientists, engineers, and managers are important for economic growth³, national security, public health and national prestige.

- *Merit based funding.* By and large, federal research funding, the largest source of research funding, is allocated competitively, based on merit review, rather than directed towards specific institutions.⁴
- *Departments and focal areas.* Typically programs of education and research in departments that cover all of the basic science and engineering fields as well as interdisciplinary and other new frontier fields located in departments, centers, institutes or other academic structures.
- *Multiple sources of support.* Research is supported by a multiplicity of federal agencies, state governments, businesses, and private non-profit and charitable organizations. This variety of sources reduces vulnerability from an over-dependency on one sponsor. It is noteworthy that federal support for university research has increased each year for the past 25 years. However, the federal share of total research funding in universities has declined from 67% in 1979 to 58% in 1999.⁵ During the same period, universities own funds dedicated to research increased from 14% to 20% of the total research expenditures.⁶
- *Mobility of faculty within the system.* It is not uncommon for a faculty member to move from one institution to another one or more times as he or she progresses up the academic ladder. This mobility mitigates inwardness, and brings fresh views to a campus. These advantages outweigh considerations of inefficiency and waste.
- *Competition for outstanding faculty.* Universities often engage in fierce competition for creative and productive faculty members. On occasion, this can lead to high salary offers and support packages and create bad feeling between research institutions. However, it can also promote the careers of the most talented and arguably makes them more productive because of the additional resources that become available to them.
- *Contribution to economic development.* In addition to the traditional mission of education, research and service, modern universities, especially public ones, are expected to contribute to the economic development of the a region and the nation. Among the ways in which they do this are the development of intellectual property and related patenting and licensing activities, incubator operations, and spin-offs of high technology companies.

One of the most important measures of a research university is its level of sponsored research expenditures, and particularly, its level of federal research awards. This is true because

³ In 2000, more than 60% of publications cited in industrial patents were the results of government financed research. National Science Board, *Science and Engineering Indicators 2002*, Arlington, VA: National Science Foundation, 2002, page 5-53.

⁴ Politically motivated allocations (“pork barrel” or “earmarked” allocations) represent a small percentage of the total of federal research funding, but are nevertheless troublesome. Information about such allocations is compiled by *The Chronicle of Higher Education* (on-line: <http://Chronicle.com/stats/pork>).

⁵ National Science Board, *Science and Engineering Indicators 2002*, op. cit., Appendix Table 5-3.

⁶ Id.

federal research funding generally is allocated competitively, based on merit review, and therefore awarded to the most meritorious projects. Table 1 below shows levels of total and federal research expenditures for the institutions that occupied the 95th through 105th positions in total and federal research expenditures in FY2001, and comparable data for the four UT universities.

Table 1
Research Expenditures (in thousands)
and Rankings of Selected Universities
Fiscal Year 2001

	Tot. Research	Rank	Fed. Research	Rank
University of South Florida*	171,550	65	58,826	95
Rockefeller University*	145,571	80	55,362	101
Arizona State University – Tempe	118,763	86	56,616	99
Florida State University*	113,817	90	57,075	98
University of Alaska – Fairbanks	110,195	93	55,287	102
University of South Carolina - Columbia*	109,973	94	51,983	103
Dartmouth College*	109,096	95	69,844	83
Auburn University	106,347	96	40,097	119
Tufts University*	105,806	97	71,669	80
Indiana University – Bloomington	103,960	98	46,712	109
UT Medical Branch - Galveston*	102,722	99	64,682	90
Tulane University*	99,761	100	55,669	100
Washington State University - Pullman	99,302	101	43,989	112
Georgetown University*	99,228	102	93,626	66
Virginia Commonwealth University*	99,180	103	57,315	97
Wake Forest University*	98,343	104	78,021	75
University of Massachusetts - Amherst	97,976	105	49,576	105
Brown University*	91,636	110	58,367	96
George Washington University*	73,805	122	51,757	104
University of Texas – Arlington	17,486	221	9,413	221
University of Texas – Dallas	15,684	227	7,049	244
University of Texas - El Paso	21,889	204	16,167	182
University of Texas - San Antonio	11,331	247	8,012	235

* Institution includes medical school/specialized biomedical research curricula

Source: *TheCenter* at the University of Florida data on American research universities available at <http://www.thecenter.ufl.edu>.

As shown in the table, roughly 100 institutions had total annual research expenditures in excess of \$100 million in 2001,⁷ and annual federal research expenditures in excess of \$56 million. Thus, to be in the top 100 institutions, UTA will have to increase its total research expenditures by \$82 million and federal by \$46 million over 2001 levels; UTD will have to

⁷ *TheCenter* at the University of Florida data on American research universities, op. cit.

increase total expenditures \$84 million and federal by \$49 million over 2001 levels⁸; UTEP will have to increase total expenditures by \$78 million and federal by \$40 million over 2001 levels; and UTSA will have to increase total expenditures by \$89 million and federal by \$48 million over 2001 levels.

It is important to note that research expenditures at each of the four UT universities have grown since FY2001, the latest year for which comparative data is available. In FY2003, UTA had \$23 million in total research expenditures, UTD had \$28 million, UTEP had \$33 million, and UTSA had \$15 million.⁹ Of course, it is likely that research expenditures have increased at the top 100 institutions as well. UTA, UTD, UTEP and UTSA all aspire to achieve “Tier 1” research university status. The term “Tier 1” is not defined in any published documents, but it is clear that the UT universities regard \$100 million in annual research expenditures as conferring Tier 1 status – a logical conclusion in light of the data shown in Table 1. For purposes of this report, when we use the term, we also define it as \$100 million in total annual research expenditures.

The Path to Tier 1 Status

As discussed above, the four UT universities must increase the level of research on their campuses by from \$67 to \$85 million to achieve Tier 1 status. This will require a tripling, at least, of current research expenditures. It is possible (although unlikely) for a university to reach \$100 million in annual sponsored research expenditures by concentrating effort and resources on only a few, narrowly defined, focus areas that are popular with federal funding agencies. But if the basic science and engineering fields are neglected, a university could find itself technically fitting within the Tier 1 definition, but it would not have the stature of national research university and would not serve its community's educational aspirations very well. High ranking research universities also have intellectual breadth not only in the technical fields but also in scholarly fields with few funders, and it is important that the UT institutions not lose sight of this fact.

The four UT institutions that are the subject of this report have different characteristics and are starting at different places as they attempt to achieve their common goal of Tier 1 status. But all share certain challenges. The first is to recruit a large cohort of research active faculty members that are able to generate annual research expenditures of between \$67 and \$85 million.

One rather crude method for determining how many researchers will be needed to reach these levels assumes that each new recruit will bring in \$230,000 in annual research expenditures (\$230,000 is the average annual research expenditure for university researchers with at least some federal funding¹⁰). This \$230,000 figure is likely somewhat higher than the current comparable averages at the four UT institutions, but not so much so as to be unrealistic.¹¹ Calculations using

⁸ For reasons that are not explained, *TheCenter's* data for 2001 lists UTD's numbers as estimates (they are unchanged from the year before).

⁹ Information provided to WAG by the universities.

¹⁰ Information provided by NSF's Division of Science Resources Statistics in email communication to Erich Bloch, January 13, 2004 based on 2001 data (the latest year for which NSF has researcher data). The \$230,000 average was calculated with research expenditure data that excluded expenditures for clinical research.

¹¹ While we do not have directly comparable figures for the UT universities, according to data provided to us by those universities, the average annual research expenditures for UTSA faculty members in the Colleges of Sciences and Engineering is approximately \$80,000 and for UTD faculty members it is approximately \$70,000, while the average for research active faculty members at UTA is \$160,000 and at UTEP is \$210,000.

this figure show that the four universities each will need to hire between 300 and 400 additional faculty members to achieve the desired level of research funding. Given the effort and resources that must be devoted to faculty searches in order to identify and successfully recruit quality, research active faculty members, we believe that no more than 30 new research active faculty members can be recruited each year (and maybe fewer), assuming that the space and research infrastructure is available to house them. Purely on the basis of this analysis, then, it would take between 10 and 12 years to recruit the necessary researchers to each campus. And this estimate is likely low – it assumes that the facilities will be available to house the new hires; that each will achieve the \$230,000 average immediately upon his or her arrival on campus; and that all the additional FTEs will be fully supported by formula funding of enrollment growth and/or tuition increases. All of these assumptions have uncertainty associated with them.

The calculations described above could be repeated using other reasonable assumptions on dollar volume and timing, but the general conclusions are likely to be the same for all: several hundred high quality researchers will have to be recruited, and the construction and renovation of facilities be staged to accommodate this faculty growth. If there are any delays in hiring and facilities staging, or if funding assumptions are too optimistic, the process is likely to take well over a decade.

Significant new funding will be required to expand the faculties of UT's institutions. Not only will the universities have to fund FTE slots, they also will have to provide start up packages for new faculty members to equip laboratories, fund post docs in some instances, and provide initial seed funding for research. These packages likely will range from \$200,000 to \$750,000 or more, depending on the field and seniority of the researcher. Universities also will have to fund new buildings, facilities and equipment.

In addition to the challenges posed by the massive recruiting that must be undertaken, the progress and success of the four universities will depend on how they address the following issues:

- *Strategic Planning.* The development of a realistic strategic plan, with a specific agenda for prioritization of research and education programs, identification of funding sources, and a timetable for achieving the various goals, is of critical importance if an institution is to achieve its goals. The universities' plans should be developed with extensive input from administrators and faculty, partly because of their knowledge and experience and even more to ensure their buy-in.
- *Identifying Resources to Fund the Growth in Research Capacity.* As mentioned above, the state is not likely to increase significantly its appropriations to the universities, so universities must look elsewhere for the resources to finance faculty growth and the space, equipment and facilities that these researchers will require. In our view, tuition increases represent the only reasonable source of funding for FTE salaries, given the state's financial constraints. Industry and gifts from alumni and foundations can provide funding for other aspects of growth, including set up costs and facilities, as can tuition revenue bonds (although this would effectively reduce the tuition revenue available for salaries). Some UT institutions are pursuing earmarked funds in an attempt to grow their research capacity. In our view, the use of earmarked funds to support research is not an acceptable or useful long term strategy. It deadens the competitive spirit and undermines the merit review system that is responsible for raising U.S. research universities and their research

accomplishments to a world leadership position. Overplayed, earmarking reduces the performance of researchers and reduces the ability to evaluate their work. Earmarking triggers an angered response from colleagues, and can result in negative reviews of research proposals. Clearly, UT System universities must put their major emphasis on obtaining federal funds by the traditional competitive granting mechanisms as they attempt to expand their research capacity.

- *Competing for Faculty.* The recruitment process for research capable individuals is a highly competitive one and will require significant new resources. Nevertheless, recruiting outstanding faculty is the principal mechanism by which the UT institutions can assure research quality, and the universities must arrange its priorities so that it succeeds in this competition. If an institution is to be able to attract premier faculty, it is especially important that the university's senior leadership include individuals with knowledge and experience in science and/or engineering research.
- *Research Culture.* Each of the institutions that desires to elevate its research stature must foster a research culture on its campus. It must create an environment in which excellence in research is recognized and rewarded with appropriate incentives and where teaching loads are not excessive to the detriment of research productivity.
- *High Student Enrollment.* For the most part, the institutions we visited had large and growing enrollments, resulting in high student-faculty ratios and heavy teaching loads. The former is frowned on by ranking organizations and students alike, and the latter poses a significant barrier to research productivity. There seems to be growing recognition on the campuses that there should be limits on the size of the undergraduate student body, and that excessive enrollment, especially with low admission standards, can become a losing financial proposition, wasteful of resources and expensive to students and parents.
- *Unproductive Competition Among the Institutions.* During the course of our site visits, we sensed a certain degree of competition, turf fighting and zero-sum gaming among the various public institutions of higher education in Texas, and within the UT System as well. It is important for these institutions to find a way to lessen these unproductive activities.
- *Graduate Students and Programs.* Each of the institutions must find ways to attract the high quality graduate students so important to a university's research programs. These graduate students are also working scientists and can as much as double their professors' output. In this regard, we note that the various universities have been thwarted at one time or another in their attempts to develop new Ph.D. programs. We believe universities must be permitted to develop doctoral programs in all fields in which they can be accredited by the appropriate accrediting boards. Departments that lack such programs, in effect, are denied the ability to compete well for new research active faculty members and for research funds and national research standing. To the extent the UT System and the Texas Higher Education Coordinating Board can promote the development of these programs, we encourage them to do so.
- *Research Infrastructure.* Faculty members at all four institutions expressed frustration with the lack of support for proposal preparation, grant administration and accounting, and the like. The vice presidents for research on each campus should

evaluate their research infrastructures and take actions to provide more support to faculty members who are trying to attract external research funding. Such actions should also include the development of incentives to encourage faculty members to apply for grants.

- *National Recognition.* Recognition from peers reflects well on the accomplishments of individual researchers as well as on the quality of an institution. Leading universities have outreach programs that focus explicitly on this issue, and so should the research universities in the UT System.
- *Technology Transfer.* Technology transfer is a forward-looking idea for many research universities. As these institutions increase the level and quality of their research, intellectual property is developed and that intellectual property can result in significant income for the university and its researchers, and it can contribute to the national economy. Although commercialization activities have been modest at the four universities that are the subject of this report, as they ramp up their research activities, they should establish explicit policies to address relevant matters including the granting of licenses, allowable rules for faculty and even students, and allowable commercialization activities. They also should establish effective organizations to deal with these issues.

In an important sense, there will be no winners and losers as these universities progress at differing rates to realize their ambitions. *All will steadily improve as they move forward.*

Strategic Planning

During the course of our campus visits, we found that the four UT institutions have not developed realistic or detailed strategic plans, identifying specific priorities for research, education and economic development or metrics and timelines for monitoring progress towards their goals. A lack of such plans will hamper these institutions as they attempt to achieve their overarching objectives.

Each university must articulate its vision and mission before it can undertake the strategic planning process. This is generally done by the institution's upper administration, through a consultative process that solicits input from the institution's schools and departments. Once the vision and mission have been articulated, the university can develop a detailed plan defining its goals and prioritizing its strategic objectives; describing the ways in which those objectives will be achieved; identifying the resources that will be used to achieve those objectives, and establishing a realistic timeline for various actions. Finally, the plan should include metrics by which the institution and the System can measure progress.

As these strategic plans are developed, it is of critical importance that the university involve all of its constituents in the planning process, including school and departmental leaders and faculty. This broad participation is important for a number of reasons – it provides the expertise needed to inform the planning process, and facilitates acceptance by the stakeholders of the strategic plan. Without this, universities will not be able to achieve their objectives.

The Significance of Collaboration

Each of the four universities we visited recognizes the importance of forming linkages and partnerships with other research institutions – medical centers, universities, government and private sector research entities, and with each other. These interactions can be mutually beneficial in several ways: many frontier fields are multidisciplinary and require contributions of human and facility resources not found in a single institution; many government projects are of a magnitude and complexity that call for teaming. And for universities in an expansion mode that are developing new strengths, they can find mentors in other institutions. The biomedical fields present special opportunities because there are renowned medical centers in Texas that recognize the advantages of joining forces with the basic science and engineering departments of universities. (It should not escape anyone's notice that the National Institutes of Health has become the most important financial supporter of research at American universities.)

We were particularly impressed with the extraordinary possibilities of research collaboration in the Dallas Metroplex region. The trio of UT institutions there – UTD, UTA and the University of Texas Southwestern Medical Center at Dallas (UTSWMC) – are in close proximity, and already are working together at the intersection of science, engineering and the biomedical fields. Together they can become a powerful force for organizing and mounting major research projects that are very competitive nationally. The three institutions, together with the UT System administration, should put in place a 5-year joint strategy focus in engineering and science, including the biomedical sciences. The joint strategy should include a mechanism for frequent status meetings attended by the deans of the schools involved, as well as a mechanism for frequent face to face dialogue between faculty members at the three institutions.

Role of the UT System Administration and Texas Higher Education Coordinating Board

The state authorities that administer higher education in Texas (including both the UT System and the Coordinating Board) have an opportunity to make a real difference for the UT institutions as they pursue Tier 1 status. The following actions all would help enhance research performance at those universities:

- The Coordinating Board should permit universities to undertake doctoral programs in all fields for which they can receive official recognition from a respected accrediting board. We cannot stress enough how important this is. Without such qualification, a department is, in effect, denied the ability to compete well for new, high quality researchers and research funds, and the ability to achieve higher research standing.
- The UT System and its constituent universities should participate in discussions and develop policies addressing the issues of undergraduate enrollment growth and admissions standards.
- The UT System should foster communication between universities and develop incentives for collaborations (research and programmatic) among the institutions. Communication and appropriate incentives can facilitate cooperative ventures which can accelerate a university's rise in stature.
- The UT System does not appear to have a uniform sabbatical leave program, and faculty members on campuses we visited would like to see one instituted that is similar to the one at UT Austin. Sabbatical or paid leaves should be supported on all campuses, as they are at most high ranking research universities.

- The universities' upper administrations should include individuals who collectively, have the background and expertise in science or technology to address and develop the universities' research and education missions and initiatives. This is important not only to the functioning of a university and the allocation of its resources, but also when competitively recruiting large numbers of new faculty in the scientific and technological fields. The UT System plays an important role in assuring appropriate balance through its involvement in presidential searches. Although leadership searches on the campuses (at the provost or dean level) should be the primary responsibility of the individual presidents, consultation with the UT System administration on these searches is recommended. This would allow the System to help ensure that appropriate individuals for these important positions are identified at an earlier stage.
- In light of the massive recruiting effort that will be undertaken over the decade at each of the four institutions that are the subject of this report, the UT System should consider actions that it can take to help these institutions recruit the highest quality faculty members. These might include:
 - Mounting workshops for search committees to expose committee members to best practices in faculty recruiting;
 - Following up with campuses to see how well recent recruits are performing; and
 - Encouraging the establishment of blue ribbon search committees with external members that can provide advice on searches for deans, endowed chairs and other high profile positions.
- The UT System can also provide some central support to help faculty members with their grant proposals. For example, the System might sponsor workshops on proposal writing; provide support in identifying funding opportunities; and, on occasion, hire a consultant to review proposals, especially large ones, before they are submitted to a federal agency.
- Throughout this report, we recommend that the four UT institutions develop sound, realistic, and achievable strategic plans. For these plans to yield results, however, goals must be stated explicitly and metrics must be established to permit measurement of progress and accomplishment. The UT System should ensure that appropriate metrics are articulated and it should judge institutional performance against those metrics, especially as the institutions recruit large numbers of new research faculty in their pursuit of research eminence. As the UT System develops research metrics, we believe it should adopt a relatively broad definition of research awards – one that encompasses peer reviewed awards for projects, equipment and student support designed to contribute to the creation of new knowledge. For example, in addition to the traditional individual and center research projects, we believe the following activities should be included in such a definition:
 - awards to support undergraduate and graduate students as research assistants;
 - infrastructure and facility awards supported by government agencies to maintain U.S. leadership in science and technology;
 - evaluative research dedicated to testing research results to validate or nullify research hypotheses; and

- data collection and field sampling that are critical elements of social and environmental science.

This type of definition would recognize the different styles and modes of research and scholarly activities undertaken across the science, engineering, humanities and social science fields. All of these contribute to the generation of new knowledge and understanding.

Evaluation of the Individual Institutions

We were asked specifically not to compare the four UT universities that are the subjects of this report, and as a result, we have not done so. The following sections of this report examine each institution's strengths and weaknesses as centers of research; review any special opportunities presented; assess the resources required for improvement and the potential for securing them; and evaluate the feasibility of the universities' own plans. Our general conclusions and recommendations for the universities are presented at the end of the applicable sections, while recommendations specific to individual schools and departments are in the subsections dealing with those schools and departments.

THE UNIVERSITY OF TEXAS AT DALLAS (UTD)⁵³

In the late 1950s, the three founders of Texas Instruments, Eugene McDermott, Cecil Green and J. Erik Jonsson, were importing engineering talent from outside the state of Texas, while the region's young people were pursuing education elsewhere.⁵⁴ These executives were convinced that the region “must grow academically; it must provide the intellectual atmosphere which will allow it to compete in the new industries dependent on highly trained and creative minds.”⁵⁵

Acting on these convictions, Texas Instruments’ founders formed The Graduate Research Center of the Southwest (later renamed the Southwest Center for Advanced Studies (SCAS)), a research oriented institution granting Ph.D. degrees in physics, earth and space sciences, and molecular biology. In 1969, the University of Texas at Dallas was established and SCAS, which was donated to the University of Texas System, formed the initial core of this institution. It is likely that the founders, all of whom were familiar with the Massachusetts Institute of Technology as alumnae, donors, or recruiters of MIT graduates, had that institution in mind as model for their new creation.⁵⁶

Forty years is a short time within which to develop a major research university, and only a few schools have accomplished this feat.⁵⁷ UTD is not yet among them, and its inability to achieve significant progress towards this goal in the past is due to a combination of factors that are discussed in more detail below. Nevertheless, we believe that with continued progress, support from the state, the UT System and private sources, and with strong leadership, UTD could become a top tier research university and fulfill the dreams of its founders. The substantial funds made available by Project Emmitt, which are described below, and the research capacity building know-how evidenced by UTD’s leadership and faculty lead us to this conclusion. However, the time that will be required for UTD to achieve this goal is much less certain. In general, we agree with experts in university rankings who say that an institution has to spend a fortune and exert a Herculean effort to rise even one spot in the rankings.⁵⁸

University Leadership

President Jennifer is now in his ninth and last year as President of UTD. Under his leadership, the University articulated the goal of becoming a Tier 1 research university with \$100 million in external research funding annually, and a graduate student population of roughly 6,000 individuals (up from the current level of 5,600). These goals by and large are supported by the faculty members with whom we met. To his credit, President Jennifer also succeeded in securing Project Emmitt for UTD and the significant funding that goes along with it. President Jennifer expressed to us his strong view that, in order to achieve the UTD’s goals, the next president must

⁵³ This section of the report includes information that was provided to us during the course of our campus meetings. Where facts are given without citing to a particular document, that information was given to us orally during the course of those meetings.

⁵⁴ <http://www.utdallas.edu/utdgeneral/utdhistory.html>

⁵⁵ *The Charter of Progress*, Graduate Research Center of the Southwest, 1961, p.10 (as cited in *An Executive Briefing Provided by The University of Texas at Dallas to The Washington Advisory Group, LLC*, prepared by the Office of Strategic Planning and Analysis, The University of Texas at Dallas, August 19, 2003).

⁵⁶ We make this statement based on our impressions from conversations WAG principals had with these individuals during their lifetimes.

⁵⁷ For example, UC San Diego and the University of Texas Southwestern Medical Center at Dallas.

⁵⁸ M. Arnone, “The Wannabes,” *The Chronicle of Higher Education*, January 3, 2003.

have substantial experience and eminence in teaching and research at a top tier research university. We concur in this judgment. UTD's new president must understand what will be required to greatly enhance the research and graduate programs of the University, secure greater amounts of grants funds and, at the same time, successfully reach out to the philanthropic community in the Dallas area. The new president will be joining a provost, deans, and department chairs who are qualified to embark on a path to research eminence. The selection of a new president for a university is always a major task. When that university is seeking to move to a significantly higher level, the responsibility is particularly great.

Research At UTD

UTD has so far failed to achieve national research prominence for a number of structural reasons, some of which have been corrected (e.g., the delay in allowing the University to admit freshman and sophomores and to grant graduate degrees in certain key scientific and engineering fields), and others which remain to be addressed (e.g., poor hiring practices in UTD's earlier days that resulted in feelings of insularity, complacency and lack of interest in research among some faculty members). And while UTD recently secured major funding in connection with Project Emmitt,⁵⁹ generally it has been unable to access large philanthropic and industrial sponsors in Dallas and elsewhere.

Project Emmitt represents a relatively well defined and highly visible opportunity for UTD from which it can embark on its quest to achieve higher standing among the nation's research universities. Done well, this effort should make it possible for UTD to tap into considerably larger sources of private donations than have been available in the past. If successful, the University should emerge with a larger and stronger research qualified faculty, student body and educational infrastructure. Project Emmitt provides UTD with a 5 year fundraising head start as it pursues its goal of achieving Tier 1 status. According to the Provost, it will have to raise an additional \$200 million for the following 5 year period to pursue successfully this goal.

Over the past decade, the University has made progress, having developed truly excellent undergraduate programs, and recruited actively and well in specific research areas. UTD now has a total of 35 endowed chairs, distinguished chairs and named professorships. This represents a 70% increase since 2000 – a positive trend that the University wishes to continue through Project Emmitt and increased private fundraising efforts.

Despite this progress, UTD, starting with a low ranking, must expand significantly both the quantity and the quality of its research activities in order to achieve its goals. It must jump perhaps 50 or more positions in national rankings over a decade – a feat that few if any institutions have achieved. *TheCenter*, an organization that collects data on American research universities, reported that UTD was ranked 165th among public research universities in total research expenditures in 2001, and 174th in federal research expenditures.⁶⁰ UTD was ranked

⁵⁹ Project Emmitt provides state and local incentives for Texas Instruments to build a \$3 billion wafer fabrication facility in the Metroplex. Texas Instruments agreed to keep its facility in the area provided it received certain tax abatements, and UT Dallas receive an enhancement package from the state. *An Executive Briefing Provided by The University of Texas at Dallas to The Washington Advisory Group, LLC*, op. cit., page 47.

⁶⁰ *TheCenter* at the University of Florida data on American research universities, available at <http://www.thecent.ufl.edu>. FY2001 numbers are the most recent ones available from *TheCenter*. We note that the UTD data on total and federal research expenditures for FY2001 reported by *TheCenter* are

227th in total research expenditures among all universities in 2001, and 244th in federal research expenditures.⁶¹ In this regard, it is important to note that by FY2003, UTD had increased its research expenditures to \$27,693,369 (a 76% increase over data reported by *TheCenter* for FY2001).⁶² While comparative data is not yet available, it is likely that this increase moved UTD up in the rankings.

In contrast to its rankings in research expenditures, UTD does quite well in the rankings based on undergraduate quality. In 2001, it ranked 49th among public universities in SAT scores, and in 2002 it ranked 49th in National Merit and Achievement Scholars.⁶³ This is particularly impressive in light of the fact that UTD only recently began to admit freshman and sophomores. The high quality of UTD's undergraduate population is due, in part, to the strictures imposed by the Texas legislature with respect to selective admissions, but it is clear the University has worked hard and imaginatively to reach its current level of excellence. It should be recognized and commended for this, and the fact that UTD has been able to build such excellence in undergraduate education bodes well for it as it turns its attention to research and graduate education. However, UTD seeks recognition as a Tier 1 research university, a more difficult undertaking than its achievements in undergraduate education. UTD recognizes the uneven quality of its graduate students and the need to be competitive in providing fellowships and assistantships to improve this situation. It is beginning to raise the necessary funds. In leading research universities, graduate students are known to increase the productivity of the research faculty, in some cases by as much as 100%. If UTD expends the kind of effort on recruiting graduate students as it has on undergraduate students, good results will ensue.

The main obstacle that UTD faces in achieving its goals relates to scale – UTD is simply too small in terms of the total number of faculty in each disciplinary or sub-disciplinary area. This problem of scale handicaps it in two ways: it reduces the national visibility of UTD as an institution (as opposed to the visibility of many individual faculty members) and it often prevents its faculty from participating in the large programmatic grants that are the mechanism through which a significant part of the funds available from federal granting agencies are distributed.

UTD's leaders understand the challenges they face and are approaching them in sensible ways, pursuing a strategy of focused excellence so that UTD becomes the third public research extensive university in Texas "with flagship type" Tier 1 status (along with the University of Texas at Austin and Texas A&M University).⁶⁴ UTD is concentrating its efforts and resources in the areas of information transmission and processing, advanced materials and instrumentation, and disease-centric science and technology.⁶⁵ Where practical, it plans to pick specialties that have synergy within UTD and the Dallas-Fort Worth Metroplex generally. The somewhat narrow focus that UTD is pursuing may be appropriate at this time, given the origins of the University, its core competencies, and the realities presented by the state's declining financial position and the currently poor prospects for state funding of higher education. However, if it is pursued relentlessly and without a larger vision, the University might achieve \$100 million in annual

unchanged from FY2000 and that the source for *TheCenter's* data, *NSF/SRS Survey of R&D Expenditures at Universities and Colleges, FY 2001*, indicates the data are estimates.

⁶¹ *Id.*

⁶² UTD's financial statements for FY2003.

⁶³ *TheCenter* at the University of Florida data on American research universities, available at <http://www.thecent.ufl.edu>.

⁶⁴ Information provided to us during our meeting with the Provost.

⁶⁵ *An Executive Briefing Provided by The University of Texas at Dallas to The Washington Advisory Group, LLC*, op. cit, page 9.

sponsored research expenditures, but not raise its stature and reputation to a position among the top research universities in the country, most of which are broadly based.

The model of allocating limited resources to a small number of focus or niche areas is a strategy that UTD has in common with at least two of its sister institutions (San Antonio and El Paso), and with many lower tier universities that seek to rise in stature but are unable to "to spend a fortune and exert a Herculean effort." Irwin Feller, an economist at Pennsylvania State University who studies rankings expresses concern with this model, saying "for all its efforts to improve its rankings, a university may not improve conditions for itself or its community. Pumping money into marquee programs could drain money from other departments leaving steeples of excellence surrounded by tenements of mediocrity."⁶⁶

UTD's leaders recognize this danger and understand that they must build critical size cohorts of faculty members in the basic physical, biological, and engineering fields. For example, the Dean of Engineering, who is playing a key role in the allocation of Project Emmitt funds, recognizes the need to build strength in the basic physical and biological sciences, concomitant with the growth in electrical engineering, computer science and engineering, and management science. Recruiting faculty members with excellent research credentials will require the ability to offer competitive salaries, and adequate set up funds, space and infrastructure. UTD's leaders know that they must make every hire count, and that they must attract senior leaders who in turn can attract the best junior faculty members and graduate students. UTD's leaders also understand the value and necessity of combining excellence in research with excellence in teaching. UTD has already found success in these directions in its recent recruitments of faculty and administrators.

As part of its strategy, the University also plans to establish and strengthen linkages and partnerships with other research entities and with the high-tech industry in the Metroplex. UTD's efforts to develop more interactions with the University of Texas Southwestern Medical Center at Dallas (UTSWMC) will be vital. The latter is a superb medical school with very extensive, excellent programs in both basic and clinical research. UTD brings to the collaboration expertise in fields where medical schools are not traditionally strong, such as chemistry, physics, computer science, psychology, and engineering. These fields are becoming increasingly important in cutting edge biomedical research. The two institutions already have established important links and synergies but there is potential for a great deal more. We met a number of officials at UTSWMC, including the President, Dean of the Medical School, several department chairs, and other faculty members, all of whom expressed enthusiasm and support for further partnerships.

The nearby University of Texas at Arlington (UTA) offers another possibility for symbiotic partnerships. Both institutions are strong in the physical and engineering sciences, and this makes it possible for them to collaborate on large and competitive research proposals in fields such as nanotechnology, designated for high priority by federal agencies. An example of a successful collaboration of this type is the SPRING (Strategic Partnership for Research In Nanotechnology) consortium which involves UTD, UTA, the University of Texas at Austin, Rice University, and the Air Force Materials Research Laboratory. SPRING received congressional approval for \$6 million of equipment in FY03 and \$10 million for equipment and research support in FY04. The collective rich intellectual resources of the trio of UT institutions in the greater Dallas area have greater potential for research growth in the combined engineering,

⁶⁶ M. Arnone, op. cit. Also see I. Feller, I., *Strategic Options to Enhance the Research Competitiveness of EPSCoR Universities*, <http://www.aaas.org/spp/rcp/epscor/Feller.html>.

science and biomedical fields than any could aspire to individually. Joint research initiatives could be highly attractive in the national competition for federal grants.

Money, particularly support from state governments, is the biggest constraint that public universities face in moving into the national spotlight.⁶⁷ Because of the state of Texas's declining financial position and the currently poor prospects for state funding of higher education, UTD must be able to tap into new sources of funds to fully implement its plans and achieve its goals. UTD's location in the high-tech North Dallas area of the Metroplex is a major asset in this regard, and Project Emmitt, which includes a substantial private sector contribution, has jumpstarted UTD's financial campaign.

With its abundance of research university "users", including well prepared prospective students, strong science and technology based industries and sophisticated and generous potential donors, the area provides UTD with certain natural advantages. In fact, this location was directly responsible for Project Emmitt's major infusion of funds to support UTD's science and engineering research and education programs. Project Emmitt, in addition to providing state and local incentives for Texas Instruments to build a \$3 billion wafer fabrication facility in the Metroplex as noted above, also provides UTD with \$300 million in support to accelerate research in engineering, natural sciences and related fields.⁶⁸ UTD's location and resurgence also provides it with access to wealthy donors in the Dallas community, and allows significant interactions with UTSWMC, one of the top medical schools in the nation.

In addition to the funds generated by Project Emmitt, UTD is looking towards the following sources of revenue to fund its expansion of research:

1. *Funds generated through enrollment growth.* As is true with its sister universities, UTD is counting on student derived income to partially fund its rise to Tier 1 status. So long as the state continues to fund this growth in student contact hours, this is a positive development. But we are concerned that, in the present fiscal climate, the level of this funding stream is uncertain. The record nationally and in Texas shows a steady decline in state support of public universities.
2. *Increased tuition and fees.* Increased tuition and fees are a potentially important source of revenue and the only ones that UTD has identified as a source for funding for the additional FTEs it will need to achieve its goals. However, it is not clear how much leeway UTD will have to pursue tuition increases.
3. *PUF and other state funds.* The availability of Permanent University Funds (PUF) or other state funds could prove to be important sources of funds for UTD, however such funding is subject to significant uncertainty and, at present, cannot be counted on.

⁶⁷ Nils Hasselmo, President of the Association of American Research Universities. Quote from M. Arnone, op. cit.

⁶⁸ Of the \$300 million, (i) the Governor's Enterprise Fund will provide \$50 million for research projects in science and technology that demonstrate promise for economic development; (ii) the Texas Land Office will provide \$85 million for new science and engineering research facilities; (iii) UT System PUF bonds will provide \$50 million for research space and equipment; (iv) the state will provide \$15 million for new faculty positions in science and technology; (v) \$75 million must be obtained from philanthropies to fund endowments to support faculty and students; and (vi) \$25 million in state and private investments must be raised to fund new faculty initiatives. *An Executive Briefing Provided by UTD to the Washington Advisory Group*, op. cit., page 47.

4. *Industrial Support.* Research support from industry in the form of grants, cooperative programs, analytical services and consulting can be a source of income for the University, especially since it is situated in a region with a wide variety of commercial enterprises in broad and diverse sectors.
5. *Philanthropy.* UTD plans to do significantly better than it has done in raising large philanthropic contributions from wealthy donors in the Dallas community. If it is successful, UTD will be able to put its future on a more substantial and realizable basis.
6. *Federal and other sponsored research.* UTD's leadership believes that UTD must double the number of faculty members engaged in research, and double the average research expenditures of each such faculty member in order to reach Tier 1 status.⁶⁹ One strategy that UTD intends to pursue is to apply for the larger (\$10 million plus) center type grants that are available in areas such as nanotechnology or space sciences. It is not clear, however, that these goals can be achieved within the decade.

Identifying the necessary resources is just one of several critical steps in achieving research prominence. The ability to identify and recruit outstanding researchers is another, as is the ability to provide researchers with adequate space, equipment, start up packages and the like. UTD's faculty and administration are "research sophisticated", in the sense that they have a good grasp of opportunities for research support and understand the needs of local high-tech industry. Their general approach of focusing on the themes of digital communications, materials science and disease-centric research makes sense, particularly since we do not believe this will be done in a way that diminishes basic disciplines.

UTD's Academic Units

SCHOOL OF NATURAL SCIENCES AND MATHEMATICS⁷⁰

The School of Natural Sciences and Mathematics (NSM) has six departments (Molecular and Cellular Biology, Chemistry, Geosciences, Mathematical Sciences, Physics and Science and Mathematics Education) and a number of centers and institutes (e.g., Space Sciences, NanoTech Institute, Lithospheric Studies, Sickle Cell Disease Center, Applied Biology, and Quantum Electronics).⁷¹ During the 2002-03 academic year, the School had 72 tenure and tenure track faculty members, research awards of \$13,022,149,⁷² and total research expenditures of \$12,457,378.⁷³

NSM's departments have roughly 10-15 tenure and tenure track faculty each. These numbers are small compared to corresponding departments at many of the better research

⁶⁹ The refrain heard during a number of our meetings on campus was "we need twice as many faculty members doing twice as well."

⁷⁰ In this section, we discuss all of the academic departments in the School with the exception of the Departments of Mathematical Sciences and Science and Mathematics Education. Those Departments were not included because we did not meet with any of its faculty, and a review of their web page indicates very little research.

⁷¹ Its Department of Science Education is not research oriented.

⁷² *An Executive Briefing Provided by UTD to the Washington Advisory Group*, op. cit., page 51.

⁷³ Information From UTD's Financial Statements, Fiscal Year ending August 31, 2003, Schedule S-13.

universities, and balanced growth could help achieve more favorable critical masses of researchers throughout the School. A doubling of tenure and tenure track faculty in the sciences is probably needed over the next decade. We were told that the School plans to add 45 new faculty positions over the next decade, and increase its level of externally funded research to \$50 million per year. Its current (2003) level of annual research expenditures is \$12.5 million.⁷⁴ Even if the current faculty were able to double the amount of its externally funded research, new hires each would have to average \$550,000 in annual research expenditures for the School to reach \$50 million. We do not believe it likely that this result can be achieved. The School also expects that all of its current space to be upgraded and renovated over the next decade and that 100,000 sq.ft. of additional space will be available for its expanded efforts. It was not clear to us how much of this growth and expansion has been authorized by the University.

We were told that teaching loads in some of NSM's departments are higher than those at top tier research universities against which UTD must compete for faculty members – up to three courses per semester. Plans for faculty growth will need to provide some relief, in addition to accommodating the expected increases in the number of undergraduate and graduate students. From the figures presented to us, it appears that School would like to grow its faculty by roughly 50% over the next five to ten years although UTD's administration has not specifically authorized this growth. It is not clear how teaching loads for research faculty would be impacted by that level of growth.

At this time, NSM has an interim Dean. In view of the ambitious and difficult goals of the School, a permanent Dean should be named as soon as possible following the appointment of a new university president.

Department of Molecular and Cellular Biology

The Department of Molecular and Cellular Biology has 16 tenure track and 4 senior lecturers. At present it has no chairman, and is being run by a “troika” of tenured faculty. Faculty members with whom we met viewed this situation as unfortunate and we certainly concur. Good leadership for the Department is essential at this point, and we believe an external search for a chair should be concluded expeditiously.

The Department has approximately 600 undergraduate majors and 74 graduate students, including 24 Master's and 21 Doctoral students. Teaching loads appear reasonable (1+2 for research active faculty). Most of those with whom we spoke taught one course per semester. As in other departments, the faculty members here feel the undergraduates are very good, while the overall quality of graduate students is mediocre. This mediocrity was attributed to factors such as non-competitive stipends, problems with tuition remission, and a lack of a good central recruiting policy.

This Department has a number of well trained, research productive faculty members, but fewer than half have external grant support. Faculty members carry out research in a variety of areas within “modern biology,” i.e., genomics, proteomics, bioinformatics, structural biology, and animal models of disease, without an overall focus on any particular area. Thus, at present, there is no critical mass of excellence in a sub-discipline, and the Department is too small and spread too thin. The Department must hire 8 to 10 new research active faculty members in order to develop the necessary critical mass.

⁷⁴ Information provide to WAG by UTD.

The individuals with whom we spoke described laboratory space and research infrastructure as inadequate. For example, the Department's electron microscope is outdated and it does not have up-to-date advanced light microscopy and sequencing and microarray facilities. Better core facilities and sufficient research space will be needed to attract new recruits and increase research support.

A healthy Department of Molecular and Cellular Biology is vital, even if the University's main focus is on engineering, computer sciences, and physical sciences. This is true not only because of the increasing intersections of these disciplines at the cutting edge of molecular biology, neuroscience, computational biology, bioengineering, etc., but also because of the availability of funding in those fields and the increasing emphasis on interdisciplinary research. Over the last several decades, MIT has built its biology department into one of the largest departments in the university and one of the best in the world, to the great benefit of the institution as a whole, and to the national scientific enterprise. While UTD cannot build a biology department like MIT's in the coming decade, a large, more focused effort in the biological sciences with a substantial number of new research active faculty will be very important if UTD is to move to the next level. UTD's department has a productive core of researchers that can provide a foundation on which to build, but it is too small to be viable. Unless this situation improves, UTD will not be able to fully exploit possible linkages and partnerships with UTSWMC.

Center for Sickle Cell Research

The new Center for Sickle Cell Research provides a good example of, and possible model for, a UTD collaboration with UTSWMC. The director of the Center is based at UTSWMC, and the Center is jointly supported by a large NIH grant. UTD's share of that grant is \$150,000-200,000 per year. UTD's participant in the Center, an M.D. well trained in pediatric hematology and oncology, is an impressive new hire who works on hemoglobin gene regulation and is supported by an NIH grant in addition to the Center grant.

Department of Chemistry

The Department of Chemistry has 13 tenure and tenure track faculty and 3 adjunct faculty (senior lecturers), with 56 Ph.D. students and external funding of approximately \$3 million per year. Much of the research conducted by Chemistry faculty is centered in the NanoTech Institute whose director, a recent recruit from Honeywell, is very impressive. That recruitment was facilitated by the earlier recruitment of the 2000 Nobel Laureate in Chemistry, Alan MacDiarmid. Often, appointments of very senior people who did important work elsewhere and who maintain other positions do not contribute substantially to small departments beyond a certain public relations value. In this case, Professor MacDiarmid was able to identify outstanding researchers working in industry who could be attracted to UTD and contribute significantly to its vitality and growth.

We understand that the Dean intends to strengthen this Department by adding 6 new faculty positions, thereby achieving a critical mass of researchers. The Department's faculty appropriately focus on important and high opportunity fields such as nanotechnology and other material sciences, fuel cells, and membranes. The Department seems uneven in terms of research accomplishments and potential. Recent hires in nanomaterials already are making an impact on research and enhancing UTD's standing. Beyond this work, the Department's principal strengths seem to be in polymers.

Rogers MRI Center at UTSWMC

The Rogers MRI Center has very good, and currently expanding, facilities at UTSWMC. Dr. Dean Sherry, who is a Professor of Chemistry at UTD, also is a Professor of Radiology at UTSWMC and there is a long standing history of joint activities between the two institutions led by Dr. Sherry and Dr. Craig Malloy at UTSWMC. It is of interest that UTD had NMR facilities in the Chemistry Department before UTSWMC and that stimulated the collaboration. The Rogers Center now is expanding into new facilities and will become one of the largest MRI Centers in the country. It is expecting a new 3T magnet for metabolic studies that will be designated the UTD-UTSWMC magnet – an important symbol of the partnership.

The Rogers Center now has two large NIH Center grants, each about \$2 million a year, and UTD is a subcontractor on those grants. The Center is a vital asset for UTD as well as UTSWMC because it represents a currently forefront, high opportunity area that will become even more important in the future to chemistry, biology, brain and behavioral sciences, psychology, and possibly other programs such as bioengineering. The extensive and impressive joint activities in this area provide convincing evidence that collaborations between UTD and UTSWMC can and do occur.

Department of Geosciences

The Department of Geosciences has 12 tenure and tenure track professors and two senior lecturers who cover a broad range of topical research areas, and 30 Ph.D. students.⁷⁵ Research in geosciences is concentrated in the Center for Lithospheric Studies. In our briefings, we were told that about 7 of the 11 faculty members are research qualified. Their teaching loads of two organized courses per semester are high compared to other geosciences departments at top rated universities. The Department has good contacts with the exploration industry but it is of a sub-critical size. Nevertheless, a review of its publications in major journals shows breadth and competence across geological and geophysical sub disciplines of the type that should be fundable federal agencies and industry. The Department should be able to increase its level of sponsored research. With the approval of a doctoral program in the spring and the addition of about 4 research capable faculty members, the situation should improve.

Department of Physics

The Department of Physics has 15 tenure and tenure track and 33 Ph.D. students.⁷⁶ Its largest research center and one of the longest-standing centers at UTD is the Center for Space Sciences. The technical staff of the Space Sciences Center is comprised of 4 members, 4 research scientists and an engineering team of 6. The average research budget for the Center is about \$3 million per year, depending on particular space missions. The Center for Space Sciences has a relatively long-standing record of plasma and related experimental studies of the space environment, in addition to a continuing program of hardware fabrication for space probes. This program has been the main source of research funding in the Department and constitutes its only critical mass research effort.

Recent strategic hires in nanomaterials have brought the Department into the NanoTech Institute and the proposed display initiative. The focus of these efforts are on the respective interdisciplinary research centers and do not represent critical mass research groups within the

⁷⁵ Id.

⁷⁶ Id.

Department. Other members of the Department maintain small research programs in atomic physics, condensed matter physics, high energy physics, cosmology, and quantum optics. However, the Department is too small to support effectively the goals of the University. Other than space sciences and, possibly, materials science, we did not see the kind of critical mass research groups that can sustain programs of Ph.D. level research that will be sufficiently competitive to contribute to UTD's efforts to become a Tier 1 research university.

The Department desires to grow to a steady-state level of 17 tenure and tenure track faculty, but the timetable and a detailed path for this to occur was not described to us. The Department does have the approval of the administration to hire in space sciences and materials science, and it anticipates 5 or 6 faculty members to retire over the next few years. However, there appears to be a disconnect between the strategic hiring goals being promoted by the Vice President for Research (who wants to hire established scientists in targeted research areas) and the rather vague plans described by the Department to hire excellent young researchers who will grow in stature over time. A shared vision must be developed as soon as possible.

One fact of note is that total R&D expenditures in Physics at UTD fell by 85% between 1992 and 2001.⁷⁷ While this might be related to particular cycles in multi-year grants, it is an indicator of the fragility of research funding in physics.

Recommendations for the School of Natural Sciences and Mathematics

As described above, we found NSM's departments and programs to be, for the most part, too small for the University's aspirations, but with pockets of strength on which it can build. Our specific recommendations for the School are as follows:

1. Physics, chemistry, biology and related departments and centers are cores of strength in almost every successful research university. UTD has a small foundation of productive researchers in these fields. However, the School must double the size of its tenure and tenure track faculty over the next decade to achieve critical mass, satisfy teaching responsibilities, and create a real possibility of increasing its externally funded research to the \$50 million level to which the School aspires. Adequate space will have to be made available to provide for the new hires and for growth in the current faculty's research programs.
2. Research active faculty members should have teaching loads of no more than 2+1, and in some cases less, depending on the magnitude of their research programs.
3. The Department of Molecular and Cellular Biology, a forefront and well funded field, is particularly small relative to what is required for critical mass and for its potential contribution to the sponsored research at UTD. A permanent chair must be recruited as soon as possible, and the Department should add at least 8 to 10 new research active faculty members at a rate of approximately two per year.

SCHOOL OF BEHAVIORAL AND BRAIN SCIENCES

Although the School of Behavioral and Brain Sciences (BBS) is the smallest school in terms of faculty, it ranks first in publications per tenure and tenure track faculty member, second in research support per faculty, and third in total external support. The faculty impressed us as

⁷⁷ NSF WebCASPAR Database System, <http://caspar.nsf.gov>.

having good morale and enthusiasm and being strongly supportive of their Dean. The Dean feels that an additional 8 to 10 members of the faculty will be needed in the next three years to keep pace with the growth of their educational and research programs. This estimate appears reasonable to us.

There are 707 majors in the School – 492 are in psychology, 91 in neuroscience, and 124 in speech and audiology.⁷⁸ There are approximately 240 Master's and 100 Ph.D. students. The School offers Ph.D. degrees in Audiology and in Human Development and Communicative Disorders. Currently, it is not allowed by the Coordinating Board to grant Ph.D.'s in Psychology. Given the strength of this School, this seems unreasonable. The Psychiatry Department at UTSMC has expressed interest in a joint Psychology program with UTD. This should be actively pursued.

Most of the research in neuroscience and related areas – cognitive science and psychology – is done by faculty members in this School, and much of it is on audition and the auditory system. A major strength of the School, and indeed of UTD, is the Callier Center, which specializes in hearing, speech, language and communicative disorders. The Callier Center has two sites – one on the UTD campus and the other adjacent to UTSMC. Its clinical programs serve approximately 70,000 patients per year and the Center also provides educational programs for both hearing impaired and normal children. Much of the research both at Callier and in the School in general is concerned with cochlear implantation treatment for deafness, which is one of the major advancements in modern medicine. For example, researchers are studying critical periods in the auditory system to determine the optimal times to do implants, as well as the reorganization of the cortex that occurs following the cochlear implant procedure. This emphasis on the auditory system and related research areas makes much sense and the School of Behavioral and Brain Sciences is recognized as one of the top institutions in the country in this field. Indeed, the BBS graduate program in Audiology is recognized by *U.S. News and World Report* as in the top 25 programs in the nation (the only UTD program so far recognized as in the top 25).⁷⁹ Furthermore, editors of the five major journals in hearing are in the BBS.

One of the School's new initiatives is the development of a Center for Brain Health. Six faculty members are involved, in which there is considerable community interest. The faculty members involved study such things as recovery from traumatic brain injury, aging of the brain and Alzheimer's disease, gender and aggression, child care and language, and hearing impaired humans.

Generally, the School of Behavioral and Brain Sciences is impressive, but some of its members are quite senior, it has lost some faculty, and like many other departments at UTD, only about 50% of its faculty members presently have research grants. Some key new appointments could energize the School and bring it close to top tier.

Recommendations for the School of Behavioral and Brain Sciences

1. At least 8 to 10 new appointments of research active faculty should be made in the next three years, including filling four existing vacancies. Psychology should receive several of these appointments as the group is currently too small. Other appointments could augment the fields listed above in the areas under the umbrella of

⁷⁸ Information provide to WAG by UTD.

⁷⁹ *U.S. News & World Report's America's Best Graduate Schools 2004 Edition*, p. 41.

the Center for Brain Health. They could also continue to build on their major strength which is audiology, where they have potential to be a national leader.

2. The School's facilities on the UTD campus are marginal, but a new Callier Center building is being completed now. If this is not adequate to house the needed new faculty appointments, consideration should be given to seeking additional space.
3. The School should continue to build on its already strong collaborations with UTSWMC which is an enthusiastic partner.
4. The School should be permitted to develop a Ph.D. program in Psychology, perhaps jointly with UTSWMC.

ERIK JONSSON SCHOOL OF ENGINEERING & COMPUTER SCIENCE

In 1986, the Texas Higher Education Coordinating Board permitted the establishment of a School of Engineering and Computer Science at UTD, and the School accepted its first graduate students in 1987 and its first freshman class in 1995. Its new Dean was hired in August 2003, after having served for many years with Texas Instruments. In 2002, the School had an enrollment of 3,408 students, including 2,033 undergraduate and 1,375 graduate students.⁸⁰ The School has only two departments – Computer Science and Engineering (CSE) and Electrical Engineering (EE) – and it grants approximately 754 degrees per year in these two disciplines, of which roughly 14 are Ph.D.s.⁸¹

The concentrated strength of the College of Engineering in two disciplines makes the academic performance in each one of these departments competitive with top ten engineering schools. Specifically, UTD is fifth in the country in BS degrees awarded in ECE/CSE and third in the number of MSEE degrees awarded.⁸² Among Texas' graduate engineering schools, UTD is third in the number of total awarded Ph.D. degrees after TAMU and UT Austin.⁸³ The School is fifth in the state in research expenditures per faculty member (after TAMU, UT Austin, Rice, and U of Houston) and last in terms of the mix of engineering disciplines, with only two areas of specialization.⁸⁴ Thus, while the School's two departments are strong and competitive as compared to those of the top ten institutions,⁸⁵ the small number of departments makes the School weak in comparison to schools at other universities because its focus is so much narrower.

UTD currently has a high quality faculty cohort in the School of Engineering and it has been able to attract active research groups in materials, nanotechnology, and electronic communications. Their research is narrowly focused on electronic-related applications and on some specialized but significant biomedical-related projects performed in collaboration with the UTSWMC. The School's research base is respectable and its faculty members are involved in high quality research and are publishing in top scientific journals. But the School must broaden its scope to achieve its objectives and serve the region's economic development needs. Because

⁸⁰ *An Executive Briefing Provided by UTD to the Washington Advisory Group*, op. cit., page 27.

⁸¹ *The Erik Jonsson School of Engineering & Computer Science Status & Plans*, Washington Advisory Group Power Point Presentation, October 22, 2003.

⁸² *Id.*

⁸³ *Id.*

⁸⁴ *Id.*

⁸⁵ See benchmarking data provided in *The Erik Jonsson School of Engineering & Computer Science Status & Plans*, Washington Advisory Group Power Point Presentation, October 22, 2003.

of the requirements of surrounding industries' and UTD's designated research foci, the following examples should be considered: Industrial Engineering and Manufacturing Systems, Mechanical and Materials Engineering, Chemical and Bioengineering. This expansion of the engineering mission would give the School a modern and comprehensive look and a more realistic base from which to achieve its stated goals.

Like the University generally, the School of Engineering aspires to Tier 1 status, and its new Dean has set a goal of being one of the top 50 engineering schools in the country, with \$50 million in external research funding annually.⁸⁶ He plans to recruit 40 new faculty members over the next five years (he has been given authorization from the University to do so) and 400 new graduate students, and to establish two new academic departments.⁸⁷ Currently, the School has 78 tenure and tenure track faculty members,⁸⁸ including 25 assistant professors (creating an undesirably low ratio of assistant professors to total faculty). The undergraduate student-to-faculty ratio is 29:1 as compared to 18-25:1 at top 50 institutions.⁸⁹ With the new faculty positions contemplated by the Dean, the School's student to faculty ratio may be reduced to levels comparable to those of top ten institutions.

Faculty salaries are a key parameter in attracting top faculty. The administration is prepared to pay competitive salaries to recruit entry level assistant professors with demonstrated research capability. However, existing faculty salaries are not competitive (other than salaries of individuals hired in the past 2 to 3 years). For example, in the year 1999 professorial rank, salaries at UTD were \$80,000/year, while at Georgia Tech, where salaries are in the competitive range, they were \$95,000/year.⁹⁰ The salary issue needs to be addressed, and given the priority it deserves.

Department of Computer Science and Engineering

The Department of Computer Science and Engineering has about 40 tenure and tenure track faculty members⁹¹ and almost half of the School's student population. Its faculty members participate in a number of multidisciplinary programs, including the Institute of Interactive Arts and Engineering in collaboration with the School of Arts & Humanities, the materials science research group and the Biomedical Engineering Program with UTSWMC. The faculty members are all enthusiastic and supportive of the University's plans for growth, and are working on a variety of programs including Networking, Software Engineering, Computer Systems, Intelligent Systems and Human Language Technology and Computation Theory and Applications which are funded by federal and state programs. This Department expects to increase its research funding to almost \$25 million a year from the current \$4 million level,⁹² a daunting, if not impossible, task for any top CSE department, and we saw no evidence of any detailed plans that could justify such academic and research growth, despite the fact that the Department has a very large number of established centers such as the Centers in Digital Forensics and Emergency Preparedness; Integrated Circuits and Systems; Systems, Communications, and Signal Processing; Embedded Software; Photonic Technology and Engineering; and Advances in Telecommunications Systems and Services.

⁸⁶ Id.

⁸⁷ Id.

⁸⁸ Information provided to WAG by UTD.

⁸⁹ *The Erik Jonsson School of Engineering & Computer Science Status & Plans*, op. cit.

⁹⁰ Data comes from a report circulated to the Deans of school of engineering at Big 10+ universities.

⁹¹ Information provided to WAG by UTD.

⁹² The \$4 million figure is the one that was used by the Dean during his presentations to WAG.

Department of Electrical Engineering

The Department of Electrical Engineering has 38 tenure and tenure track faculty members⁹³ and half of the School's students. It has been authorized to recruit 5 to 7 new faculty members for the next academic year. The Department has a variety of high quality programs funded by the federal and state government, including: Signal Processing, Microelectronic Circuits and Systems, Nanotech Materials and Processes, Optical Circuits and Systems and Speech Processing and Biotech Aids to Hearing. The Department has not gone through any strategic planning exercise and faculty members are not clear on the University's overarching research goals and objectives.

Recommendations for the Erik Jonsson School of Engineering & Computer Science

Our specific recommendations for the School are as follows:

1. The School of Engineering should expand the number of departments over the next 10 years. Because of the requirements of the surrounding industry, and the UTD designated foci, the following areas should be considered: Industrial Engineering and Manufacturing Systems, Mechanical and Materials Engineering, Chemical and Bioengineering. This expansion of the engineering mission would give the College a modern and comprehensive look and a more realistic base from which to achieve its stated goals.
2. The School's current educational offerings should be expanded to include a Bachelors degree in Computer Engineering, co-sponsored by both of the School's departments.
3. The School of Engineering should develop strategies to focus growth in the preferred strategic subjects identified by UTD; namely, Information Transmission and Processing, Advanced Materials and Instrumentation, and Disease-Centric Science and Technology. These strategies should be based on a realistic estimate of the funding projected over the coming five to ten years, and the effects of the strategies on tuition, faculty salaries, and available space and equipment for research. Large increases in faculty and research are essential for the expansion envisioned.
4. At present, the School is expecting to increase the number of tenure track faculty by 40 during the next five years. This rapid expansion of the faculty will be difficult if the quality of hires is to be maintained. Therefore, a rational academic and business plan must be developed that encompasses a strategy to attract the required talent, and deals with resource issues, including those related to space, equipment and infrastructure.
5. The School of Engineering should increase its support for the expansion of the biomedical program between UTD and UTSWMC, and develop a process that will allow and sustain joint appointments. It also should consider the development of an undergraduate program in biomedical engineering because of its great advantage in having a high quality medical school in the area.

⁹³ Information provided to WAG by UTD.

6. UTD's administration and the School are communicating with the local business community to create an awareness of UTD's efforts and to foster a dialogue with the community. We recommend that this dialogue encompass the broadest industry participation, not just the electronics or communications industry, but aerospace and aeronautics, natural resource industries, and others that have a major presence in the region. The objectives of engaging in this type of dialogue should be to provide guidance to the School as it develops new initiatives and educational programs, and to foster industry funded research, collaborative efforts, the joint use of unique equipment, consulting arrangements, and other relationships.

SCHOOL OF MANAGEMENT

Management science (along with physical and biological sciences, electrical engineering, and computer science) is one of the key focus areas designated by the Provost, who notes that "aim[ing] first at building critical-size cohorts" in these areas is a key UTD strategy for the 1990s and the 21st century.⁹⁴ The state-of-the-art new building, with some room for expansion, that houses the School of Management (one of only two new buildings authorized and built recently at UTD) is tangible evidence of the position this School enjoys. Clearly, it is one of the major areas of strength on which UTD is relying as it plans to take the next big step to becoming a first tier research university.

The School has 2,092 undergraduates, 1,653 Master's and 83 Ph.D. students.⁹⁵ It offers two undergraduate degree programs (in Business and in Accounting and Information Management), several at the Master's level (three versions of the MBA, MS in Accounting and Information Management and in Information Technology and Management, and an MA in International Management), and two Ph.D.s (one in Management Science and one in International Management Studies). It also offers an Executive MBA and several certificate programs and short courses. It has 65 tenure and tenure track faculty,⁹⁶ all of whom are research active; several of them serve on the editorial boards of first tier journals in their fields and many rank high in citation analyses. It also has 50 non-tenure-track lecturers and adjuncts.⁹⁷ The Ph.D. students are virtually all full-time and supported as TAs and, we are told that several have gone on to find positions at such places as Stanford, Yale, Carnegie Mellon, Northwestern, Virginia, and Washington University in St. Louis.

The School has a strong quantitative-technical orientation, and it is in such areas that its comparative advantage is clearest. Although it is not ranked among the top 50 business schools in the widely followed *U.S. News and World Report* or *Financial Times* rankings, a recent article that rated such schools in terms of their publication in four leading journals of Information Science-Information Technology and Management-Science-Operations Research ranked UTD as number 13, just below Duke and Harvard and just above Washington University and the University of Michigan.⁹⁸

The School of Management is self-supporting, with funds coming primarily from tuition and fees. Its plan is to grow the faculty in proportion to the increase in student credit hours, with

⁹⁴ Untitled document from Provost.

⁹⁵ Information provided to WAG by UTD.

⁹⁶ Id.

⁹⁷ Id.

⁹⁸ R. Bapna and J. R. Marsden, "The Paper Chase," *Operations Research and Management Science Today (OR/MS Today)*, V. 29, No. 6, December 2002.

particular emphasis on growing graduate programs because the state's funding formula allots three times as much funding per credit hour at the Master's level than for upper level undergraduate hours, and nine times as much at the Ph.D. level. It receives virtually no funding from external grants and the faculty has no interest or incentive to pursue such funds; as is true with all top tier business schools, research prestige comes from publication productivity (both quantity and quality), not from grantsmanship.

The School does receive, however, external funding from the business community. It has outside funding, much of which comes from 13 large corporate "strategic partners", who earn that designation by contributing at least \$20,000 per year to the School. Other business "partners" contribute lesser amounts, between \$5,000 and \$20,000. The vehicle for these partnerships appears to be the School's seven Centers, all of which are largely or entirely self-funded and serve more as an outreach than a research function; they are managed by Directors who are Senior Lecturers and run short programs and certificate programs.

The goal of the School of Management, as enunciated by its Dean, is to be among the nation's 20 leading business schools, measured broadly rather than just in its areas of primary focus, within 2 to 3 years. It has moved up slightly in the broad rankings, but is nowhere near the top 20 currently (it is in a 5-way tie for #78 in the *U.S. News and World Report* 2003 ranking of MBA programs and #61 in the Financial Times 2003 ranking of Executive MBA programs). To achieve this level, the Dean asserts, will require some \$40-\$50 million in endowment to fund chaired professorships (the current 2+2 teaching load is not competitive with top ranked schools, which generally have 2+1 loads at most) and additional funding for graduate students, particularly at the PhD level. The faculty also stresses the need for direct funding for research, to provide both teaching relief and acquisition of data, etc. They feel, we believe correctly, that an expanded full-time MBA program would increase the School's national visibility (currently almost all of the MBA students are part-time) but that such students would initially require a subsidy (as did the high quality undergraduates at first) until the program became better known.

Recommendations for the School of Management

1. The School should develop a specific plan for raising the endowment money needed (see above) to fund chaired professorships and funding for Ph.D. students – neither the faculty teaching loads nor the funds available for graduate students are currently competitive with those of the School's aspirational peers. Expanding the "strategic partners" concept would be helpful, but some much larger gifts would also be essential; one cannot get to \$40-\$50 million in \$20,000 increments. Whether funding of this magnitude is potentially available from the North Texas corporate-philanthropic community is something the School must ascertain, possibly with the help of a specialist consulting firm.
2. If the School is to rise in the broader rankings, which specifically rate MBA and EMBA programs, it will by definition have to improve the quality of the students in those programs, which means a substantial expansion of its full-time MBA cohort.
3. The Dean's goal of reaching the top 20 in the broad overall rankings within 2 to 3 years is almost certainly too ambitious. Continuing to increase the visibility of the School in the technical-quantitative areas in which it is already very strong, along with a more gradual rise in the overall rankings, would be more realistic.

SCHOOL OF SOCIAL SCIENCES

The School of Social Sciences (SSS), with some 1,000 students, offers six baccalaureate programs, four master's programs, and three Ph.D. programs – a well established degree in Public Policy and Political Economy with 78 doctoral candidates,⁹⁹ and two newly authorized programs, one in Economics with 17 doctoral candidates and one in Political Science with 12. The 49 tenure and tenure track faculty members¹⁰⁰ are all research active and a number of them publish in the very top journals in their fields. Faculty teaching loads are 2+2; all full-time Ph.D. candidates are funded as either TAs or RAs.

The School's goal, as articulated in a briefing paper provided to us, is "to develop several nationally-competitive graduate programs by limiting the scope of each program in order to build depth in selected subfields within disciplinary and policy areas. An integral part of the strategic plan is to seek complementarities across disciplines in order to leverage scarce resources."¹⁰¹ The major areas of research concentration, all of which have substantial faculty strength, are: democratic support, electoral choice, and partisan attitudes (comparative studies); human resources; and geographic information science (GIS) for the social sciences. Much of the work in GIS is performed through the SSS's Bruton Center, which conducts both basic and applied research relating to urban and regional development and performs grant and contract research with local, national, and international organizations. Similarly, many of the faculty involved in research on human resource issues work directly with the Texas Schools Project, a long term research project, funded with a \$1.5 million grant, that can access individual longitudinal data on virtually every K-12 student in Texas (with plans to extend into college and the workplace). This remarkable database actually serves as a recruiting tool for new faculty interested in education-related issues.

The Dean estimates the average annual flow of research grant funding to his School at \$150,000 and \$250,000 (this is UTD's share of grants totaling \$400,000 or more; most grants are shared with faculty at other institutions, given the small size of his faculty). Included are a \$600,000 multi-year FIPSE (Fund for the Improvement of Postsecondary Education) grant; 2 to 3 NSF grants generate about \$150,000 per year and grants from local government, another \$30,000 to \$40,000. One faculty member has several small grants in the area of criminology, with a couple (including one for over \$3 million) pending with the Department of Homeland Security.

The Dean and faculty are anxious to receive authorization for two innovative Ph.D. programs in areas where the faculty have particular strength: Criminal Justice and GIS. Everyone with whom we met agreed that the major obstacle to the SSS achieving national visibility as a first tier School is not quality but scale. One faculty member stated that the School needs an additional 15 faculty members in order to field all of its teaching and degree programs, and probably more if the new PhD programs are authorized. However, the School is not currently authorized to make any new hires. Also, the School's interdisciplinary focus is both a strength and a weakness: a strength because it is a source of unique advantage in areas which are of growing interest both to students and to some granting agencies (e.g., the NSF), but a weakness because neither the Texas bureaucracy nor outside rating systems are familiar with such programs and therefore do not know how to categorize them.

⁹⁹ Information provided to WAG by UTD.

¹⁰⁰ Id.

¹⁰¹ *General Overview*, School of Social Sciences, December 2003.

Recommendations for the School of Social Sciences

1. The School should be granted authorization for the two new Ph.D. programs described in the preceding paragraph. These are niche areas in which the School has particular strength, and it could gain both visibility and opportunities for external research funding by capitalizing on them.
2. The School's faculty FTEs should be increased by at least 25% in order to reduce teaching loads for research active faculty and staff the new Ph.D. programs.
3. The School should preserve its interdisciplinary focus and should preserve and expand its emphasis on prioritizing areas with actual or potential complementarities with other Schools, both within UTD and in other, particularly nearby, institutions.
4. The School should work intensively to exploit such complementarities through joint research projects and proposals, in order to overcome the small-scale problem.

General Observations, Conclusions And Recommendations For UTD

Over the past decade, the University has developed truly excellent undergraduate programs and recruited actively and well in specific research areas. The University has the potential to achieve Tier 1 research university status, although whether it can do so within a decade is questionable. UTD must address a number of issues, some related to resource needs, and others more structural. We agree with the Provost's assessment that UTD must double the size of its research active faculty and its current faculty members must double their research efficiency. UTD also must improve the quality of its graduate students. Finally, it must recruit a new president with appropriate expertise and standing, as well as a new dean for the School of Natural Sciences and Mathematics.

If it is able to recruit the right people in the right numbers; form meaningful and productive partnerships with UTA and UTSWMC and other institutions; and secure the resources that will be needed, it will be in a good position to achieve its goals. UTD is fortunate that it has been given a five year fundraising head start in its march towards Tier 1 status with Project Emmitt. Its success in attracting Emmitt funding suggests that the University has the support of the public and private sectors to achieve its goals and that it is capable of achieving substantial fundraising success. Emmitt and its aftermath, coming at this time of low expectations for augmented state financial support, are perhaps the most important advantages that UTD can count on in moving forward. In addition, its current partnerships with UTSWMC show much potential, and expanded partnerships with UTSWMC and UTA will be important to UTD's future.

UTD's major strengths are:

- Its ability to recruit quality faculty, as demonstrated by recent hires;
- Project Emmitt and the industrial support it has received;
- Its existing and potential collaborations with UTSWMC, UTA, and other potential partners in the Metroplex;
- Its proximity to a community with record of large donations to research institutions; and
- Its excellent undergraduate students and programs.

Its weaknesses are:

- Its inability, so far, to attract significant levels of external research funding;
- Its inability in recent years to raise large philanthropic contributions (other than Project Emmitt) in comparison, for example, to the neighboring UTSWMC;
- The small size of its research active faculty; and
- The uneven quality of its graduate student populations.

In particular, UTD must build on its current research strengths which include:

- Brain and behavioral sciences (particularly audiology);
- Magnetic resonance imaging;
- Information technology (especially communications);
- Advanced materials;
- Advanced instrumentation; and
- Management science and operations research.

If UTD proceeds as described above, the next high opportunity research areas for it to consider are:

- The biological sciences through a larger and better funded Department of Molecular and Cellular Biology (this will be central for UTD if it is to become a Tier 1 research university);
- Expanded and new collaborations with UTSWMC and UTA, where there are many overlapping interests and opportunities for synergy;
- Further development of the engineering programs that underpin Project Emmitt;
- Expanded involvement in nanotechnology by broadening materials sciences, chemistry, physics, and computational research and visualization; and
- Geographic information science (GIS) which, if a strong PhD program were authorized, could pull in faculty participation from the School of Engineering and Computer Science and the School of Natural Science (geophysics) and, with this larger group, be in a good position to attract NSF funding.

All of the foregoing will require a major enlargement of resources:

- The University estimates that it must recruit 250 faculty members in science and engineering, each of whom brings in an average of \$300,000 per year in research expenditures.¹⁰² This \$300,000 figure may be on the high side, given the \$230,000 national average mentioned earlier, and UTD's current average of \$180,000.¹⁰³ Since state funding is not likely to be available for this type of expansion, UTD will have to identify other sources for it. As we mentioned earlier, we believe tuition increases represent the only realistic possibility for funding for the salaries of these individuals.

¹⁰² Personal communication from Provost.

¹⁰³ Information provided to WAG by UTD.

However, some thought is being given to creating a country tax district to support the university, but this is at least 5 years away. Set up costs could then be funded from a variety of sources including the PUF, indirect cost recoveries, and philanthropy.

- In terms of facilities that will be needed to support the contemplated expansion, Project Emmitt should take care of UTD's needs for the next five years. After that, additional capital projects on a scale similar to that of Project Emmitt will have to be undertaken, and sources to fund those projects will have to be secured.

The difficulty of accomplishing all of the foregoing tasks should not be underestimated. They will require rigorous and extensive planning by the faculty and administration, and not all areas requiring change and enhancement can be tackled at once. Priorities must be set, and we suggest the following:

- Develop an institution-wide strategic plan (including realistic timetables for achieving goals) that is properly vetted by responsible administration officials and the research active faculty;
- Develop and implement a plan for the Project Emmitt resources;
- Enhance the research capability of the School of Natural Sciences and Mathematics by expanding the faculty size to critical levels; and
- Broaden the disciplinary base of the School of Engineering.

As mentioned earlier, UTD estimates that it will take some 250 new research active hires, each with a research efficiency of \$300,000 per year to reach Tier 1 status. If these individuals are recruited at the rate of 20 per year (a number the Provost believes is the maximum that can be achieved while insuring quality) it will take approximately 10 years to achieve Tier 1 status. We would have used the national research efficiency number of \$230,000, in which case 325 additional faculty members would be needed. If recruited at a rate of 20 per year, it would take some 15 years to achieve Tier 1 status. The differences between these two calculations indicates the degree of uncertainty involved in any estimate of this type. In our view, either is reasonable. The main difficulty UTD will face in achieving its goal will be in obtaining state support for the additional FTEs, and in finding sources of funding for their set up costs and the required teaching and laboratory facilities.

The foregoing discussion provides an overview of what we learned at UTD and our broad recommendations for research areas to pursue. Our specific recommendations for the University are as follows:

1. *Recruiting.* The key to UTD's success will be in recruiting the very best people to join the faculty. UTD's leadership understands how to identify and recruit top people; the challenge will be to continue to do so at an appropriate pace that will maintain UTD's momentum, but not compromise quality.
2. *Research Areas.* UTD has done a good job of focusing on a few research areas (and the people to go with them) that are topical. We emphasize the importance of maintaining or building critical strength in the basic science and engineering departments at the same time. The University should strive to be nimble with respect to changing trends in research support while developing a long-term vision of advancing science and engineering in the disciplinary departments.

3. *Partnerships.* Partnerships between UTD and other research entities in and near Dallas can become vital instruments for UTD in realizing its ambitions. Some such activities are ongoing, including individual collaborations among researchers at UTD and at UTSWMC. UTSWMC can be helpful in identifying and recruiting faculty for UTD in the life science and allied fields. More formal agreements for joint activities would be welcomed, and would help create an environment that encourages research cooperation. Both UTSWMC and UTD are interested in building closer relationships. In addition to further research collaboration and shared space and equipment, other ways in which bridges could be built include the use of joint search committees for key faculty hires, joint seminars, and the possibility of joint Ph.D. or even MD-Ph.D. programs with some of the Ph.D. thesis research being done at UTD. There are several examples of such successful MD-Ph.D. programs, e.g., Rockefeller University and Cornell Medical School.
4. *Collaboration with Other UT Institutions.* Both UTD and UTA are building quality research programs in Electrical Engineering, Computer Science and Engineering, and Material Sciences including Nanotechnology. Their proximity to each other opens the possibility of collaboration in jointly pursuing sizeable projects of the type frequently initiated by federal mission agencies. The combined strength of the two institutions would make for proposals that could compete very well. In general, joint activities and proposal submissions by the trio of UT System institutions in the Metroplex should be encouraged. Such activity could lead to highly competitive research proposals because of the strength of the combined teams. The three institutions together with the UT System Administration should put in place a 5-year joint strategy focus in engineering and science, including the biomedical sciences. The joint strategy should include a mechanism for frequent face-to-face dialogue between faculty members at the three institutions, since such dialogue is an important mechanism for launching new interdisciplinary concepts.
5. *Strategic Planning.* UTD should develop a strategic plan to guide its pursuit of research eminence, drawing on the expertise of the University's Provost, deans, department chairs and research active faculty who know what it takes to build research strength, as well as on input from other interested parties. This plan should be detailed and level headed and include a timeline for recruiting faculty and key milestones along the way. It also must be realistic about the possibilities of state allocations.
6. *Facilities.* UTD has an extensive facilities plan that extends to 2025, which allows for a careful investment of resources and contributes to the goals of the institution. However, it is not clear that the plan and schedule can keep pace with the expansion expected by UTD. We suggest that the University develop a realistic, detailed space and infrastructure plan, one staged to match the anticipated growth in students and the research activities of its faculty.
7. *Recruiting a New President.* The recruitment of a first class president for UTD is an absolute must if it is to achieve its goals. This person should be an accomplished scientist or engineer and a strategic thinker. He or she should have both the reputation and the personality to coax funds from the Dallas philanthropic community and the state, and the administrative capacity to appoint an excellent executive team and, with them, execute the planned programs with courage, judgment, and precision.

8. *Grant Preparation.* Faculty members with whom we spoke would welcome more central support for grant preparation and management, and for identifying sources of support.
9. *Graduate Students.* UTD must allocate additional resources to improve the quality of its graduate students. The current unsatisfactory state of affairs has been attributed to factors such as non-competitive stipends, problems with tuition remission, and a lack of a good central recruiting policy. No successful research university has only a mediocre cohort of graduate students.
10. *Philanthropy.* UTD must develop a strategy for gaining access to major donors in the Greater Dallas region.

APPENDIX 1

SCOPE OF WORK

The Consultant shall perform the following Work in connection with the development of a detailed plan (the “Plan”) to significantly expand the research capabilities of the following eight (8) academic institutions (the “Institutions”) of the University:

Group A

The University of Texas at Arlington
The University of Texas at Dallas
The University of Texas at El Paso
The University of Texas at San Antonio

Group B

The University of Texas at Brownsville
The University of Texas – Pan American
The University of Texas of the Permian Basin
The University of Texas at Tyler

In accordance with Section 4.d. of this Agreement, Consultant shall assemble two teams of individuals to perform the Work:

- One team, composed of seven or eight members, shall conduct and supervise the Work at the Group A Institutions.
- A second team, composed of six members, shall conduct and supervise the Work at the Group B Institutions.
- Team members shall include nationally recognized leaders with demonstrated competence, knowledge and experience in developing research capabilities for scientific, technological or higher education enterprises.

Consultant, through its teams, shall:

- Review background information provided by the Institutions as well as information developed independently, and shall request additional information from Institutions as the Work progresses.
- Visit Institutions during September 2003, October 2003, November 2003, December 2003 and January 2004. Analyze and evaluate the information gathered and formulate strategies to significantly expand the Institutions’ research capabilities.
- During January 2004 and February 2004, both teams shall identify their major findings and conclusions, answer questions in this Exhibit, and provide recommended strategies and tactics for using current resources to greater effect and for future development of the Institution, and for significantly expanding the Institutions’ research capabilities, in light of constraints and opportunities described in this Exhibit.

Consultant shall include the following work product in the Plan:

- 1) A set of strategies and tactics for using current resources to greater effect and for future development of each Institution.
- 2) Highly focused solutions to significantly expand the research capabilities of each Institution that are aligned with national and state research priorities.

Consultant shall address the following questions concerning each Institution in the Plan:

- 1) What are the current research strengths of the Institution?

- 2) What are the possibilities for further expansion of the research profile at the Institution, using its existing strengths?
- 3) What are the next high-opportunity research areas that the Institution could develop? Explicit recommendations concerning numbers of faculty, target departments, and specific disciplines or sub-disciplines shall be addressed.
- 4) What are the additional resources that the Institution needs to pursue its high-opportunity research possibilities? Specifics of support personnel, graduate students, space, and equipment shall be provided.
- 5) In what order should actions be taken to develop research at the Institution? What is the set of priorities, and why are these the priorities? What is a likely time frame for the research enhancement?
- 6) Are there partners (local, state, or national) who could help the Institution increase its research profile?

Consultant shall address the following questions for the group of Institutions as a whole in the Plan:

- 1) To what extent do the strengths of the Institutions overlap?
- 2) Are there obvious opportunities for collaboration among the Institutions that should be pursued?
- 3) Are there shared resources that should be developed for the Institutions?
- 4) What are the high potential possibilities for collaboration with a nearby medical or health science campus?

Consultant shall address the following constraints in the Plan:

- 1) Each Institution's enrollment is expected to grow. Largest growth is anticipated at U.T. Arlington and U.T. San Antonio. With the exception of U.T. Dallas, the Institutions do not currently pursue selective admissions policies. The pressure of enrollment, however, may lead to greater selectivity at all campuses over the next five years.
- 2) The principal basis for state appropriations is formula funding, based on semester credit hours of instruction, with a two-year lag. The formula provides additional funding for graduate and upper-division courses, and the formula also funds engineering and science courses at a higher rate. Because of the lag in formula funding, increased growth will not pay for itself in the short term.
- 3) The State faces a current revenue shortfall of approximately \$9 billion. Part of this shortfall will be met with a budget cut in appropriated funds. Even when the economy improves, it is not realistic to expect substantial increases in state appropriations.
- 4) Although six of the Institutions are entitled to share in the proceeds of the Permanent University Fund ("PUF") endowment, recent losses in the stock market make additional distributions from the PUF unlikely in the short term.
- 5) Current State law does not permit the University to waive tuition for graduate students. Research and teaching assistants who are appointed at least half time have been eligible to pay resident (in-state) tuition, and, were eligible for staff benefits, including health benefits. Recent legislative changes impact this eligibility. Funds available for graduate fellowships are quite modest.

Consultant shall address the following opportunities in the Plan:

- 1) The local communities are very supportive of the Institutions.
- 2) There may be philanthropic support from foundation or individuals for research expansion.

- 3) The Texas Legislature recently deregulated tuition. Authority for setting tuition, for the first time, will be delegated to the Board of Regents, allowing for a more differentiated tuition structure.
- 4) The state legislature recently approved legislation that will allow the Institutions to retain all of their indirect costs reimbursements. Formerly, these Institutions were permitted to retain only 50% of their indirect costs.
- 5) There is a possibility of some special item funding from the Governor's Office.

In addition to the forgoing questions, constraints and opportunities, the Consultant shall identify and respond to any additional issues relevant to the specific challenges of each Institution.

APPENDIX 2

THE WASHINGTON ADVISORY GROUP TEAM

Erich Bloch is a Washington Advisory Group principal who advises on corporate R&D management and strategic planning for academically based research enterprises and other not-for-profit organizations. He is also serving as a member of the President's Council of Advisors on Science and Technology, and is the Distinguished Fellow at the Council on Competitiveness. As Director of the National Science Foundation from 1984–1990, he oversaw the Foundation's \$3B annual budget. Previously, he was Corporate Vice President for Technical Personnel Development at IBM. He received the National Medal of Technology for developments that "revolutionized the computer industry," and is the recipient of the 2002 Vannevar Bush Award.

Purnell W. Choppin, M.D. is a Washington Advisory Group principal who advises on biomedical research organizations, foundations, and on medical research organizations, life sciences academic research and education programs, foundations, and other philanthropic endeavors. Dr. Choppin is President Emeritus of the Howard Hughes Medical Institute (HHMI), a medical research organization that is among the largest philanthropies in the world. During his tenure as President of HHMI from 1987 through 1999, its programs were greatly expanded and strengthened: the number of HHMI investigators increased from 96 to 330; the number of host institutions from 19 to 71; and a major grants program was established to further science education at all levels and provide support for international biomedical research. Prior to joining HHMI as Vice President and Chief Scientific Officer in 1985, Dr. Choppin was Leon Hess Professor of Virology, Vice President for academic programs, and Dean of graduate studies at The Rockefeller University. Dr. Choppin is a member of many scientific and professional societies, including the National Academy of Sciences, the Institute of Medicine, and the American Philosophical Society (currently vice president).

Edward E. David, Jr., is a Washington Advisory Group principal who advises on R&D strategic planning and management, intellectual property, technology transfer, enhancing corporate research programs, and developing corporate-academic research partnerships. Dr. David was Science Advisor to the President and Director of the White House Office of Science and Technology from 1970–1973. From 1977–1986, he was President of Exxon Research and Engineering Company. Dr. David spent the first two decades of his research career at Bell Telephone Laboratories, latterly as Executive Director. He was also the U.S. Representative to the NATO Science Committee.

John E. Dowling received his A.B. and Ph.D. from Harvard University. He taught in the Biology Department at Harvard from 1961 to 1964, first as an Instructor, then as Assistant Professor. In 1964 he moved to Johns Hopkins University, where he held an appointment as Associate Professor of Ophthalmology and Biophysics. He returned to Harvard as Professor of Biology in 1971 and is presently the Llura and Gordon Gund Professor of Neurosciences and Harvard College Professor. He was Chairman of the Biology Department at Harvard from 1975 to 1978 and served as Associate Dean of the Faculty of Arts and Sciences from 1980 to 1984. He was Master of Leverett House at Harvard from 1981–1998 and currently serves as President of the Corporation of The Marine Biological Laboratory in Woods Hole. Professor Dowling is a Fellow of the American Academy of Arts and Sciences, a member of the National Academy of Sciences and a member of the American Philosophical Society.

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