technical note technical note

Re-Assessment of the Economic Impact of the William J. Hughes Technical Center on Southern New Jersey

ACT-500 Research Group

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William J. Hughes Technical Center
Atlantic City International Airport, NJ 08405

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16. Abstract

The William J. Hughes Technical Center is a major contributor to the economy of southern New Jersey. Rigorous analysis, using industry standard economic models, indicates that the Technical Center is responsible for 6,200 jobs in the 7-county area. It is projected that the Technical Center will contribute $3.3 billion dollars to the regional economy over a period of 10 years beginning in 2001.

This study was completed before the events of September 11, 2001 and does not reflect the impact of the Aviation and Transportation Security Act, PL 107-71.

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The impetus for this reassessment of the economic significance of the William J. Hughes Technical Center is directly traceable to the adoption of best business practices, where applicable, by federal agencies. An independent contactor, specializing in economic analysis was employed to assess the economic impact of the Technical Center in 1996. This report serves to update and, therefore, maintain the timeliness and value of that study, which was completed in 1997.

With continued support from FAA personnel, the contactor was able to collect the necessary input data for modeling and analyzing the economic impacts. Michael Pendleton conducted the model simulation activities and generated study results. Tom Schweizer took the overall responsibility for project management, modeling support, and report editing.

A brief description of technical personnel who participated in this study is as follows:

1. Dennis Steelman - FAA, ACT 504, Chief Scientist/COTR, NAS System Engineering and Analysis Division, William J. Hughes Technical Center.
2. Thomas Schweizer, Ph.D. - President and CEO of PERI and Manager of the FAA Economic Impact Study. He specializes in technology assessment and in the use of modeling techniques to analyze the institutional impacts of changes in technology policy.
3. Michael Pendleton, MS. - Mr. Pendleton is a Project Manager at PERI. He specializes in assessing economic policy and scientific issues pertaining to energy and environmental technologies.
4. Linda Cassone, ACT-51, Contracting Officer/ACQUIRE Systems Administrator.

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EXECUTIVE SUMMARY

This study updates and, therefore, maintains the value of a 1997 study whose purpose was to determine the economic contributions of the Federal Aviation Administration's (FAA) William J. Hughes Technical Center to the economy of southern New Jersey. Economic contributions encompass a broad range of effects including the impact of the Technical Center on local employment and the locally produced goods and services purchased by the Technical Center. Beyond the direct expenditures, Technical Center purchasing actions have a multiplier effect on the local economy, reflecting the demand for local goods and services of the employees of the Technical Center and its contractors. This study shows the impact of the Technical Center on the southern New Jersey gross regional product to be $353 million in 2001 and projected to be $3.27 billion over the next 10 years. For comparison, the earlier study (ACT-500 Research Group, 1997) found that impact to be $279 million in 1997 ($297 million in 2001 $) and was projected to be $3.0 billion ($3.2 billion in 2001$) over the following 10 years.

Independent Economic Analysts used the Regional Economic Models, Inc., (REMI) EDFS-53 model to estimate the effects of Technical Center spending on the local economy. This state-of-the-art model provided the full multiplier analysis, estimating the spending and re-spending in the local economy. The model uses that fraction of Technical Center and employee spending that stays in the local economy and estimates how much of that spending becomes local income and is re-spent in the local economy. In addition to the importance of the employment and payroll brought to the region, the employees of the Technical Center are technically sophisticated, with critical, specialized skills that are important to the region. The Technical Center attracts highly skilled workers and brings higher quality employment opportunities to the workers of the region.

The study region included the counties of Atlantic, Cape May, Ocean, Cumberland, Burlington, Camden, Gloucester, and Salem. The Technical Center directly employs 1,656 people, not including its contractor employees. Of these employees, 1,428 live within the study region. The payroll of the Technical Center (2001$) is $129.6 million, of which $111.8 million (86%) is earned by employees who live within the region. An additional $319 million was spent in FY2001[1] on Technical Center related activities (contracts, construction, operations and maintenance, etc.), $158.6 million (49.7%) of which was spent with firms located within the study region.

This study concludes that the southern New Jersey region is permanently more prosperous with more high-quality jobs and a larger inflow of population because of the Technical Center's presence in southern New Jersey. The effects are larger than would be estimated by counting Technical Center employees and their incomes alone or even including the contractors that perform vital Technical Center functions. The impact of the Technical Center is magnified or multiplied by the spending and re-spending of dollars in the economy. The Technical Center contracts for services are often supplied locally, further increasing the multiplier beyond what would normally be the effect of a government operation. Furthermore, the employees and contractors are people who largely spend their personal resources on services produced locally,

[1] Data on FY 2001 expenditures were available through June 2001. Extrapolation in consultation with the FAA was used to estimate spending over this fiscal year. The determination of which expenditures were in-region vs. out-of-region was made internally by the FAA.

strengthening the local educational and construction sectors, to name only two. Finally, there are benefits to the region of having a scientific and technical research facility that cannot be quantified.

Table ES1 contains a summary of the aggregate contributions of the Technical Center to the regional economy. A 10-year total contribution is also provided, indicating the major sustaining value of the Technical Center to the region.

Table ES1. Summary of Technical Center Impacts on the Local Economy

Area of Impact	**2001 Impact**	**Ten Year Total Impact**
In-Region Employment	6,200 jobs	55,000 job-years
Gross Regional Product (Constant 2001 $)	$353 Million	$3.3 Billion
Real Disposable Personal Income (Constant 2001 $)	$189 Million	$2.1 Billion

1. Introduction

Government organizations have become increasingly concerned with the quality of their operations. In addition, they have been charged by the National Performance Review (NPR) to conduct activities in "a more business-like fashion." That is, they are required to identify and serve, more effectively, all stakeholders including direct customers, the broader set of taxpayers, their employees, local businesses, and individuals affected by their activities. To meet this need, the William J. Hughes Technical Center regularly examines its micro- and macro-management plans to determine the impact of its operation. One aspect of this examination is an assessment of the effects of the Technical Center on the economy and quality of life in the surrounding communities. Critical to this management effort is the ability to accurately catalog the value-added products it produces.

Some of the Technical Center products are produced for, and funded by, its customer base (e.g., results of aviation safety research, evaluations of new Air Traffic Control [ATC] equipment, and maintenance of the current ATC system). The ultimate benefit is to the health and safety of the flying public. However, those mission-related products are only part of its contribution to the nation. To make a full evaluation, it is important to capture some of the value creation that is less direct in nature. These additional values are described as the benefits to the economy and quality of life in the surrounding communities.

This study and the previous 1997 study (ACT-500 Research Group, 1997) were conducted by the same independent contractor on the behalf of the Federal Aviation Administration. This was determined to be appropriate because regional economic analysis is not a core competency of the Technical Center. Additionally, concerns were raised regarding the credibility of an analysis of the Technical Center by its own economic departments might be questionable.

To determine the indirect impacts of the Technical Center, it was necessary to use an economic simulation model to calculate all the economic activity of the Technical Center's spending, and employment generated in the study region. This analytical effort employed the EDFS-53 model designed by Regional Economic Models, Inc. (REMI) of Amherst, MA. It is the same model that was used in the earlier study conducted in 1997 (ACT-500 Research Group, 1997); a description of the model is provided in Section 2 (Methodology).

1.1 Purpose

This study updates an earlier analysis of the economic contributions of the Technical Center to the economy of southern New Jersey. The study takes data on the direct expenditures of the Technical Center and quantifies the induced and indirect economic effects of those expenditures. The accounting of direct expenditures included the jobs of all Federal employees at the Technical Center and the money spent within the region on goods and services to support its operation.[2] The indirect economic effects of the Technical Center result from the money that is re-circulated in the regional economy by the Technical Center's employees and the local businesses that sell goods and services to the Technical Center.

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[2] While the Atlantic City International Airport is also owned by the Federal Aviation Administration and is located in close physical proximity to the Center it is leased to and operated by the Southern New Jersey Transportation Authority. Only the Center's employment and operating expenses were considered in this study.

1.2 Background

The FAA William J. Hughes Technical Center is the national scientific test base for FAA research, development, and acquisition programs. Technical Center activities involve test and evaluation in ATC, communications, navigation, airports, aircraft safety, and security. They also involve long-range development of innovative aviation systems and concepts, development of new ATC equipment and software, and in-service modification of existing systems and procedures.

The National Aviation Facilities Experimental Center (NAFEC) was established as the foremost aviation research and development facility by the Airways Modernization Board on July 1, 1958. A former naval station, this facility was selected for its broad range of flying conditions and its proximity to both the northeast high-density corridor and open airspace above the Atlantic Ocean. The Federal Aviation Act of 1958 dissolved the Airways Modernization Board and created the FAA as an independent government agency. NAFEC became the FAA Technical Center on May 29, 1980, concluding with the dedication of the $50 million, 516,000-square foot Technical Building. It was renamed the William J. Hughes Technical Center in May of 1996. The Technical Center continues its commitment to stay on the cutting edge of aviation research and technology as evidenced by the growth and expansion of its research facilities.

At any one time, an average of 150 projects are underway at the Technical Center, many assigned by FAA Headquarters. Much work is performed through contracts with private industry. Research is also accomplished by academic institutions through aviation research grants. Covering 5,059 acres, the Technical Center consists of laboratories, test facilities, support facilities, the Atlantic City International Airport (ACY), and a non-commercial aircraft hangar. The Technical Center also has a heating and air conditioning plant, industrial shops, maintenance facilities, and a security department and is home to the United States Coast Guard Air Station Group, Atlantic City.

In 1999, 2,281 acres, comprising the ACY and associated operations were leased to, and are now operated by the Southern New Jersey Transportation Authority (SJTA) to facilitate airport expansion via the federal Airport Improvement Fund. Economic benefits derived from this lease are not incorporated into this study. Additionally, spending associated with Federal Superfund Remediation is not incorporated.

Located 10 miles northwest of Atlantic City, is used extensively by the Technical Center and the United States Coast Guard Air Station Group, Atlantic City. The airport, including two operating runways, is open to private, commercial, and military aircraft. The main instrument runway is 10,000 ft long and 180 ft wide. Several experimental approach and guidance systems are tested at the airport. The 1999 transition of ACY has resulted in numerous infrastructure expansions funded by the Airport Improvement Fund, which were unavailable when the airport was operated by the Technical Center.

Over 1,650 full-time Federal employees work at the Technical Center in 150 occupational specialties. The Technical Center also conducts an active cooperative education program with several academic institutions across the country. The Technical Center youth and summer employment programs stimulate student and community interest in scientific and aviation-related fields.

2. Methodology

In the previous study (FAA 1997), a comprehensive picture of the regional impact of the Technical Center was developed by PERI analysts using the REMI EDFS-53 model. In addition, PERI conducted contractor interviews and a community involvement survey to gather qualitative data on the Technical Center's contribution to the region. This update to the study does not include contractor interviews or a community involvement survey. Rather, the update focused on using the current REMI model to again examine the economic impacts of the Technical Center. The model provides state-of-the-art methods of accounting for employee and Technical Center spending, estimating the fraction that stays in the local economy and estimating what fraction of that spending becomes local income and is re-spent in the local economy.

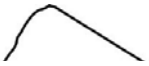

Figure 1. Southern New Jersey Study Region

The study region includes the counties of Atlantic, Cape May, Ocean, Cumberland, Burlington, Camden, Gloucester, and Salem, as shown in Figure 1. The Technical Center directly employs 1,656 people, not including its contractor employees.[3] Of the Technical Center employees, 1,428 live within the study region.

The analysis began with the development of a baseline regional forecast for 2001. This baseline analysis is accomplished by running REMI "as is." Then, the data on Technical Center employment and operating expenditures were used to produce a counterfactual experiment – the determination of the size and shape of the economy, as if the Technical Center had not existed as of 2001. The difference between those two cases is reported as the results of this study (i.e., the economic impact of the Technical Center).

2.1 Basic Characteristics of the REMI Model[4]

The REMI model is a tool for economic and policy analysis that blends traditional input-output analysis with economic simulation. It allows the investigator to capture the full range of industry effects of a change over time. The model shows the impact as changes on an industry flow to its suppliers and their employees and, in turn, their suppliers and employees. The economic simulation capabilities accurately capture the broad set of economic responses to any shock to the system, such as the effect on wages and employment in other industries of a negative shock to one industry.

The model antecedents are the Treyz-Friedlaender-Stevens regional model developed for the National Academy of Sciences and the Massachusetts Economic Policy Analysis model developed by Dr. Treyz for the state of Massachusetts. A REMI regional or multi-regional model can be built for any county or aggregation of counties (including states). Essentially, the REMI model predicts, for each year in the future, the level and distribution of employment in the region for each of 53 industry sectors (displayed in Table 1), 94 detailed occupational categories, 25 final demand sectors, and 202 age/sex cohorts. The model also predicts other variables such

[3] When the Technical Center awards a contract, it is purchasing a good or service, not directly creating employment. Therefore, all the jobs created by Technical Center contractors are considered an indirect impact.

[4] Portions of this section are from "REMI and I-0 Models Compared," by Glen Weisbrod.

as personal income, population, wage rates, output, and value added for the specified region. Treyz (1993) and Treyz, Rickman, and Shao (1992) outline the detailed structure of the model. Independent evaluations of the REMI model consistently rate it as a high-performance model with a sound theoretical structure, especially for analysis of community economic development (Cassino & Giarratani, 1992).

Table 1. REMI EDFS-53 Model Industrial Sectors

Lumber and Wood Products	Petroleum and Coal Products	Wholesale Trade
Furniture and Fixtures	Rubber an Misc. Plastics Products	Hotels and Other Lodging Places
Stone, Clay, and Glass Products	Leather and Leather Products	Personal and Misc. Repair Services
Primary Metal Industries	Mining	Private Households
Fabricated Metal Products	Construction	Auto Repair, Services, and Parking
Machinery and Computer Equipment	Railroad Transportation	Business Services
Electrical Equipment, Except Computer Equipment	Trucking and Warehousing	Amusement and Recreation Services
Motor Vehicles and Equipment	Local/Interurban Passenger Transit	Motion Pictures
Transportation Equipment Excluding Motor Vehicles	Transportation by Air	Health Services
Instruments and Related Products	Other Transportation and Transportation Services	Legal, Engineering, and Management, and Misc. Services
Misc. Manufacturing Industries	Communications	Education Services
Food and Kindred Products	Electric, Gas, and Sanitary Services	Social Services, Membership Organizations, Museums, etc.
Tobacco Products	Depository and Non-Depository Credit Institutions	Agriculture Services, Forestry, Fisheries, and Other
Textile Mill Products	Insurance Carriers, Agents, Brokers, and Services	State and Local Government
Apparel and Other Textile Products	Security and Commodity Brokers & Investment Services	Federal Government, Civilian
Paper and Allied Products	Real Estate	Federal Government - Military
Printing and Publishing	Eating and Drinking Places	Farm
Chemicals and Allied Products	Other Retail Trade	

The REMI model uses an input-output (I-O) structure to detail linkages between industries, but its methodology goes beyond other strictly I-O models. The REMI I-O structure generates intermediate demand for each industry. The proportion of intermediate and final demands for each industry fulfilled by producers in the region is endogenously determined. This proportion is called the Regional Purchase Coefficient. Demand not fulfilled by local production leads to imports into the region. Additionally, export demand for each industry is endogenously

determined. It is this internalization of import-competing production and production for exports that most clearly separates the REMI model from other models using similar approaches and makes regional analysis viable.

In national policy simulations, the importance of the economy's openness is often marginal. An example is a change in U.S. taxes that can produce only a small effect on the decisions of firms whether to locate in the country. This effect is not of the same order of magnitude as the effect seen by a state or city in the United States making a similarly sized change in taxes on the decisions of firms to locate locally.

Factors that further differentiate the REMI model from simple I-O models include use of

- measured regional labor wage rates and total factor productivity for each industry sector rather than national averages;
- measured regional electrical, gas, and oil fuel costs, rather than national averages;
- actual state corporate and average property taxes rather than national averages;
- measured regional capital costs for equipment inventory and structures rather than national averages;
- measured regional production costs and in profitability by industry rather than national averages;
- measured regional labor intensity (i.e., labor input per unit of output) for each industry sector rather than national averages;
- measured regional occupation mix of the regional labor force and demand for each occupation category rather than national averages; and
- measured regional residential and non-residential investment rather than national averages.

The model is calibrated through a data set that includes a history of employment by industry sector from 1969 to the present. The model also uses national forecasts of future growth or decline by industry sector, produced by the U.S. Bureau of Labor Statistics. Historical data are used to track how the industrial mix and concentration of employment in the region is different from the rest of the country. These data also track how the economic growth trends in the region differ from national trends for each industry sector. This makes it possible to estimate the extent to which each industrial sector in the region has employment dependent on serving other industries within the region and employment dependent on exports of goods and services to the rest of the nation. This is determined historically and then forecast into the future.

A key difference between pure I-O analysis and the REMI EDFS-53 model is that the I-O systems are static analysis tools, whereas the REMI model is dynamic. I-O analysis is not usually applicable for economic simulation. It is not designed to simulate effects of factors that change the relative costs and competitive position of businesses in an area, as can occur from changes in occupational wage rates, population and labor force participation rates, energy and transportation costs, and costs of capital. Determining these factors requires a more sophisticated simulation model such as EDFS-53.

The REMI model, unlike simple I-O models, can be used for both long- and short-term analysis. It is able to simulate how long-term impacts may differ from short-term impacts due to induced

changes in competition for labor (wage rates), population in/out migration rates, lab or capital substitution, and inflation. The REMI model estimates the future economic profile of a region based on national forecasts of industry growth, changing technology, and its own estimates of the shifting competitive position of each industry in a given region compared to that industry elsewhere in the country. The model uses I-O analysis techniques, the best means of estimating the extent of inter-industry interactions and thereby measures the multiplier effects on the local economy. This is because the degree to which demand changes in the local economy get distributed elsewhere rather than mainly affecting the local economy is dependent on the trade-intensity of the affected industrial sectors. That is, if the effects of the Technical Center fall on the construction or repair industries (inherently local), then that is far different from effects on the computer industry (essentially global).

The REMI EDFS-53 model is best for this study for several other reasons. The EDFS-53 model can be applied at the level of a single county or multi-county region. By restricting the study region to the counties immediately surrounding the Technical Center, the analysts obtained a more accurate measure of its impact. The model also can measure effects on local, state, and Federal expenditures. This increases the accuracy of the measures because the effects of government spending are the crucial parameters. The model uses a time-series of data to account for regional trends. It employs a quasi-equilibrium modeling approach, which permits the effects of the location preferences of both industries and households to enter into the model dynamically. Rather than relying on external estimates, the model endogenously determines the extent of migration and industry relocation based on relative wage rates and other costs of doing business. In simpler terms, the model takes neither of the extreme views of the economy sometimes espoused. It neither forces immediate equilibrium with no individuals being involuntarily unemployed nor ignores the natural forces that eventually move the economy toward equilibrium.

In summary, the analysts selected the EDFS-53 model because they believe that it is the best choice for analyzing the impacts of the Technical Center on the southern New Jersey economy. It is better equipped than simple regional I-O models to estimate the total probable effects of a major economic driver.

2.2 Major Economic Assumptions

The analysts used the standard set of assumptions to operate the REMI model, except when conducting counterfactual assessments of the Technical Center benefits. Specifically, the EDFS-53 model is preprogrammed by REMI with data on the economy of the eight-county southern New Jersey region, including basic assumptions about macroeconomic factors such as current levels of employment and economic output. The data are based on historical information collected from a variety of sources including the U.S. Department of Labor and the Department of Commerce. The major assumptions regarding the southern New Jersey region are shown in Table 2.

Table 2. Major Economic Assumptions in the EDFS-53 Model

Description	Units	1999	2000	2001
Total Employment	Millions	1.117	1.140	1.156
Population	Millions	2.219	2.235	2.252
Gross Regional Product	Billions of Constant 1992 $	56.779	58.550	60.325
Personal Income	Billions of Nominal $	64.384	68.087	71.477
Producer Price Index	Constant 1992 $	118.704	121.897	124.983
Real Disposable Personal Income	Billions of Constant 1992 $	45.470	46.783	47.967
Real Disposable Income per Capita	Thousands of 1992 $	20.491	20.932	21.230

2.3 Running the Model

The process for conducting an analysis is illustrated by the following steps (See Figure 2).

a. Formulate the policy question and determine that the model is structurally capable of performing the experiment. For this study, the policy question is "What is the economic impact of the William J. Hughes Technical Center on the economy of southern New Jersey?"

b. Run the model using the REMI baseline economic assumptions. This produces a control forecast that serves as the baseline against which to compare the changes to the economy.

c. Determine the expenditures of the Technical Center, from available data, input them into the model by setting or add-factoring, as the case may be, the appropriate subset of policy variables available in the EDFS-53 model.

d. Rerun the model, creating a complete, alternative simulation forecast based on the policy variable changes that have been specified.

e. Examine the model output to determine the difference between the control and the simulation forecasts to estimate the total economic impact of the Technical Center.

Note that because the EDFS-53 model includes the current basic economic data on the study region, the benefits calculation is performed by subtracting out the presence of the Technical Center. The difference in projections for population, employment, personal income, and output between the alternate and control forecasts represents the total economic impact of the Technical Center.

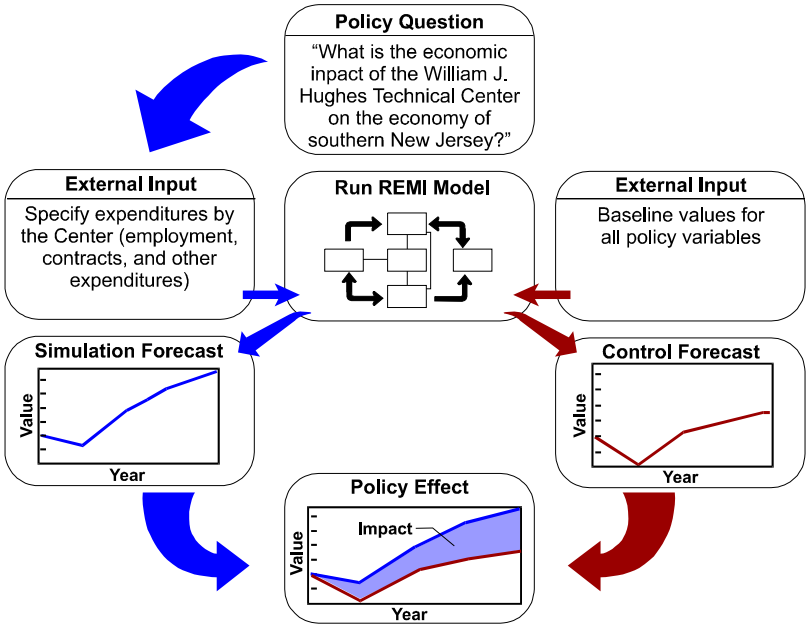

Figure 2. Analysis Approach

3. Expenditures

This study examined two major categories of expenditures made by the Technical Center: operating expenditures and employee salaries. To accurately measure the impact of the Technical Center on the study region, the analysts determined not only what goods and services the Center purchases but also what portion of those are purchased from firms within the region. Additionally, the analysts determined the number of Technical Center employees living within the region and the total of their salaries. Operating Expenditures

Information was gathered from several sources to determine the Technical Center's operating expenditures. The Technical Center Contracts Section has a detailed database called ACQUIRE, which indicates awards made to each contracting entity, as well as corresponding North American Industry Classification System (NAICS) code and address (location) information. While compiling the data for this study, a number of inconsistencies were found in the assignment of NAICS codes, and corrections were made to assign appropriate codes. Because ACQUIRE had data for the first 8.5 months in FY 2001, annual total expenditures were estimated by extrapolating the 8.5 month data to 12 months. In addition, to account for typically higher expenditures at the end of a fiscal year, an extra month's worth of expenditures were assumed during the remainder of FY 2001. These assumptions mean that the 8.5-month values were multiplied by 1.54 to get full 12-month values.

Most expenditures made by the Technical Center were available from the ACQUIRE database. Added to those totals were small credit card purchases other overhead costs, contracts awarded from headquarters in Washington, DC, and building construction expenditures[5]. Using this information, analysts were able to determine the total dollar amount of awards made in each industrial sector and how much was spent within the region. The details of operating expenditures are shown in Table 3. (The data in Table 3 are organized by Standard Industrial Classification (SIC) code to allow comparison to the 1997 study.)

Table 3. Operating Expenditures by SIC Codes

SIC CODES	REMI SECTOR CATEGORY	ALL AWARDS (2001$)	IN-REGION AWARDS (2001$)
02	Farm	$1,669	$0
07-09	Agricultural Services, Forestry, Fisheries, Other	$256,565	$30,026
15-17	Construction	$7,446,534	$5,373,905
24	Lumber and Wood Products	$686	$686
25	Furniture and Fixtures	$167,645	$0
34	Fabricated Metal Products	$287,689	$0
35	Machinery and Computer Equipment	$2,016,593	$205,251
36	Electronic Equipment except computer)	$1,041,111	$51,959
37	Motor Vehicles and Equipment	$5,432,011	$3,654,624
38	Instruments and Related Products	$214,037	$66,011
39	Miscellaneous Manufacturing Industries	$762	$762
20	Food and Kindred Products	$32,423	$32,427
26	Paper and Allied Products	$708,660	$708,740
27	Printing and Publishing	$62,481	$57,175
28	Chemicals and Allied Products	$738,259	$0
31	Leather and Leather Products	$6,858	$0
15-17	Construction	$7,446,534	$5,373,905
42	Trucking and Warehousing	$27,432	$1,372
45	Transportation by Air	$708,066	$701,814
44, 46, 47	Other Transportation and Trans. Services	$1,412,176	$6,059
48	Communications	$50,450,136	$2,419,907
49	Electric, Gas, and Sanitary Services	$5,472,280	$5,462,153

[5] During the late 1990s, the Technical Center added a $15 M building,or spending of $3 M/year.

SIC CODES	REMI SECTOR CATEGORY	ALL AWARDS (2001$)	IN-REGION AWARDS (2001$)
62	Sec. & Commod. Brokers & Investment Services	$20,193	$0
52-57, 59	Other Retail Trade	$57,150	$0
50, 51	Wholesale Trade	$42,186,979	$640,160
72, 76	Personal and Misc. Repair Services	$2,508,239	$281,459
75	Auto Repair, Services, and Parking	$98,701	$65,041
73	Business Services	$86,465,622	$39,595,452
78	Motion Pictures	$3,131,120	$1,323,318
81, 87, 89	Legal, Engineering and Mgmt, and Misc. Serv.	$105,115,806	$97,657,696
82	Educational Services	$351,828	$167,288
83, 84, 86	Soc. Serv., Membership Orgs., Museums, etc.	$32,532	$19,365
92	State and Local	$576,427	$144,443
N/A	Uncategorized Expenditures	$1,942,351	$14,778
	Total	$318,971,020	$158,667,094

The EDFS-53 model does not use the SIC (or NAICS) code system. Whereas the SIC code system divides all business activity into 83 different industrial sectors, the REMI EDFS-53 model uses only 53 sectors to represent the regional economy. For example, there are three 2-digit SIC codes used to represent various types of construction i.e., building construction, heavy construction, and special trades), whereas EDFS-53 combines all three into a single sector that covers all construction activities.

The two largest expenditure groups are Business Services (SIC 73) and Legal, Engineering, and Management, and Misc. Services (SIC 81, 87, and 89). These two groups total $191,581,428. A significant amount of that work is performed locally, and the bulk of the money is paid to local employees. Consequently, much of that money remains in the local economy where it continues to circulate.

3.1 Employment

The Technical Center employs 1,656 people. Based on zip codes in the Technical Center personnel database, 1,351 (82%) of the employees have permanent residences within the study region. Eleven employees (less than 1 percent) live in other parts of New Jersey, and 294 (14 %) have permanent residences outside the state. Finally, 154 of the out-of-state employees are Air Traffic Control Specialists (ATCSs) on temporary assignment to the Technical Center. To account for the portion of their income spent outside the region e.g., money sent to their home states), researchers assumed that their in-region spending is half of their salary. To reflect this in the model, analysts added an additional 77 employees (half of the 154 ATCSs) to the 1,351 in-region employees for a total of 1,428. Considering that the visiting ATCSs receive a per-diem allowance in addition to their regular salary, analysts believe this approximation of their in-region spending is a conservative estimate. Table 4 shows the data on employee distribution.

Table 4. Technical Center Employment by Region

County	Employees	% of Total Employees
Atlantic	916	55%
Burlington	52	3%
Camden	115	7%
Cape May	93	6%
Cumberland	42	3%
Gloucester	61	4%
Ocean	69	4%
Salem	3	< 1%
In-Region Subtotal	1,351	82%
Other New Jersey Counties	11	1%
Out-of-State Employees	294	18%
ATCSs subset of Out-of-State Employees)	154	9%
Total Employees	1,656	100%
Employees Counted as In-Region [1]	1,428	86%

[1] The study assumed that in-region spending for ATCSs amounts to 50% of their annual salary. To reflect this in the model, in-region employees were increased by 77 (½ of 154) to total 1,428.

4. Creating a Simulation

The analysts used the REMI EDFS-53 model to estimate the total economic contribution of the Technical Center to southern New Jersey. Researchers compared a control forecast of the regional economy to one that effected a change in the economy. This was based on the counterfactual analysis of a situation without the economic value added by the Technical Center. This analysis captures the effects of Technical Center and contractor employment and purchases, and the multiple rounds of economic stimulus produced as these incomes are spent, received, and re-spent by the recipients. The difference is the Technical Center's total economic impact upon southern New Jersey.

The REMI model bases its control forecast on the most recent available estimates of local economic activity for 53 detailed industries extrapolated forward in time by their national

economic trends through 2001. In this study's control forecast, therefore, Technical Center-related spending, employment, and payroll are assumed to be unchanged from their 2001 levels.

In the REMI model, the Technical Center is part of the southern New Jersey civilian Federal government sector. To simulate the economic effect of the Technical Center, analysts adjusted the baseline information on this sector to reflect the level of expenditures and employment discussed in Section 3.

The Technical Center employees tend to be scientists, engineers, and other degreed technical professionals with post-graduate degrees. Its workforce, therefore, is not representative of the remainder of the regional Federal civilian sector, which mostly supports military bases. Indeed, due to the nature of aviation research and development that requires specialized education and skills, Technical Center employees in 2001 were significantly different in most respects from the average government employee in the region. An additional adjustment factor, to reflect the fact that these workers earn more than the average federal civilian employee in the southern New Jersey region, was also included.

5. Simulation Results

The results of the simulation of the southern New Jersey economy without the Technical Center's economic contributions are shown in Table 5. The difference between the simulation and the control forecast for southern New Jersey is the impact. Note that the impact results are rounded in Table 5.

Gross Regional Product (GRP) is the sum of consumption, fixed investment, government expenditures, and exports minus imports. Table 5 shows the corresponding effect on 2001 Real Disposable Personal Income (RDPI) (in 2001 $) to be $189 million. RDPI is defined as the sum of wages, salaries, other labor income, investment income, and transfer payments, minus social insurance taxes.

Table 5. Technical Center Impacts for 2001

Description	Units	Control	Simulation	Approximate Impact
Total employment		1,155,561	1,149,331	6,200
Gross Regional Product	Billions of 2001 $	71.609	71.257	0.35
Real Disposable Personal Income	Billions of 2001 $	56.940	56.751	0.19

5.1 Single-Year Contribution to Job Creation, Incomes, and Regional Product

As shown in Table 5, the Technical Center's 1,428 local jobs represent only a portion of total employment in the study region resulting from the Technical Center. The results show that approximately 4,800 additional jobs in southern New Jersey can be attributed to the Technical Center. The high "multiplier effect" of the Technical Center's activities is in part because contractors perform a large amount of work on behalf of the Technical Center. The majority of these contractors would not be in the region without the Technical Center.

The total earnings of the Technical Center employees are $129.6 million[6], of which $111.8 million is earned by employees living within the region. The contribution to the gross regional product, the dollar value of all goods and services produced within the region, is estimated to be over $350 million in 2001. This figure includes the salaries of both Technical Center and contract employees working for the Technical Center and the salaries of a wide range of other residents, from store clerks, to educators, to local government employees, whose livelihoods are based on the demand created by the presence of the Technical Center and the purchases of its employees and contractors.

As mentioned earlier, an important factor contributing to the multiplier effect is the nature of the Technical Center's contract purchases and the characteristics of the Technical Center employees. It is a unique institution due to the sophistication of its employees and contractors. Any government spending impacts the local economy through local goods and services purchased and impacts global economy through goods and services purchased from outside the area. The multipliers found in regional models are typically much smaller than multipliers estimated for a nation as a whole because many of the goods and services purchased make up the indirect effects (imports) to a specific region. In this case, the purchases made by the Technical Center are nearly all services that are purchased in the local economy. Similarly, Technical Center employees consume more educational and other local services than the average resident, due to their employment as technology and knowledge workers. In economic terms, the Technical Center has a uniquely positive multiplier effect on the size and quality of the local economy compared to the general government operation, which has a more global impact.

5.2 Long-Term Contribution to Job Creation, Incomes, and Regional Product

In addition to quantifying the short-term effects of the Technical Center on the local economy, it is crucial to assess the permanence of the impacts. In a closed system (i.e., a national economy with little international trade), the effects of a facility like the Technical Center would be diminished by the passage of time, as markets adjust and equilibrium is reestablished. In the long run, then, approximately the same number of people would be employed in similar jobs making about the same income and spending about the same amount, regardless of any particular project or facility.

A region, such as southern New Jersey, is far from a closed system and is, in fact, actually competing with other regions. Over a 10-year period, the Technical Center regionally generates approximately 55,000 more person years of employment, and the Gross Regional Product (GRP) and real disposable personal incomes are about $3.3 and 2.1 billion dollars higher, respectively. The southern New Jersey region is more prosperous, with more high-quality jobs and a larger inflow of population because of the Technical Center. The results of a 10-year analysis are also shown in Table 5.

Table 6 also presents the long-term contribution of the Technical Center to the region. For a ten year period, the cumulative contribution to GRP is about $3.3 billion (in constant 2001 $). The corresponding contribution to RDPI over that period is $2.1 billion. The southern New Jersey region is more prosperous, with more high-quality jobs and a larger inflow of population because of the Technical Center.

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[6] The total payroll of the Technical Center is actually $152.5 million. The figure of $129.6 million represents the payroll minus indirect contributions to health insurance, some FICA, etc.

Table 6. Technical Center Total Impacts Over 10 Years

Description	Approximate Impact
Total Employment	55,000 job-years
Gross Regional Product	3.3 Billions of 2001 $
Real Disposable Personal Income	2.1 Billions of 2001 $

The results in Tables 5 and 6 show an interesting and potentially counter-intuitive effect. Specifically, the ratio of the 10-year total GRP to the 1-year value is about 9.3. By comparison, the ratio of the 10- year RDPI to the 1-year value is 11.1. The first inclination is that these ratios should be more similar. Even more striking is the fact that the RDPI ratio is greater than 10, indicating that the average annual RDPI value is greater than the starting RDPI value. The ratio of the GRP 10- year total, being less than 10, indicates that the average annual GRP is lower than the starting value, suggesting or the effect of the Technical Center on the local economy declines over time.

It is important to recognize that the results cited in Tables 5 and 6 are differences between two runs – the base case where the Technical Center is part of the local economy and the counterfactual case where the Technical Center is removed from the local economy. The difference between the two cases is likely to be very sensitive to small changes in either case. It is useful, therefore, to examine the two cases themselves for clues. Detailed, year-by-year printouts of GRP and RDPI values allow a hypothesis to be presented that describes what occurs in the southern New Jersey economy. These results are described in Table 7.

Note that the difference between the two simulations is shrinking over time for the GRP results ($297 million/year declining to $257 million/year) but still increasing for the RDPI results ($159 million/year and $187 million/year, respectively).

This trend shows that in the counterfactual case, the loss of the Technical Center has impacts on regional production (GRP) and incomes (RDPI) that are estimated to be large and long-lasting. The way that the economy recovers after a shock of this nature, large or small, is through the changes in prices and wages that the shock produces.

In this case, the decline in employment opportunities at the Technical Center has an immediate result of loss of incomes to the former employees of the Technical Center. At the same time, there is a “second-round” impact on demand in the region as these employees cut their lifestyles and some move away. Then, in the next phase, the wages of all workers in the area are affected, as the laid-off employees bid for a smaller total pool of jobs. There is no recovery at this point. Finally, the inducement of the lower wages leads to new jobs being created, which begins the recovery in production and eventually incomes.

Table 7. Analysis of Simulation Results (in 1992 $)

Analysis Results		2001	2010	Sum
Gross Regional Product	With Tech Center	$60.325 B	$74.415 B	$675.7 B
	Without Tech Center	$60.028 B	$74.158 B	$672.9 B
Real Disposable Personal Income	With Tech Center	$47.967 B	$57.467 B	$527.1 B
	Without Tech Center	$47.808 B	$57.280 B	$525.4 B
Difference Results		**2001**	**2010**	**Sum**
Gross Regional Product		$0.297 B	$0.257 B	$2.753 B
Real Disposable Personal Income		$0.159 B	$0.187 B	$1.735 B
Gross Regional Product	With Tech Center	Ten year average annual rate of change: 1.02360		
	Without Tech Center	Ten year average annual rate of change: 1.02377		
Real Disposable Personal Income	With Tech Center	Ten year average annual rate of change: 1.020281		
	Without Tech Center	Ten year average annual rate of change: 1.020288		

Note, all results in this table are in 1992 $, which is what REMI uses for modeling. Analysis results, presented elsewhere in this report, have been converted to 2001 $.

The critical point, however, is that this recovery can continue only so long as the wages remain lower, in order to induce investment that would not have taken place otherwise. This implies that for the region, gross product will show recovery as soon as the wage decline has stimulated some economic activity. Investment takes place and generates production, whereas the investment itself generates much of its personal income outside of a small geographic area.

Without an equivalent increase in personal incomes coming from the investment to the residents of the region, for the most part, increases in personal income must take place through recovery of labor incomes. And, as we have said, this recovery will be slow because if wages bounced back, the investment inducement would stop, and stop the recovery in its tracks.

The conclusion that the 10-year impact on production is less than 10 times the first-year impact is thus understandable. It means that the induced new economic activity in the region is eventually more than enough to compensate for the "second-round" cut in demand when the former workers cut their spending.

The conclusion that the 10-year impact on incomes is more that 10 times the first-year impact is also quite plausible. It means that the region is still trying to recover after 10 years, with wages still lower in general than they otherwise would have been. It could, in fact, have been much worse, had wages fallen further. However, the out-migration of the former employees mitigated this fall in wages, balancing labor supply and demand at a modestly reduced wage.

6. Summary of Results

In summary, this study shows that there are significant positive economic impacts from the Technical Center's presence in southern New Jersey. Table 8 shows the annual expenditures that flow into the local economy. It also shows direct Federal employment at the Technical Center. The spending and re-spending of dollars in the economy establishes a multiplier effect that significantly increases the impact of the Technical Center on the economy. These effects are larger than would be estimated by simply counting employees and their incomes or even by including the contractors that perform vital Technical Center functions.

Table 8. Technical Center Direct Expenditures in 2001

	Total	**In-Region**
Annual Expenditures	$319 Million	$159 Million
Technical Center Employees	1,656	1,428

Table 9 shows the results of the multiplier effects estimated by the REMI model. The $159 million spent by 1428 employees increases the GRP by $353 million. The Technical Center employees and contractors spend more personal resources on services produced locally, strengthening the local educational and construction sectors, to name only two. Finally, there are positive impacts of having a scientific and technical research facility in the region that can't be quantified.

Table 9. Southern New Jersey Regional Impact

	2001 Annual Impact	**Approximate 10 Year Impact**
Regional Employment	6,200 Jobs	55,000 Job-Years
Gross Regional Product (2001 $)	$353 Million	$3.3 Billion
Real Disposable Personal Income (2001 $)	$189 Million	$2.1 Billion

A comparison to the results from the first study and this one (see Table 10) shows that the Technical Center's economic impacts are somewhat greater now than they were 4 years ago. This result not surprising given the increase in absolute in-region spending that has occurred at the Technical Center over the past four years.

Appendix A, which is available only on the CD-Rom for this document, contains the raw data for the survey.

Table 10. Comparison of Current Study and Previous Study Results

Single-Year Impacts			
Description	**Units**	**1997**	**2001**
Total Employment	Jobs	5,900	6,200
Gross Regional Product	Billions 2001 $	0.30	0.35
Personal Income	Billions 2001 $	0.23	0.34
Real Disposable Personal Income	Billions 2001 $	0.13	0.19
Ten-Year Impacts			
Description	**Units**	**1997**	**2001**
Total Employment	Person Years	50,000 – 60, 000	50,000 – 60, 000
Gross Regional Product	Billions 2001 $	3.2	3.3
Personal Income	Billions of nominal $	3.1	4.4
Real Disposable Personal Income	Billions 2001 $	1.5	2.1

Note: Values from 1997 study have been escalated to allow for fair comparisons with 2001 study values.

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