



The Economic Impact of UT-Battelle on the State of Tennessee

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Executive Summary

In 2000, the University of Tennessee and Ohio-based Battelle, a global science and technology enterprise that manages laboratories across the country, formed a not-for-profit partnership to manage the Oak Ridge National Laboratory (ORNL or the Lab) for the U.S. Department of Energy. Recently, the Department of Energy extended its contract with UT-Battelle through March 31, 2010. The sole function of this partnership is to manage and operate ORNL, which provides a significant source of economic benefits for local area and Tennessee residents through the creation of jobs and income as well through the expansion of state and local tax bases. Due to the prominence of ORNL and its associated activities, the Lab positively influences the economic success of the region.

This study was conducted by the Center for Business and Economic Research (CBER) at the University of Tennessee in cooperation with, and based on data provided by, ORNL. The report quantifies the income, employment, and tax revenues of the UT-Battelle partnership as they arise through operation of the Lab, including 1) direct impacts—those arising directly from hiring employees at ORNL; 2) indirect impacts—those due to the purchase of goods and services by ORNL and to spending by visitors and guest scientists and researchers at ORNL; and 3) multiplier impacts—those arising from the ripple effects created as new income is spent and re-spent in the local economy.

UT-Battelle's operation of ORNL in 2005 led to the following key findings:

- ORNL expenditures increased Tennessee's gross state product by \$820.3 million in 2005.
- Total personal income generated in Tennessee by ORNL activities was \$683.8 million.
- ORNL spending supported 20,708 full-time equivalent jobs in the state in 2005.
- ORNL expenditures generated \$30.1 million in state and local sales and use tax revenue in Tennessee in 2005.

In addition to these key economic findings, ORNL contributes to the state and local economies in numerous qualitative ways including:

- Facilitating business start-ups and spin-offs resulting from research and development at the Lab.
- Helping to create an entrepreneurial climate at the University of Tennessee and in the surrounding community.
- Supporting of 35 joint UT-ORNL faculty appointments.
- Providing monetary contributions to support local area high school science programs, economic development, and other philanthropic efforts.
- Donating in excess of \$835,000 to the United Way campaign in 2005.

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Introduction

This report examines the qualitative and quantitative benefits that UT-Battelle's operation of the Oak Ridge National Laboratory (ORNL) has on the Tennessee economy. While benefits occur through both the management and operation of the Lab and through the very existence of a partnership between the University of Tennessee and Battelle, the focus of this report is on the ORNL activities. It does not include benefits arising from the management of the partnership or from revenues that are returned to either of the individual entities of the University of Tennessee and Battelle due to their successful operation of the Lab.

ORNL is the largest U.S. Department of Energy science and energy laboratory. It has been managed since April 2000 by UT-Battelle, a non-profit company established by the Department of Energy specifically to manage and operate the ORNL. The management partnership between UT and Battelle is grounded in the purpose of "science in service to humanity" and in the expression of "responsibility to the pursuit, and the benefits, of scientific discovery."¹ In late 2005, the

ORNL wins six R&D Awards, pushing total to lab-leading 128

In FY 2005, researchers and engineers at the Department of Energy's Oak Ridge National Laboratory won six Research and Development awards, presented each year by *R&D Magazine* in recognition of the year's most significant technological innovations. ORNL's 128 awards are second only to General Electric.

The following researchers were recognized for their inventions:

Hybrid Solar Lighting System, developed by Jeff Muhs, David Beshears, Duncan Earl, Curt Maxey, Melissa Lapsa, Wes Wysor, Christina Ward, and Randall Lind of the Engineering Science and Technology Division, John Jordan of ORNL Creative Media and Sunlight Direct of Oak Ridge.

LandScan Global Population Database developed by Eddie Bright, Phil Coleman, Amy King, Budhendra Bhaduri, and Ed Tinnel of ORNL's Computational Sciences and Engineering Division.

Metal Infusion Surface Treatment (MIST) developed by C3 International, assisted by staff from ORNL's Materials Science and Technology Division.

NanoFermentation, developed by Tommy Joe Phelps of ORNL's Environmental Sciences Division, Lonnie Love of the Engineering Science and Technology Division, Adam Rondinone of the Chemical Sciences Division, former ORNL researcher Bob Lauf, now a consultant, and post-doctoral research fellows, Yul Roh, Chuanlun Zhang, and Ji-Won Moon.

TMA 6301 and TMA 4701 developed by Govindarajan Muralidharan, Vinod Sikka, Phil Maziasz, Neal Evans, Michael Santella and Christopher Stevens of the Materials Science and Technology Division, Duraloy Technologies, and Nucor Sheet Mill Group.

Trane CDQ developed by Jim Sand, formerly of ORNL's Engineering Science and Technology Division in collaboration with the Trane Company.

Source: ORNL News Release, July 7, 2005. Available at <http://www.ornl.gov/info/press_releases/get_press_release.cfm?ReleaseNumber=mr20060705-00>

¹ UT-Battelle Web site, undated. <<http://ut-battelle.org/about.htm>>

Department of Energy praised the contributions of UT-Battelle and extended the contract between DOE and UT-Battelle through March 31, 2010.²

ORNL's history is varied. Originally known as Clinton Laboratories, it was established in 1943 as a part of the Manhattan Project. In its early years, its mission was focused solely on pioneering a method for producing and separating plutonium. In the period since then, ORNL has delved into the study of nuclear energy and related research in the physical and life sciences and more.

Today, ORNL is a multi-program science and technology laboratory with six major roles in support of the Department of Energy: neutron science, energy, high-performance computing, systems biology, materials science at the nanoscale, and national security.³ With a staff of over 4,000, ORNL conducts basic and applied research and development. These efforts are designed to create scientific knowledge and technological solutions addressing key areas of science, increase the availability of clean abundant energy, restore and protect the environment, and contribute to national security. ORNL also performs other work for the DOE, including isotope production, information management, and technical program management, and provides research and technical assistance to other organizations.

Oak Ridge National Laboratory is the home of 19 experimental user facilities. Designed to serve staff scientists, engineers, and researchers from universities, industry, foreign institutions, and other government laboratories, the user facilities exemplify collaboration. They also advance national research and development and fulfill the DOE missions by minimizing unnecessary duplication of effort, promoting beneficial scientific interactions, and making the most effective use of costly and, in many cases, unique equipment. The diverse and sophisticated research conducted by staff scientists, coupled with the availability of unique resource equipment, is attracting a growing number of guest researchers. In fact, approximately 3,000 guest researchers visit ORNL annually.⁴

² Meeting 21st Century Challenges: The Role of Oak Ridge National Laboratory, May 9, 2006. Available at <http://www.ornl.gov/ornlhome/state_of_the_lab/state_of_the_lab_2006.pdf>

³ Oak Ridge National Laboratory Fact Sheet, 2006. Available at <<http://www.ornl.gov/ornlhome/fact.pdf>>

⁴ Additional details regarding ORNL activities can be found at <<http://www.ornl.gov>>

What Oak Ridge National Lab Offers Tennessee

The presence of ORNL results in many benefits for the Tennessee economy, both quantitatively and qualitatively. First, ORNL provides employment and income for residents of the state. The jobs are often highly skilled and high paying, resulting in a remarkably high quality workforce comprised of some of the top researchers in their field. High paying positions also create large economic impacts on the East Tennessee and Tennessee economies. Second, the presence of ORNL provides the state with many qualitative benefits. For example, the state receives national, and indeed worldwide, recognition as a leader in advanced materials, manufacturing, biological sciences, transportation technologies, and neutron sciences.

The addition of the \$1.4 billion Spallation Neutron Source, along with the recently upgraded High Flux Isotope Reactor, make ORNL the world's foremost center for neutron science research. The presence of such sophisticated research in Tennessee has an important influence on the perceptions of the Tennessee economy and education system that spreads benefits to and enhances the perceptions of other companies and institutions in the state. It can also be a significant positive attraction for economic activity, as firms want to locate near a pool of highly trained workers and near the research facilities. The next section of the report focuses on the quantifiable economic benefits attributed to ORNL while the final section will examine qualitative benefits of the laboratory. We are unable to quantify all of the economic gains from attracting other businesses and workers, so the economic effects measured in this report understate the total gains in income, jobs, and taxes to the region.

Job, Income, Output and Tax Benefits of UT-Battelle in Tennessee

This section of the report estimates the quantifiable benefits of UT-Battelle in terms of income created, jobs added, and taxes collected via management and operation of the Lab. The model used to generate the estimates is described in the Appendix.

ORNL Expenditure Data

The analysis measures economic benefits for 2005 based on the actual expenditure patterns of ORNL in 2005. The economic impact comes as UT-Battelle pays Lab workers in Tennessee and purchases goods and services in Tennessee. The economy benefits in other ways as well,

such as when visiting scientists come to Tennessee and spend money staying in hotels, eating in restaurants, and buying souvenirs.

The analysis is divided into the direct effects of UT-Battelle, the indirect effects, and the multiplier effects. Income and employment are created *directly* as ORNL pays workers' wages. Income and employment are created indirectly as ORNL purchases goods and services from Tennessee manufacturers, service providers, and vendors and as these firms hire workers, earn profits, and so forth. Income and employment are created through the multiplier process as the workers arising from the direct and indirect effects spend their incomes in Tennessee and other firms earn income and profits and hire employees.

The direct, indirect, and multiplier effects are added to yield the total income, employment, and tax revenue impacts. Direct effects are attributable to the actual operation of ORNL. These direct effects include the hiring of ORNL staff (the direct employment impact) and the payments to these employees (the direct income effect). Indirect effects result from ORNL purchases of goods and services and spending by visitors and guest scientists and researchers to ORNL. Finally, the multiplier effect occurs as the direct and indirect incomes are spent and re-spent within the local economy. For example, ORNL employees spend a portion of their wages and salaries in the local community on goods and services such as housing, clothing, and food. Likewise, the owners of businesses receiving these payments will use a portion of the proceeds to pay their employees and make profits, and the cycle continues. During each of these subsequent rounds of spending, a portion of the direct and indirect income leaks out of the local economy through federal taxes, payments to non-residents, savings and spending outside of the local area, diminishing the additional local income through each successive round of expenditures.

In FY2005, ORNL paid \$302.4 million in payroll in Tennessee and spent \$137.9 million in non-payroll expenditures for purchasing goods and services in the state while employing 3,990 full-time workers. This initial injection of money works its way through the state's economy to produce more economic impacts through indirect and multiplier effects.

Total economic benefits of ORNL spending in Tennessee include an \$820.3 million increase in output or gross state product (GSP), a \$683.8 million increase in personal income, \$30.1 million in state and local sales and use tax revenue, and the support of 20,708 full-time equivalent jobs (see Table 1).

Table 1: Summary of Economic Benefits of ORNL in Tennessee, FY 2005

Output (GSP)	\$820.3 million
Personal Income	\$683.8 million
Sales and Use Tax Revenue	\$30.1 million
Employment	20,708 jobs

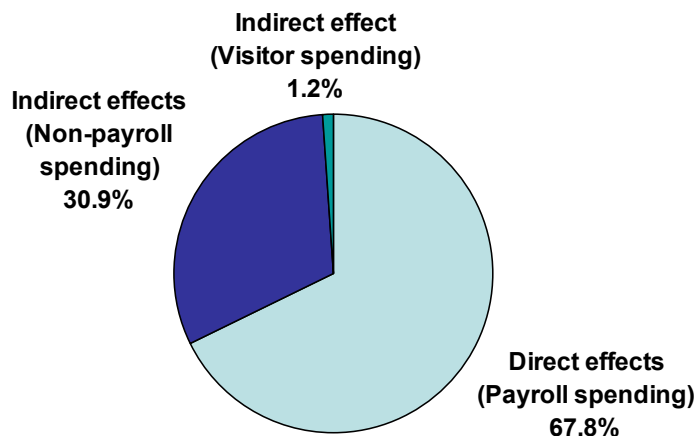
Output Benefits

The output benefit of ORNL activities is measured by the increase in gross state product (GSP) from expenditures made within the state. GSP is a broad measure of production in the economy. For FY 2005, the value of production at ORNL combined with the value arising in the area because of ORNL totaled \$820.3 million (see Table 2 and Figure 1). Much of the output is associated with the hiring of workers and the multiplier effects associated with these workers. The direct employment accounts for \$556.5 million or 67 percent of total GSP. Output generated in response to the demand associated with indirect spending adds another \$253.7 million or 31 percent. A component of indirect spending, visitor and guest scientist spending, contributes an additional \$10.1 million to the total output benefit.

Table 2: ORNL Output Benefit in Tennessee, by Source, 2005 (in millions)

Payroll Spending	\$556.5
Non-payroll Spending	\$253.7
Visitor Spending	\$10.1
Total Output Benefit	\$820.3

Figure 1: ORNL Output Benefit in Tennessee, by Source, 2005 (percent of GDP)



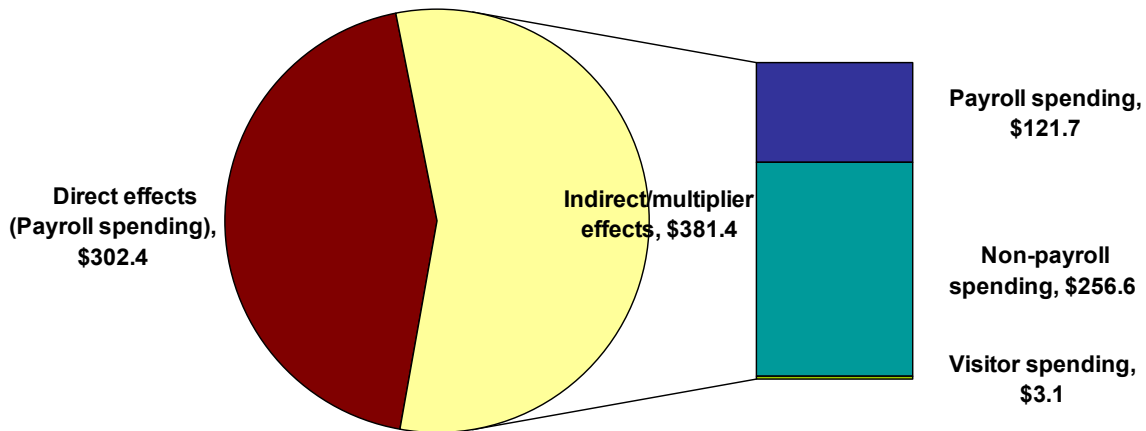
Income Benefits

Personal income is another broad measure of the economy and includes all wages, profits, interest, rents, and other forms of income earned by people in the Tennessee economy. The increase in total personal income arising because of ORNL expenditures was \$683.8 million (see Table 3 and Figure 2), which amounts to 3.5 percent of all personal income earned in the Knoxville MSA during a year.⁵ These effects can be distributed among direct effects and indirect/multiplier effects. Direct income effects result because of expenditures on wages and salaries of ORNL employees and account for \$302.4 million in 2005. Indirect and multiplier effects, accounting for a total of \$381.1 million, arise as ORNL payroll and non-payroll spending move through the economy.

Table 3: ORNL Income Benefit in Tennessee, by Source, 2005 (in millions)

Direct Effects	
Payroll Spending	\$302.4
Indirect/Multiplier Effects	
Payroll Spending	\$121.7
Non-payroll Spending	\$256.6
Visitor Spending	\$3.1
Total Income Benefit	\$683.8

Figure 2: ORNL Income Benefits, by Source, 2005 (in millions)



⁵ The Knoxville MSA consists of the following counties: Anderson, Blount, Knox, Loudon, and Union. <http://cber.bus.utk.edu/census/tnmsadef.htm>

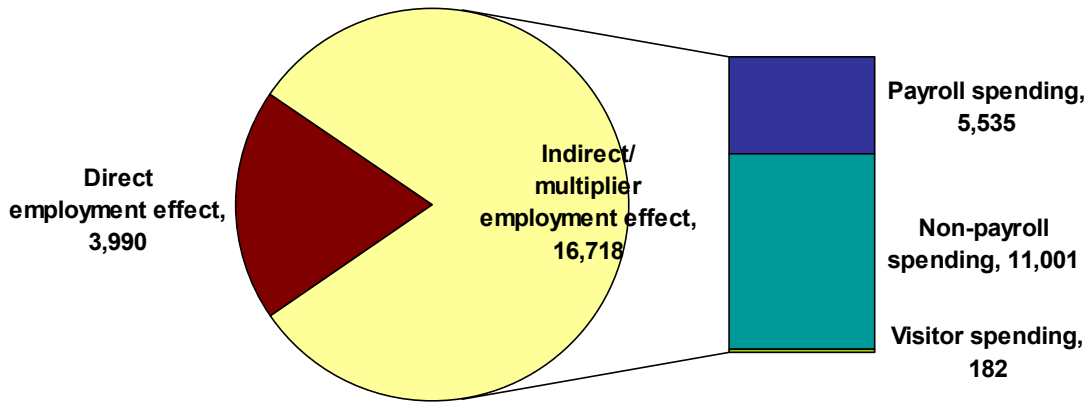
Employment Benefits

The total employment benefit of ORNL in Tennessee in FY 2005 was 20,708 full-time equivalent jobs (see Table 4 and Figure 3). The direct employment of ORNL was 3,990; and an additional 16,718 jobs were supported through the purchase of goods and services in Tennessee, visitor and guest scientist spending, and the effects of ORNL employees spending their income in Tennessee.

Table 4: ORNL Employment Benefit in Tennessee, by Source, 2005

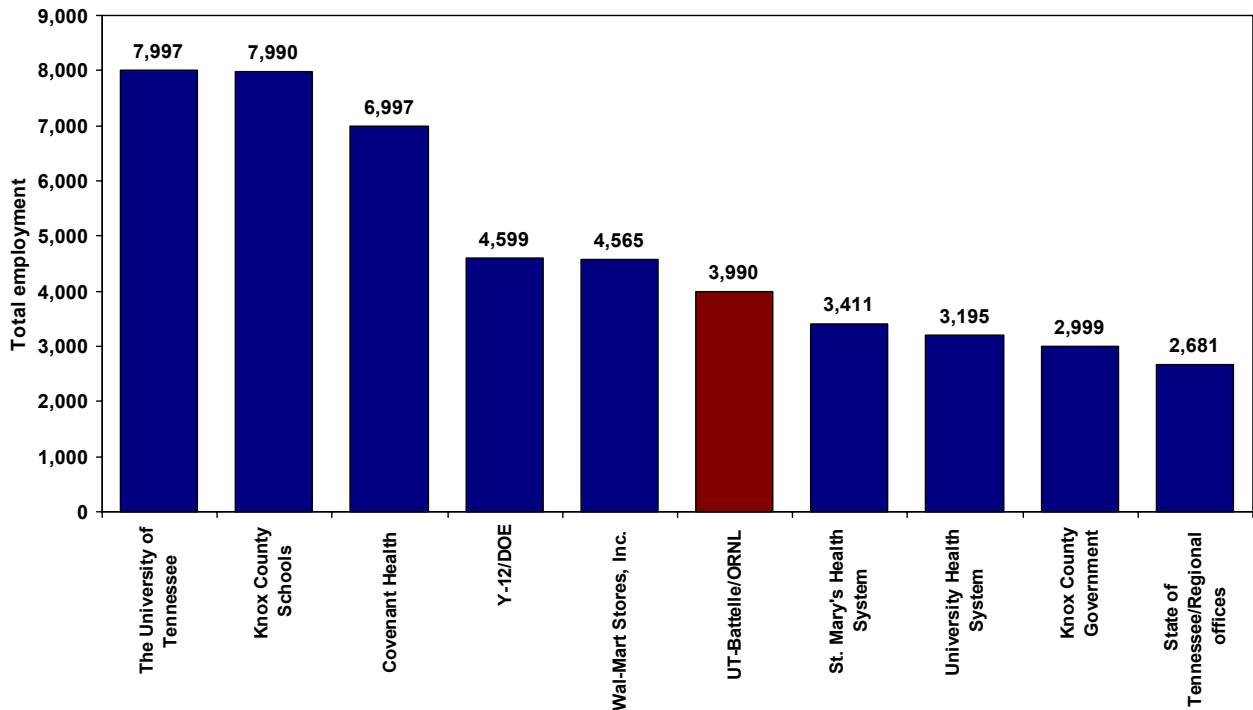
Direct Effects	
ORNL employees	3,990
Indirect/Multiplier Effects	
Payroll Spending	5,535
Non-payroll Spending	11,001
Visitor Spending	182
Subtotal	16,718
Total Employment Benefit	20,708

Figure 3: ORNL Employment Benefit in Tennessee, by Source, 2005



By way of comparison, ORNL is the sixth largest employer in the region, just below Wal-Mart and just above St. Mary's Health System (see Figure 4).⁶ But, ORNL's income and output effects will be even larger relative to its employment because of the relatively high wages and non-wage expenditures.

Figure 4: Major Employers in the Knoxville Area, 2005



Sales Tax Benefit

ORNL activities in FY 2005 resulted in revenues of \$30.1 million in state and local sales and use taxes. Of the total amount, \$14.3 million is remitted in use taxes directly by ORNL. The remaining \$15.8 million includes \$11.8 million in state sales taxes, and \$4.0 million in local tax revenues. Sales tax revenues are generated through indirect and multiplier processes as ORNL employees spend a portion of their income at local area businesses and these businesses remit the sales tax.⁷ Businesses receiving payments from ORNL pay their employees, who spend a portion of their income at local businesses and as the money spent works through the economy, state and local sales taxes are generated. In addition to sales taxes, ORNL activities result in

⁶ The Knoxville area includes the following counties: Anderson, Blount, Knox, Loudon, Sevier, and Union. This information was obtained from the Knoxville Chamber <http://www.knoxvillechamber.com/index.php?kc/main/economic_development/existing_industry>

⁷ As a general rule, ORNL is exempt from paying sales tax on purchases.

additional fiscal benefits such as payments-in-lieu-of-taxes, property taxes, and business taxes. However, this study only examines sales tax revenue, therefore the total fiscal benefits attributable to ORNL is larger than the benefit discussed here.

Qualitative Benefits of ORNL

The presence of ORNL and the UT-Battelle partnership provides numerous benefits to Tennessee and the local area; many of which may not be easily quantified. For example, ORNL fosters economic growth and enhances productivity for East Tennessee and throughout the state. ORNL also provides a highly trained group of workers who provide leadership throughout the community. This pool of workers attracts other workers and firms. Further, ORNL offers opportunities that dramatically enhance the quality of the University of Tennessee and the overall education process.

Evidence from the academic literature indicates that the local area benefits from the partnership of UT-Battelle and ORNL beyond the usual measures of jobs and income that are directly associated with the Lab. For example, companies that spin off from ORNL provide jobs, income, and tax revenues from Tennessee. Further, synergies arise through what economists call agglomeration effects. Examples of agglomeration effects are when the presence of ORNL allows suppliers and other research firms to reach a minimum threshold to become highly productive and then these firms can sell to much broader markets and when the access to a very skilled labor force allows companies to startup or thrive through the ability to obtain quality workers in the local market (who may be hired away from the Lab). Research drawn from the economics literature shows that the presence of high-technology jobs is a strong indicator/determinant of regional economic growth.⁸ Further, research on the mobility of high-tech workers shows that these workers tend to be younger and well educated.⁹ Likewise, work by Bartley shows that a high concentration of jobs in high-tech industries tends to draw younger workers and that quality-of-life factors are also quite important to these workers.¹⁰ This suggests that ORNL is likely to hire workers that are important contributors to the community, but also that the area's quality of life must remain strong in order to recruit the best to the ORNL. Other

⁸Bee, Ed. "Knowledge Networks and Technical Invention in America's Metropolitan Areas: A Paradigm for High-Technology Economic Development" *Economic Development Quarterly*, May 2003, 17:2, pp. 115-31.

⁹ Herzog, Henry W., Jr., Alan M. Schlottmann, and Donald L. Johnson. 1986. "High-Technology Jobs and Worker Mobility," *Journal of Regional Science*, 26:3, 445-459.

¹⁰ Bartley, Katherine F. 2006. "Technology and the Convergence of U.S. Urban Migration Patterns: 1970-2000," *Growth and Change*, 37:11, 82-106.

firms are likely to locate in an area or to expand because a pool of trained workers is present. Another paper evidences that high-tech firms show a strong propensity to locate close to universities, especially universities heavily engaged in research activities, in order to access knowledge spillovers.¹¹ A resulting conclusion is that UT-Battelle partnership, and the separate organizations of UT and Battelle, are essential to attracting and developing high-tech businesses, young well-educated workers, and strong economic growth.

The following discussion identifies some ORNL activities that are specifically intended to strengthen the local economic environment.

*Technology Transfer and Economic Development (TTED)*¹²

ORNL Technology Transfer & Economic Development (TTED) organization exists to work with commercial businesses. It is designed to foster economic development and the growth of business and industry by providing innovative equipment, cutting-edge technology, and the expertise of ORNL researchers to technology-based companies throughout the nation. Technology transfer is used to move innovations from the research laboratory to the marketplace, all to enhance U.S. competitiveness and bolster the regional economy. FY 2005 saw record numbers for invention disclosures, licenses and options, and revenue, all measures of technology-transfer efforts.¹³ While TTED resources are intended to benefit the entire country, they are particularly beneficial in the immediate area because of proximity to the Lab.

During 2005, TTED accomplished a number of activities that enhanced the successful operation of ORNL, including:

- more than 90 work for others agreements valued at \$53 million
- 10 new cooperative research and development agreements valued at \$10.5 million
- 167 new invention disclosures
- 151 new licenses/options
- 28 new fee-bearing licenses
- more than \$2.5 million in revenue from licensing

Further, the TTED and more broadly, the Lab, are focused on facilitating business startups and spinoffs that result from the research and developments. Since UT-Battelle assumed management in 2000, technology and other resources have been major contributors in the

¹¹ Audretsch, David B., Erik E. Lehmann, and Susanne Warning. 2005. "University Spillovers and New Firm Location," *Research Policy*, 34:7, 1113-22.

¹² ORNL Web site, undated. <<http://www.ornl.gov/adm/tted/>>

¹³ ORNL Technology Transfer and Economic Development Year-in-Review Newsletter, 2005.

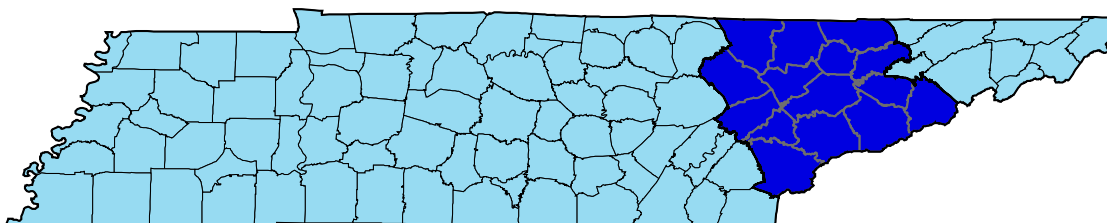
creation of 61 companies with revenues of over \$36 million in FY 2005 and resulting in 285 full-time and 33 part-time jobs.¹⁴

Tech 2020¹⁵

Technology 2020 (Tech 2020) is a not-for-profit, public-private partnership focusing on using East Tennessee's information technology resources to grow new technology-oriented businesses for East Tennessee. The project began in 1993 in order to capitalize on the unique resources in the East Tennessee region: ORNL, the University of Tennessee, the headquarters of the Tennessee Valley Authority, as well as numerous technology companies in the region. The Oak Ridge/Knoxville area has one of the highest concentrations of technology expertise in Tennessee. The motivation behind the formation of Tech 2020 was to reduce the region's dependence on the federal government and to foster a strong private sector technology industry. Among the highest priorities were helping start new technology businesses, helping new businesses meet the challenges associated with business start-up, and ultimately helping grow companies headquartered in Tennessee as a means of providing high-quality jobs for residents. The Technology 2020 partnership has grown with UT-Battelle management, leading to the formation of the Center for Entrepreneurial Growth and a mix of investment programs. Tech 2020's three-part funding initiative for new business start-ups received the 2005 Incubator Innovation Award. The "Access to Capital Initiatives" assists Tech 2020 clients obtain the funding needed to grow quickly.

The original service area of Tech 2020 was a 15-county region in East Tennessee called Tennessee's Resource Valley. Future plans will service a much larger area, reaching from the Tri-Cities to Chattanooga. Figure 5 below shows the 15 counties currently included in the Resource Valley.

Figure 5: Tennessee's Resource Valley



¹⁴ ORNL Technology Transfer and Economic Development Year-in-Review Newsletter, 2005, p. 2.

¹⁵ Technology 2020 Web site, undated. <<http://www.tech2020.org>>

Sponsored by Tech 2020, the Oak Ridge Center for Entrepreneurial Growth (CEG) aims to create an entrepreneurial climate in the state of Tennessee and to improve the dissemination of technology through the creation and support of early-stage companies focused on growth and long-term sustainability. At the close of FY 2005, the Oak Ridge CEG had 67 member companies, including 61 that have direct links to ORNL (see Figure 6).

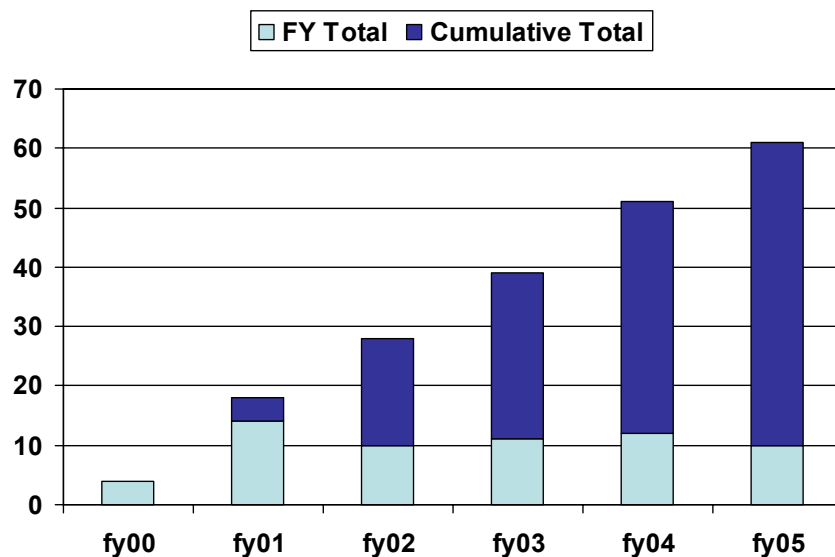
Some services provided by CEG to member companies are:

- business counseling, management team coaching, and financing preparation for clients
- review of business plans and financial statements
- review of sales and marketing plans/materials
- assistance in defining and working strategic partnerships and alliances
- assistance with development and review of action plans for progression from start up to self sustaining businesses
- assistance in the pursuit of debt/equity financing

CEG offers other program benefits in addition to the services specifically provided to CEG clients including:

- creation of an entrepreneurial climate at the University of Tennessee and in the surrounding community
- identification of new technologies with commercial potential
- improvement in the region’s access to university resources
- provision of networking opportunities for CEG clients

Figure 6: CEG Company Start-ups FY 00-FY 05



Beyond Business

This study has mainly focused on UT-Battelle's contributions to economic growth; both directly through the operation of ORNL as well as through the activities of entities such as Technology Transfer and Economic Development, Tech 2020, and the Oak Ridge Center for Entrepreneurial Growth. Again, UT-Battelle is a not-for-profit company, established for the sole purpose of managing and operating the Oak Ridge National Laboratory for the U.S. Department of Energy. Both UT and Battelle "are committed to serving the U.S. Department of Energy by enhancing ORNL's leadership in scientific research, laboratory operations, and community service. As ORNL's largest research partner, the University of Tennessee will strengthen the Laboratory's partnerships among state and regional stakeholders. Battelle's founding purpose "science in service to humanity" expresses a special responsibility to the pursuit, and the benefits, of scientific discovery."¹⁶

ORNL also employs many graduate students and faculty from UT, across a range of program areas. For example, ORNL participates in an initiative with the University of Tennessee MBA program, where graduate assistantships and internships are provided to a select group of students each semester. Of course, many faculty and students from the "hard" sciences, economics and other areas are also employed. The incomes earned by this faculty and students are included in the calculations provided above, but the benefits transcend the incomes earned. Faculty and students have opportunities to undertake research and to learn from experiences that they would not have in the absence of the Lab. The University of Tennessee is able to recruit better faculty and graduate students as a result, and this improves the overall quality of the University. The opportunity to work at the Lab and the University simultaneously is an important attraction for many top researchers. Currently there are 35 faculty with joint appointments between ORNL and UT. Some examples of these appointments are:

- Dr. Robert Harrison, computational chemistry and Dr. Igor B. Jouline, computational biology and bioinformatics, both at the Joint Institute for Computational Sciences (JICS).
- Drs. Jack Dongarra and Jesse Poore, joint faculty in computational fields through the UT-ORNL Science Alliance and Dr. Charles L. Merkle, H.H. Arnold Chair in Computational Mechanics at UT Space Institute.

¹⁶ UT-Battelle Web site, undated. <<http://www.ut-battelle.org/about.htm>>

- Drs. Ted Barnes (Theoretical Physics), Pengcheng Dai (Neutron Science), David Dean (Theoretical and Computational Physics), Adolfo Eguiluz (Theoretical Condensed Matter Physics), Geoff Greene (Fundamental Neutron Physics), David Mandrus (Experimental Condensed Matter Physics), Adriana Moreo (Condensed Matter Theory), Thomas Papenbrock (Nuclear Physics Theory), Hanno Weitering (Experimental Condensed Matter Physics), and Zhenyu Zhang (Condensed Matter Physics), all UT-ORNL joint faculty members.
- Dr. Michael L. Simpson UT-ORNL Joint Faculty Member, Distinguished Research Staff Member, Engineering Science & Technology and Condensed Matter Sciences Divisions.
- Dr. Narendra Dahotre, a professor in the Department of Materials Science and Engineering and joint UT-ORNL faculty member, who recently received the Chancellor's Award for Research and Creative Achievement.
- Claudia Rawn, assistant professor Materials Science and Engineering and joint UT-ORNL faculty member.

While the focus of UT-Battelle may be scientific progress and discovery, the partnership has made great contributions to a wide variety of local area groups. Included in these contributions are:¹⁷

- UT-Battelle donated \$10,000 to Farragut High School; one of 30 such gifts to East Tennessee high school science programs over the last few years.
- A mentor program at ORNL provides counseling and training to five minority-owned and women-owned businesses. The program assists the businesses with financial management, organizational management, an overall business management plan, and marketing assistance.
- UT-Battelle donated \$60,000 to the Oak Ridge Rowing Association to build new launch docks and to help make Oak Ridge the premier site for competitive rowing.
- UT-Battelle launched a new incentive plan to strengthen math and science education in Tennessee. The company paid a \$10,000 signing bonus as an incentive for three teachers, two starting in Union County and one in Morgan County.

¹⁷ ORNL Archived News Releases for 2006. Available at http://www.ornl.gov/info/press_releases/get_archived_prs.cfm?ThisYear=2006

- UT-Battelle and ORNL contributed in excess of \$835,000 to the United Way campaign.
- UT-Battelle contributed \$2 million towards the construction of the new Oak Ridge High School.
- UT-Battelle sponsored Knoxville's Project GRAD's 'MOVE IT Math' program.
- UT-Battelle supported local economic development efforts with contributions of over \$500,000 annually.

Appendix: An Overview of the Economic Impact Model

The main purpose of this study is to analyze the benefits of the operations of ORNL in Tennessee. The economic benefits accruing to the state are measured by the increase in production of goods and services (gross state product), the number of jobs created and the amount of personal income that is generated for residents. The main fiscal benefit is the additional sales tax revenue generated due to the increase in economic activity of ORNL.

The economic impact measures are further broken down into *direct*, *indirect*, and *multiplier* effects. *Direct* effects are those specifically associated with ORNL. Workers employed by ORNL and its contractors represent the direct employment benefit of the laboratory. Likewise, the expenditures by ORNL on wages and salaries are the direct income effect. Direct fiscal effects arise through a range of taxes on businesses such as property and sales taxes from the investment in real and personal property and purchases of sales taxable items. Additionally, there are payments-in-lieu-of-taxes and other fees paid by ORNL and its contractors that contribute to the facility's direct fiscal benefit.

Indirect effects arise from ORNL's procurement of raw materials, services, supplies, and other operating services that help support jobs in regional businesses, as well as expenditures by visitors to the facilities supported by DOE. For example, many of the business services utilized by ORNL are purchased from firms within Tennessee. The economic effects of ORNL increase as the share of raw materials and other inputs acquired within the region increase. Only the portion of the expenditure actually retained by an in-state vendor can be used in the calculation of the firm's indirect income benefit to the state economy. For example, if new computers are purchased from a supplier in Middle Tennessee but the computers were actually manufactured outside the state, only the mark-up of the machines above cost would be counted as new income in the state. State and local governments gain benefits due to the sales tax on these sales, but this impact is counted separately. Therefore, the size of ORNL's indirect impact on regional jobs and incomes depends primarily on the dollar value of regionally purchased goods and services and whether these same goods and services are produced within the region or imported into the community.

The indirect effects arising from visitors to ORNL are unique in that most private sector firms would not be expected to attract many visitors. However, since many of the facilities at ORNL provide research opportunities for visiting scientists and the public at large is interested in

its science and energy, the visitor effect has both a substantial quantitative and qualitative benefit. The quantitative effect of visitors to ORNL is due to their expenditures on lodging, food, entertainment, etc. incurred in the state during their visit. ORNL maintains data on the number of guest scientists using ORNL facilities during the year and also visitors to the American Museum of Science and Energy. Estimates of expenditures per day were based on recent surveys conducted by the Knoxville Convention and Visitor's Bureau.

Finally, multiplier effects are created as the additional income generated by the direct and indirect effects is spent and re-spent within the local economy. For example, part of the wages received by ORNL's employees will be spent on retail sales. If the employee goes shopping in Nashville, part of the sales receipt will be used to pay local employees of the retail establishments. These employees will in turn spend a portion of their income in the state on groceries, housing, clothing, etc., thereby adding to the amount of statewide personal income directly attributed to ORNL's activities. It should be noted, during each of these subsequent rounds of spending, a large portion of the income generated leaks out of Tennessee's economy through taxes, savings, and spending outside the state, thereby diminishing the increment to total state income attributable to these firms.

Total economic impacts attributed to increased business activity are computed as the sum of the direct, indirect, and multiplier effects. The model used in this report was developed by the Center for Business and Economic Research at the University of Tennessee to calculate economic impacts of firm activity using the RIMS II multipliers specific to Tennessee. Using the expenditure and employment data provided by ORNL, the model allows calculation of the output, income, employment, and sales tax revenue impacts accruing in the state of Tennessee.