

What if ... the Shipyard Closed?

The economic impact of a
Portsmouth Naval Shipyard closure
on New Hampshire

Published April 2005

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Acknowledgments

The following New Hampshire Employment Security staff were instrumental in the preparation of this report:

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Completion of this project would not have been possible without data and technical assistance provided by the following organizations and individuals:

Department of the Navy Portsmouth Naval Shipyard Public Affairs Office

Seacoast Shipyard Association

Regional Economic Models, Inc.

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Photographs courtesy of the Portsmouth Naval Shipyard Public Affairs Office

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Executive Summary

The fifth round of the Base Realignment and Closure (BRAC) Act is well underway, and everyone in the Seacoast Region of New Hampshire and in Southern Maine is concerned that the Portsmouth Naval Shipyard might be included on the list to be released by the Secretary of Defense in mid-May. The Yard survived a closure order in the mid-sixties, as well as four rounds of BRAC. The area has not gone unscathed as Pease Air Force Base fell victim to the first round of BRAC. History has shown the shipyard's ability to change its focus in order to be in alignment with the needs of the Navy. But it is beyond our means to predict the outcome of the BRAC 2005 process.

The Shipyard has been an important economic player in the regional economy. It contributes more than 4,800 civilian jobs and more than 800 military positions to the region. The total civilian payroll was \$318,329,729; of which \$122,635,908 was paid to New Hampshire residents. In addition the shipyard spent \$5,817,322 on purchased goods and services in New Hampshire and Maine as well as \$46,418,335 on contracted facility services (utilities and maintenance/alteration/support).

The following analysis estimates the impact on New Hampshire alone, and, beyond the initial direct loss of military and civilian employment, does not include effects on Maine, the other state that would be greatly affected by a closure. The total regional effect would be a multiple of the effects, on New Hampshire alone, that are presented here.

Despite the name, Portsmouth Naval Shipyard, this shipyard is located in Kittery, Maine. Since most of the jobs are physically located in Maine (jobs by place of establishment), the closure of the Shipyard would have an immediate direct effect on the number of jobs in Maine. However, 39 percent of its civilian employees commute to the Shipyard from cities and towns in New Hampshire. The wages from these commuters are included in the New Hampshire economy, and the secondary effects following a closure would significantly reduce jobs and income in New Hampshire.

Compared to the baseline forecasts in the New Hampshire Econometric Model, a closure of the PNS would result in the following:

- A direct loss of 800 military positions and 27 civilian positions in New Hampshire. (The Department of Defense reports the military contingent of the yard as if it were in New Hampshire.)
- \$122,635,908 in lost wages paid to PSN civilian employees residing in New Hampshire. Of these New Hampshire wages, 61 percent are from Strafford County and 33 percent are from Rockingham County. In 2004, New Hampshire residents held 1,878 civilian positions at PNS.
- 1,219 jobs lost in the secondary effects of a PNS closure. The secondary effects would be caused by a decrease in purchasing power (due to the loss of the PNS wages), the loss of expenditures on local goods and services purchased by PNS, as well as the loss of facility services contracted by PNS.
- New Hampshire civilian jobs will remain at least 900 below the projected growth for the duration of the simulation, statewide.
- Gross Regional (or State) Product (GRP) in New Hampshire would fall \$133.8 million below the baseline in the first year and remain \$128.7 million below the baseline by 2021.
- Wage and salary disbursements linked to secondary effect job declines in New Hampshire would initially suffer losses of \$71.5 million, expanding to a loss of \$106.3 million by 2021.

- Wages in Strafford County would be hit the hardest. The average annual wage rate would be lowered by \$123.51 in nominal dollars by 2010, the bottom of the trough. The effects on the average annual wage rate are smaller at the statewide level, but it would take New Hampshire until 2019 to get back to the pre-closing wage level.
- New Hampshire would lose \$14.8 million in state and local revenues in the first year after closure, while state and local expenditures would be reduced by \$4.4 million. This would result in a net loss of \$10.4 million in state and local government finances.
- Sales, office and administrative occupations are the occupational group most affected by the secondary effects of the closure. By 2021 only about half of the jobs lost would be recouped.
- By 2021 the State's population will have shrunk by 3,780.
- Unemployment in New Hampshire would rise by at least 2,700 persons, with the unemployment rate rising by about 0.5 percent. Since most of the unemployment would occur in the Portsmouth-Rochester area, that area's unemployment rate would increase much more.

If the Portsmouth Naval Shipyard were to close, the opportunity for reemployment as skilled shipbuilding workers in New Hampshire, and nearby Maine and Massachusetts, would be very limited.

The shipyard has a high concentration of workers in the following major occupational groups (Standard Occupational Code - SOC):

- 17-0000 Architecture and Engineering Occupations – 1,018 positions
- 51-0000 Production Occupations - 924 positions
- 49-0000 Installation, Maintenance, and Repair Occupations - 741 positions
- 47-0000 Construction and Extraction Occupations - 691 positions

This is especially a problem as the shipyard has a high concentration of employees in certain occupations not common in the region otherwise, such as Riggers, Nuclear engineers and Lay-out workers (metal). The impact of the PNS closure, at the personal level, would be quite devastating, as individuals may have difficulties maintaining current income levels and finding jobs matching their skills. The average annual pay at the PNS is about \$65,000, a wage level substantially higher than average 2003 annual pay for all private covered employment in New Hampshire or in Rockingham County. A large portion of the shipyard employees are either highly skilled or have attained a high level of education. If workers with high levels of educational attainment seek employment in other parts of the nation, the state will lose valuable human capital as these workers migrate from New Hampshire.

For the purpose of modeling we assumed that no other major employer would enter the region and absorb some of the excess labor force. If that were to occur, the economy would tend to move back toward equilibrium. Depending on how much employment would be absorbed, the economy would recover, accordingly. In any case, the recovery period and jobs replacement would likely be a long and protracted one, especially in light of the slow recoveries experienced by other areas whose naval bases have already been closed.

Background

Portsmouth Naval Shipyard and the Base Realignment and Closure Round of 2005

The Portsmouth Naval Shipyard is in the history books as the place where the Treaty of Portsmouth, ending the Russo-Japanese War, was signed in 1905. Events are taking place this year celebrating the 100th anniversary of that treaty. But in addition the Shipyard is currently drawing attention because of its potential for closure under the 2005 round of the Base Realignment and Closure (BRAC) Act. Such a closure would lead to the direct loss of more than 4,800 civilian jobs and more than 800 military positions. The Shipyard avoided closure in each of the four previous rounds of BRAC. On the contrary, nearby Pease Air Force Base, the other military facility that remained in the Portsmouth area at the end of the cold war, was one of the first bases to close under BRAC in 1990. The loss to the regional economy resulting from this 1990 closure was significant. The roughly 3,500 military personnel stationed at the Pease Air Force Base were transferred to other bases around the nation and the world, but the purchasing power of the military families and their availability to the local labor force was lost. Pease also employed about 400 civilian employees. Of the base's original 4,100 acres; 1,100 acres on Great Bay have been set aside as a wildlife refuge. Much of the remaining 3,000 acres, which include the 1,500 acre airport district, have been successfully redeveloped, over the past 14 years, into a business and aviation industrial park known as the Pease International Tradeport. An estimated 5,000 civilian jobs had been created by October 2004.

Shipyards, however, unlike other types of defense installations, typically employ thousands of skilled civilians and relatively few military personnel. And the track record of civilian jobs regained from closures of naval shipyards and shipyard complexes under BRAC is not as positive. The Philadelphia Naval Shipyard was selected for closure in 1991's BRAC II, and officially closed in 1996. It has only recovered 34 percent of the more than 8,000 civilian jobs lost. The Long Beach Naval Shipyard in California, chosen for closure in 1995's BRAC IV, lost 4,487 civilian jobs by September 1997, the official date of closure. That area has only regained 200 jobs since then. At the Charleston Naval Complex in South Carolina, which was selected in 1993's BRAC III, more than 3,000 civilian jobs have been created since its official closing in 1996, but these jobs only represent about half the civilian jobs that were lost.¹

The BRAC 2005 Process

The decision making behind BRAC is a rather procedural two-year recommendation and approval process designed to downplay the role of local political interests. Each branch of the Department of Defense conducts an internal deliberative process of information gathering and analysis, and no base closure information is to be released before May 16, 2005.

Unlike each of the previous rounds of BRAC, the 2005 round has a statutory requirement incorporated, making military value the primary consideration. (In the earlier rounds of BRAC military value was considered a primary concern, but not a statutory requirement.) No set target has been made for the number of base closures, but the Department of Defense has estimated that the DOD's overall excess capacity is 24 percent.² In perspective, the four previous BRAC rounds eliminated nearly 20 percent of

¹ Military Base Closures: Updated Status of Prior Base Realignments and Closures (GAO-05-138, January 13, 2005). United States Government Accountability Office. Accessed February 15, 2005 <http://www.gao.gov/new.items/d05138.pdf>

² Report Required by Section 2912 of the Defense Base Closure and Realignment Act of 1990, as amended through the National Defense Authorization Act for Fiscal Year 2003, March 2004, Department of Defense.

the Department of Defense 1988 capacity. In other words an amount almost equal to what has already been eliminated in four rounds will be eliminated in this 2005 round.

The primary criteria for closure is that national security is not compromised. After that, all military installations are to be considered equally, no matter how hard an area was hit by any of the previous rounds of closures. In the post 9/11 era, national security connotes Homeland Security. In that respect Portsmouth Naval Shipyard has a role. Three U.S. Coast Guard cutters are located at the Yard.

Included under the criteria of Military value is the efficiency of the operations. The Portsmouth Naval Shipyard claims a reputation as “America’s submarine maintenance expert” – the best performing shipyard in the country, public or private. However, the demand for submarine maintenance can be predicted to go down as the Pentagon intends to decrease the size of the Navy’s submarine fleet from 55 to 37.³ The Administration’s proposed FY 2006 defense budget also reduces the number of new naval vessels from six to four, including only one new submarine.⁴

As a state or region, we have limited influence on defining national security. But, among Other considerations the Department of Defense evaluates when selecting military installations for closure, is “the economic impact on existing communities in the vicinity of military installations”. By using the New Hampshire Econometric Model to perform a regional economic simulation, we are able to show the impact that a closure of the Portsmouth Naval Shipyard would have on the economies of Rockingham and Strafford Counties as well as on the entire state of New Hampshire. This model estimates the impact on New Hampshire alone. Beyond the initial direct loss of military and civilian employment, this study does not consider effects on Maine, the other state that would be greatly affected by a closure.

Location

Despite its name, Portsmouth Naval Shipyard, the Yard is in Kittery, Maine. It is located on Seavey Island in the Piscataqua River and connected to the mainland by two bridges to Kittery. Although located in Kittery, the main gate of the Shipyard is just 1.5 miles from downtown Portsmouth, New Hampshire. The Shipyard is also only about 13 miles from Dover, New Hampshire, and about 28 miles from Rochester, New Hampshire, the two largest cities in the vicinity of the Shipyard. Kittery, Portsmouth, Dover, and Rochester are all part of the Portsmouth-Rochester, NH-ME Primary Metropolitan Statistical Area (PMSA), an interstate urban area with a population of 247,258 in 2003. This urban area was defined by the Office of Management and Budget (OMB) based on data about commuting patterns collected in the 1990 Decennial Census. OMB has defined new metropolitan areas, based on the 2000 Decennial Census, creating a Portsmouth, NH-ME Metropolitan NECTA (New England City and Town Area) and a Rochester-Dover, NH-ME Metropolitan NECTA. We chose to use the 1990 PMSA to describe the area because it corresponds well to the 2004 patterns of commuting to the Shipyard (see map). Fifty-eight percent of the Yard’s workers lived in the PMSA. The Portsmouth-Rochester PMSA definition is also more familiar to data users since data has only just started to be released, in 2005, using the new area definitions.

The Shipyard and Pease Airforce Base Following World War II

The Portsmouth Naval Shipyard has been a key employer in the Portsmouth area since the Civil War. With the construction of its first submarine, the L8, in 1917, the Shipyard changed its focus from construction of steamboats and sloops to submarines. World War II caused employment at PNS to reach an historic high of 20,466 civilian workers in 1943. From 1940 to 1945, 88 submarines were

³ Lenz, Ryan: Associated Press; Bases in Northeast prone to BRAC.

⁴ Kenny, Elizabeth: <http://www.seacoastonline.com>; Navy: Too soon to tell future of the shipyard.

commissioned from the Portsmouth Naval Shipyard. In comparison, the pre-war level was only about one submarine commissioned per year.

The Portsmouth Naval Shipyard has consistently been at the forefront in applying technology. In 1957 the Shipyard launched the Skate class USS Swordfish, the first nuclear-powered submarine built by a government-owned shipyard. The Yard became the first facility in history to overhaul a nuclear-powered ship when the first nuclear-powered submarine, the Nautilus, was serviced in Kittery in 1959. Since the base started building and overhauling nuclear-powered submarines its civilian employment level has varied between a high of 9,200 in 1962 to a low of 3,300 in 1998. In November 1969 the USS Sand Lance, the last submarine built in a public shipyard, was launched, ending a fifty-plus year PNS submarine construction era. Since then the Yard has specialized in the refueling and maintenance of nuclear-powered submarines.

During World War II the U.S. Navy leased the Portsmouth Municipal Airport, which led to opening of Portsmouth Air Force Base in 1957. The base was renamed Pease Air Force Base a year later. Geographically, Pease Air Force Base was located in Portsmouth and Newington. The military personnel and their dependents who lived on or nearby the base, mostly in Portsmouth and Newington, were therefore counted in the population of area communities. The increase in the population of these communities from 1950 to 1960 can partly be attributed to the opening of the air force base. Likewise the closure of the Pease Air Force Base in the early 1990's led to a decrease in both Portsmouth's and Newington's populations as 3,400 active duty military personnel⁵ and their dependents left the area.

The unemployment rate in the Portsmouth-Rochester, NH-ME PMSA has in general been lower than the unemployment rates of the Granite state during the 1990s. Although only 400 civilians were laid off at Pease, in combination with the decline in PNS employment (1,700) and the effect of the national recession of 1990-1991, total employment in the New Hampshire portion of the Portsmouth-Rochester PMSA dropped by 6,300 from 1990 to 1992. At the same time the labor force in the New Hampshire portion of the Portsmouth-Rochester, NH-ME PMSA was reduced by about 5,100. This reduction in labor force can be partly attributed to those military family members who had worked, or been seeking to work, in civilian jobs, but who left the area when the base closed. (Active military personnel would not be counted as part of the civilian labor force.)

During the first half of the 1990s the employment at PNS declined from more than 8,000 to just above 4,000. As the economy started recovering from the 1991 recession and the high tech boom took off in the seacoast area, jobs lost at the PNS were offset by growth in other sectors of the economy. By the late 1990s the PNS started to increase its employment, which has been growing steadily since 2001.

The Portsmouth-Rochester, NH-ME PMSA weathered the 2001 recession fairly well. Although Manufacturing lost a couple of thousand jobs, Government and Educational and health services each amended a couple of thousand jobs.

The Federal government employment share in the Portsmouth-Rochester, NH-ME PMSA is higher than the New Hampshire statewide share of federal government employment. In most regional economies, the majority of federal government employment is US Postal workers. Federal government employment for the Portsmouth-Rochester area makes up about a quarter of total government employment. In comparison, federal government employment for the whole state makes up less than ten percent of total government employment. This higher share of federal employment in the PMSA is due in large part to the civilian employment at the Portsmouth Naval Shipyard. (The federal share of government employment in

⁵ Pease ANGB 43°04'N 70°49'W, Global Security, <http://www.globalsecurity.org/military/facility/pease.htm>.

New Hampshire is not affected by employment at the Shipyard since that is counted as employment in Maine.) According to the Portsmouth Naval Shipyard, the shipyard and its tenant activities employ about 4,800 civilians, thereby accounting for about three quarters of the federal government employment in the Portsmouth-Rochester, NH-ME PMSA. Making up about 39 percent of the Yard's civilian workforce, 2,008 New Hampshire residents commuted to the Yard in 2004, to 1,878 jobs (the balance representing turnover).

Government employment data is generally available by ownership rather than by work activity. If the Portsmouth Naval Shipyard were to be coded according to work activity, it would be included in the Ship building and repairing industry (NAICS 336611). The 2003 covered employment data for New Hampshire shows that on average 51 persons were employed in Boat building (NAICS 336612) under private ownership but none in the Ship building and repairing industry (NAICS 336611).

Bath Iron Works, a privately owned shipyard, is located in Maine, about 85 miles north of Kittery. This shipyard has approximately 6,400⁶ persons employed. Although privately owned, this shipyard primarily builds Guided Missile Destroyers under contract with the US Navy. This means that Bath Iron Works is under the same threat of slowed contracts activity due to the Navy's budget constraints.

Finally, covered employment data in Shipbuilding for Massachusetts shows average employment for 2003 to be 183. So, if the Portsmouth Naval Shipyard were to be closed, the opportunity for reemployment as skilled shipbuilding workers in nearby Maine, Massachusetts, and New Hampshire would be very limited.

Capacity and Occupational Employment

Today, 95 percent of the activity at the PNS has to do with the overhauling of nuclear-powered submarines. Currently three submarines of the Los Angeles class are stationed at the Shipyard, undergoing repair and refueling. Each submarine overhaul takes about two years.⁷ While a submarine is being overhauled at the Shipyard, its approximately 135 submarine crewmembers live at the Yard. Although the Los Angeles class submarine isn't the newest generation of submarines (Virginia class), the U.S. Navy fleet consists mainly of this type of submarine and will continue to do so for at least the next decade. According to PNS, its three dry docks are capable of docking all active classes of submarines including the Virginia and the Ohio classes. History has shown the Shipyard's ability to change its focus in order to be in alignment with the needs of the Navy.

In addition, the base is host for several tenant activities such as a Naval medical clinic; the Coast Guard; and Submarine Maintenance Engineering, Planning, and Procurement (SUBMEPP). Another unit, related to the planning process and project cycle for maintenance and overhauling submarines called the Naval Material Quality Assessment Office (NMQAO), is located in downtown Portsmouth.

- The Naval Clinic employs 57 employees and serves as a primary care facility first for the military and civilian personnel at the Yard, but is also available to retired military personnel in the New England region.
- The Coast Guard has three cutters stationed at the Yard and employs approximately 295 military personnel as crew and in support roles.

⁶ "General Dynamics Awarded \$489 Million in Funding for Navy Destroyer", News, November 16, 2004, Bath Iron Works, A General Dynamics Company Quarterly Census of Employment and Wages Data from BLS is not available, even statewide for Maine, because of disclosure.

⁷ http://www.globalsecurity.org/military/facility/portsmouth_nsy.htm

- SUBMEPP employs 226 civilians, primarily engineers and technicians, who support submarine repair activities worldwide.
- NMQAO employs 27 civilians and is part of the Naval Sea Systems Command (NAVSEA), a headquarters component of the Department of the Navy. This unit was originally located at the Yard and performed work only for PNS. As the unit evolved, it became responsible for the development and administration of centralized quality assurance and assessment systems for NAVSEA.

Occupational Specialties of Civilian Employees at PNS

The economic impact, at the personal level, of a potential base closure would be quite devastating, as individuals may have difficulties maintaining current income levels and finding jobs matching their skills. Maintenance and refueling of nuclear-powered submarines is highly specialized and requires a large number of engineers and technicians, as well as a large number of skilled tradespeople. Most of the work is very specifically related to submarines, one reason why the Yard's training and apprenticeship program is crucial to making sure that the 'PNS's expertise' or 'Quality workmanship' is kept intact as the workforce reaches retirement. The average annual pay at the PNS is about \$65,000, a wage level substantially higher than the average 2003 annual pay for all private covered employment in New Hampshire (\$37,700) or in Rockingham County (\$38,000). But the average pay for PNS is in line with wages in Rockingham County for Machinery manufacturing (\$60,200) and Computer and electronic product manufacturing (\$67,300) — industries that, like PNS, require highly skilled labor.

If the Portsmouth Naval Shipyard were to close under BRAC, it would become the task of state and regional development authorities to try to replace those jobs. With data provided by the Shipyard on occupational groups and families for 4,036 of the Shipyard's civilian employees, it is possible to gain insight into the occupations and the skills represented at the Yard.

Using a conversion table provided by the National Crosswalk Service Center between General Schedule and Federal Wage Schedule codes and O*NET98 occupations, we were able to translate the PNS occupational data to Standard Occupational Classification data. In some cases we also used the O-Net database to get a more precise classification in the case of a very broad translation of code, such as Government Service Executives. The Shipyard has a high concentration of engineers and technicians. The major occupational group level shows that one out of four are employed in Architecture and engineering occupations. Within this group a little more than half are engineers and the rest are engineering technicians. At the detailed occupational level, Mechanical engineering technicians are the largest single occupational group with 266 employed, followed by Mechanical engineers and Nuclear engineers with 184 and 180 employees, respectively.

The second largest major occupational group at the Shipyard is Production occupations, with a little below 1,000 employed in that field. At the detailed level, Helpers – production workers made up a quarter of this occupational group and Painters, transportation equipment was the second largest occupational group with 152 employed. Machinist came in as the third largest occupation within Production occupations with 117 employed.

Combined, the Installation, maintenance and repair occupations and the Construction and extraction occupations employed about a third of all the Shipyard workers. Among the Installation, maintenance and repair occupations, Industrial machinery mechanics is the largest occupation employing 250 workers. A fairly large proportion (30 percent) of Construction and extraction workers is First-line supervisors/managers of construction trades and extraction workers. Due to the code translation, these First-line supervisors/managers should be interpreted more broadly than supervising just Construction and extraction workers. Electricians, and Plumbers, pipefitters, and steamfitters are the two other big

occupations within the Construction and extraction occupations group, employing 153 and 123, respectively.

By comparing the Shipyard occupational data with data from the November 2003 New Hampshire Occupational Employment Statistics (OES) survey for the “Portsmouth, Dover, Rochester wage area” (which includes only the New Hampshire portion of the Portsmouth-Rochester PMSA and thus does not include PNS), we found that the Shipyard has a high concentration of employees in certain occupations not common in the New Hampshire portion of the area otherwise. Examples of such occupations are Riggers; Nuclear engineers; Lay-out workers; and Painters, transportation equipment.

Modeling

Potential Impact of a Closure of the Portsmouth Naval Shipyard

This assessment of the potential economic impact of a closure of the Portsmouth Naval Shipyard on New Hampshire under BRAC 2005 was carried out using the Economic and Labor Market Information Bureau's New Hampshire 10-County Econometric Model⁸. Below is a discussion of the data used to estimate the direct impact of the closure scenarios and the assumptions that were made in modeling the closure impacts.

For this study, the policy modeled is the closure of the Portsmouth Naval Shipyard. The impact is assessed relative to the expected growth (baseline forecast) in the region's economy assuming no closure and growth as forecasted to 2021 by REMI.

Data and Assumption

The information used to develop the policy inputs to model the Shipyard closing was provided by the Portsmouth Naval Shipyard, some directly and some indirectly. The data provided indirectly was gathered from PNS by Seacoast Shipyard Association (SSA) and published in their "Portsmouth Naval Shipyard – Economic Impact" reports. Information provided included: 1) total military personnel and military payroll; 2) civilian payroll total and by place of residence; and, 3) total non-payroll contracts and expenditures. The information was for calendar year 2004.

BRAC is not an instantaneous process. Once a base is designated to be closed, several years may elapse before the closure is complete. This presents the first challenge which must be resolved in the modeling process, how to reflect the timing of the impact of a closure. This study takes the approach that the objective of the analysis is to identify the economic importance of the Yard. This is best accomplished by assuming that closure occurs instantaneously, that all expenditures associated with the Yard's operation and payroll cease at once. Since the data provided was based on 2004, the study simulates the closure as if it occurred on December 31, 2004.

Second, in previous rounds of BRAC, communities with significant economic impacts from closures were provided with Federal redevelopment funds. It may be that similar assistance will be provided as part of the 2005 BRAC, however the timing as to when such support might be available and the amount of the support which may be provided are completely unknown. Therefore, for this study it was assumed that there would be no offsetting injections of Federal redevelopment funds to replace the lost military expenditures.

Third, in most cases the military facilities closed as part of the previous BRACs were offered for sale, though shipyards have been less likely to be completely turned over to private use. Communities were encouraged to prepare base re-use plans and to systematically market the base infrastructure for community-wide economic development. In the present round, it is unclear if facilities will be offered for sale and re-use. Some discussion has focused on the need to retain some capacity to provide flexibility in future military options. Further, even if bases are offered for sale and re-use again, one is confronted with the problem of speculating as to when and what type of re-use may occur. To avoid such long-range speculative assumptions, this study assumes no re-use of the facilities.

⁸ The New Hampshire 10-County Econometric Model is a REMI Policy Insight® model, a product of Regional Economic Models, Inc. of Amherst, MA (see Appendix A).

Simulating the Effects of a PNS Closure on New Hampshire Using the New Hampshire 10-county Model

Simulating a possible PNS closure offered some challenges. In an ordinary facility closure simulation, removal of the facility's employment is straight-forward. But in this case, the baseline employment data⁹, on which the model's control forecasts are based, does not include the Yard's approximately 4,800 civilian jobs, because it is a New Hampshire model and the jobs are physically located in Maine. So it is not possible to remove jobs that do not exist.

The military employment data, however, comes from U.S. Department of Defense sources. The Defense Department reports the military contingent of the yard as if it were in New Hampshire.

The simulation was done in four stages:

Stage 1

The first stage of the simulation was to remove the New Hampshire wages by the county of residence. There is not a loss of 4,800 jobs in New Hampshire, but we can anticipate a rather substantial loss of wages paid to New Hampshire residents. The SSA's "Economic Impact – 2004" provided information about wages paid in 2004. The total of wages paid to civilians working at the yard was \$318.3 million. Civilian workers residing in New Hampshire received \$122.6 million in wages, \$185.5 million went to Maine civilians, and \$7.3 million to Massachusetts residents. "Economic Impact – 2004" provided information about wages paid by city or town of residence. This we aggregated by county to produce the information in the table above. This information was input into the model to yield the impact of the loss of these wages on the economies of New Hampshire and its counties. The wages were removed as a fixed amount for the entire period of the simulation. The assumption is made that no other employer or employers will come forward to replace these wages. Therefore, for the duration of the simulation, the results will not return to equilibrium (the baseline forecast).¹⁰

The model responded to this loss of purchasing power in the six New Hampshire counties by reducing employment, the labor force, and population. We recognize that a significant portion of the civilian workers are old enough and have sufficient longevity to be offered retirement options. If the Yard had closed in February 2005, nearly 13 percent of the civilian employees would have been eligible for full retirement and another 33 percent would be eligible for a pension under early retirement provisions. Acknowledging that most of these laid off workers with pensions would have attachments to the area and would want to stay, we retained them in the area. Those with full retirement eligibility we retained in their home counties as "retirement migrants" and those with early retirement eligibility we retained as "economic migrants". We reasoned that those early retirees will remain in the labor force finding jobs to supplement their pensions until they reach full retirement age. We also estimated the amount of pensions¹¹ that would be paid to these early retirees still in the labor force and modeled this amount as an addition to transfer payments in their counties of residence.

⁹ U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Accounts; and U.S. Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

¹⁰ REMI Policy Insight® is a long-term equilibrium model.

¹¹ The value of transfer money received by migrating early retirees was based on a formula from the FERS website (1 percent of your high-3 average pay times years of creditable service - converted to average pay times 22.5 years, which is the average of 20 years of service and 50 years old and 25 years of service and any age) which was applied to the 2004 New Hampshire PNS wages by county.

Stage 2

In the second stage, we accounted for the military employment. The table on page 18, shows the military employment of the Shipyard and its tenant activities in 2004. Our New Hampshire model contains the military employment because the defense department reports it as being in Portsmouth. Therefore, it is possible to model its loss by reducing the military employment in Rockingham County. We did not think that it was reasonable to remove employment representing the entire amount, however, because it is physically located in Maine. A share of its impact belongs in Maine. In general, military personnel tend to do most of their spending on base.

We reasoned that the spending they do off base is likely to be nearby and for Retail trade purchases and on Accommodation and food services such as in Eating and drinking establishments. There are seven communities within a seven mile radius of the center of Kittery: the Maine towns of Kittery, Eliot, and York and in New Hampshire the city of Portsmouth and towns of Newington, New Castle, and Rye. In Retail trade and Accommodation and food service combined, economic activity, as measured by jobs in covered employment, about 70 percent of the jobs are in the four New Hampshire communities. Most of this activity is in the City of Portsmouth, itself, a destination in the region for entertainment, fine dining, and cultural attractions (including the Albacore the last non-nuclear U.S. Navy submarine¹²). We modeled the loss of military employment in New Hampshire by using 70 percent of the total 893 military employment at the Yard. We converted that amount into a share of the existing military employment in Rockingham County, and removed that share for the period of the simulation.

Stage 3

In the third stage of the simulation, we removed the 27 civilian employees of the Naval Sea Systems Command Detachment who are physically located in the Federal Building in downtown Portsmouth. Since their activity is directly connected to submarine operations, it seems unlikely that they would remain behind should the Shipyard close. We adjusted the wages because the average pay for NAVSEA employees in 2004 was \$76,292.

Stage 4

In the fourth stage, we incorporated information published by the Seacoast Shipyard Association about the Yard's spending patterns in New Hampshire. Of the \$49,469,785 spent by the Shipyard's supply department in 2004 for purchased goods and services; \$3,552,392 went to New Hampshire firms. This is more than 50 percent greater than what was spent in Maine. Connecticut firms¹³ dominated this spending (at \$18,203,736). We modeled the New Hampshire spending, apportioning it by industry, as if were spent by a private Ship and boat building firm, based on industry averages in the REMI control forecast.¹⁴

In the second part of stage four, we modeled the spending on contracted facility services by the Yard's public works department. The Seacoast Shipyard Association published this amount as \$46,469,785 but did not break it out by state. We were able to obtain some information on contracts with New Hampshire firms from the Shipyard and some from defense department web sites, but it was incomplete. Of the total of \$46,418,335, a little over \$14 million was spent on utilities (natural gas, fuel oil, sewer, electricity,

¹² Though built on Seavey Island, the Albacore now rests on dry ground in Portsmouth as a museum, certainly a must-see for Navy personnel and their children.

¹³ Presumably much of this went to submarine manufacturer Electric Boat Company, in Groton CT and its suppliers and contractors.

¹⁴ National input/output tables for each industry are imbedded in the Model.

communications). This, we reasoned, would most likely be spent in Maine, so we did not model it. The remainder was spent on maintenance, alterations, and support. To apportion this spending to New Hampshire, we made the assumption that the bulk on this spending would involve contractors nearest to PNS. We drew a 30-mile radius from Seavey Island selecting those towns whose geographic centroid fell within the circle and used private covered employment within those towns as a measure of economic activity. Within the circle, 60 percent of the private employment was in New Hampshire cities and towns, 23 percent was in Massachusetts, and 17 percent was in Maine. We then used 60 percent of the \$32,261,052 total to model the Yard's spending on maintenance, alterations, and support. Since this spending represented expenditures required to maintain the physical plant, and we had already taken care of the production-related spending in the first part of stage 4, we distributed it as if it were spent to support a military base, using the industry averages in the REMI New Hampshire control forecast for military employment.

The Baseline Forecast

The Growth Projected Without a Portsmouth Naval Shipyard Closure

Gross Regional (or State) Product (GRP) is the value of all goods and services produced by New Hampshire's economy, annually. In real 2004 dollars, it is expected to increase from \$57.2 billion in 2004 to \$114.6 billion in 2021. GRP in real terms, over the 17 year period between 2004 and 2021, is expected to increase by 100.2 percent. The GRP for Rockingham County is expected to increase by 133.1 percent over the 2004 to 2021 period. Total GRP for Rockingham County will reach an estimated \$28.2 billion in real 2004 dollars and will represent 30 percent of New Hampshire's Gross State (Regional) Product. Strafford County's GRP will grow 64.9 percent to reach \$5.1 billion in 2021.

Growth in GRP will result in growth in employment and population.¹⁵ Total employment for the state is expected to exceed 953,000 in 2021, an increase of almost 18 percent. Rockingham County's employment is expected to increase by more than 21 percent to 222,000. Strafford's is expected to increase by almost 15 percent to nearly 69,000. Together the two counties will account for just over 30 percent of the state's jobs in 2021.

Population in the state, without the closure of the Shipyard, is expected to increase by more than a quarter million from 1.309 million in 2004 to 1.565 in 2021. This is a 19.5 percent increase in 17 years. Thirty percent of this growth will be in Rockingham County which is projected to gain 66,654 people, a 22 percent increase from a population of 299,480 in 2004 to 366,134 in 2020. Strafford's is projected to grow considerably slower than the state rate at 14.8 percent.

Rockingham County Has Two Economic Poles

The growth of Rockingham County in recent years, however, has largely taken place away from the commuting area for the Yard. Between the 1980 and the 2000 census, the 10 towns in the Southwestern corner of the county, covering a combined area of 237.4 square miles have grown by 58 percent from 84,978 to 133,917, while the 18 communities in the Northeastern corner, closest to Portsmouth, covering 237.6 square miles, have grown from 82,969 to 103,154 – just 24 percent. In the 1970 Census the population of this Northeastern part of Rockingham County was 25 percent larger than the Southwestern part. During that same period, the state's population grew by 40 percent and Strafford County by 21 percent. The city of Portsmouth's population declined by 19 percent during that period. In fact, Portsmouth's population has declined in every Decennial Census since 1970. During the same period, Portsmouth's private employment has increased by 100 percent while the state's private employment increased 61 percent, Rockingham County's by 108 and Strafford's by 40 percent.

Income

Per capita personal income, median household income, and housing costs in the Portsmouth-Rochester PMSA are higher than for the state as a whole, suggesting that living expenses in the seacoast area are higher than in other parts of New Hampshire. According to the baseline forecast, Rockingham County's personal income per capita in 2004 is \$51,831 while Strafford's is \$38,009. This compares to \$45,288 for New Hampshire and \$40,861 for the U.S.

¹⁵ Increases in population are both caused by and the cause of economic growth.

Simulation Results

Difference Between the Simulation and the Baseline Forecast

To gauge the impact of the economic shock created by our simulation of the Portsmouth Naval Shipyard closing, we compare the results of our REMI model simulation to the previously established “control” forecasts of the economies of New Hampshire’s ten counties. Comparisons show that the closure of the Yard generally produces negative results in almost every economic measure. It is important to remember that these losses do not mean that the economy will show negative growth. Rather the losses that we will discuss are relative to the control forecast. The economy will continue to grow, but by a reduced amount represented by the differences between the control forecast and the Shipyard closure simulation.

Total Job Losses

The closure simulation, which was run as if the Portsmouth Naval Shipyard had ceased to exist on December 31, 2004, had its largest impact on employment in 2005. Statewide, compared to the forecast, 2005 shows a deficit of nearly 1,900 jobs. Rockingham County suffers the largest number of job losses. This results from the direct effects of the loss of the New Hampshire share of the Yard’s military employees (all apportioned to Rockingham County) and the loss of 27 civilian jobs in the Naval Sea Systems Command Detachment. These direct effects are compounded by secondary effects resulting from the disappearance of the purchasing power of their wages and wages of the Yard’s civilian employees who commute from homes in the county.

Total Civilian Job Losses - Secondary Effect

All of the New Hampshire civilian jobs lost, except for the 27 at the Naval Systems Command in downtown Portsmouth, result from the secondary effects of the loss of the purchasing power of the lost wages. In simulating the closing, we were not able to directly remove the Yard’s civilian employment since this employment is not counted in New Hampshire. Instead, we removed wages received by New Hampshire residents, who worked at the yard in 2004, apportioned by the counties in which they lived. When wages are removed from the economy, purchases of goods and services are curtailed, leading to layoffs in the industries that provide those goods and services. Businesses that rely heavily on the Yard’s employees as customers may have to close or scale back their operations. A share of the laid-off workers may move away with their dependents, to seek employment, reducing the population. The departure of migrants that are of childbearing age reduces the area’s potential for natural increase (births minus deaths). The population losses lead to further slackening of demand for goods and services.

The direct loss of the Yard’s civilian wages weighed more heavily on Strafford County since 60 percent of the Yard’s New Hampshire civilian wages went to workers commuting from there. In Rockingham County, the loss of the wages of military families and its proportionately larger share of the PNS’s purchases of goods and services due to close proximity to the Yard, made the total loss of jobs larger than in Strafford. Civilian employment in both counties starts to recover slowly. In Rockingham, the gains flatten out. Stafford County’s small gains in the first five years turn to losses by 2010. Since the Yard’s civilian wages were removed for the duration of the simulation, employment cannot recover to the levels forecasted in the control. Eventually the losses will flatten and civilian job growth will occur at the same rate as projected. Civilian job counts will remain more than 900 below the baseline, statewide, for the duration of the simulation. The level will not return to equilibrium. This is because the simulation does not assume that another large employer would step in to replace those wages. Though state and local development officials will strive to replace these wages, the possibility of this happening was not modeled since the outcome of their efforts is unknowable.

The Effect on Unemployment in New Hampshire

The New Hampshire Econometric Model does not estimate changes in unemployment levels. However, based on the changes in employment at the PNS and the secondary job losses predicted for New Hampshire, we can deduce a change in unemployment.

Unemployment is based on place of residence. It is important to note that even though the elimination of jobs at PNS is not a direct job loss to New Hampshire, it would have a direct effect on the 1,878 New Hampshire residents working at the Shipyard as civilian employees. About 240 of them are eligible for full federal retirement, and they may leave the labor force and not seek further employment. This would leave about 1,600 of the Shipyard employees from New Hampshire unemployed, in the short run, because of the direct job loss at PNS. In addition; 1,246 jobs in New Hampshire would be lost due to secondary effects in the first year after the PNS closure. According to Census 2000 commuting patterns, six percent of workers in Rockingham County commute from Maine, close to ten percent of workers in Strafford County commute from Maine, and less than one percent of the workers in the rest of New Hampshire commute to work from Maine. Therefore, we assume that about 1,100 of these jobs lost in New Hampshire would be held by New Hampshire residents.

In total, then, the number of unemployed in New Hampshire would increase by 2,700 in the year after closure. [This is the sum of the 1,600 New Hampshire residents who would lose jobs at the Yard (and be unable to retire) and 1,100 New Hampshire residents losing jobs in New Hampshire as secondary effects take hold.] This would, in the short term, increase the unemployment rate in New Hampshire by 0.5 percent, using the 2004 annual average labor force as the base.

The Yard closure would also cause secondary job losses in Maine. These losses would be larger than the declines in New Hampshire because of the greater share of Shipyard civilian wages paid to Maine residents. As secondary job losses occur in Maine, additional New Hampshire workers would become unemployed because they commuted to those jobs. The New Hampshire Econometric Model is not designed to capture the effects of jobs lost in Maine and how they impact New Hampshire residents. What we can conclude, however, is that the unemployment rate, especially in the Portsmouth-Rochester area, would be driven yet higher.

Industry Employment

At the outset, the industries most susceptible to the secondary effects of the disappearance of the purchasing power of the Yard's wages are those where people are most likely to spend their disposable income. Retail trade initially has the greatest losses, dropping more than 300 jobs statewide in 2005. Next, Accommodation and food service loses almost 150 jobs. Construction follows a somewhat different pattern from other industries. This pattern likely reflects the loss of purchases/contracts by the Yard itself in the first year. In the second year the loss of residents' ability to purchase new homes or repairs drives construction employment still lower. Then it begins a slow climb back toward equilibrium for the remainder of the forecast period.

Projected negative population differences have long term implications for several industries. Employment in local and state government continues to fall, relative to the control forecast, throughout the period of the simulation. By 2009 local and state government employment losses increase at a faster rate as the population starts migrating away. Healthcare and social assistance, Administrative and waste services, and Professional and technical services turn upward toward the control forecast after the initial shock, but by the end of the period are trending downward.

Occupational Employment

Though the initial reduction in jobs occurs in Maine where the Shipyard is officially located, this direct loss of jobs was modeled by removing the wages received by New Hampshire residents working at the PNS. Because the New Hampshire Econometric Model is not a multi-state model, events occurring outside the state cannot be modeled directly. Most of the New Hampshire job losses resulting from simulating the closure of the Shipyard are from the secondary effects of the closure. These job losses are due to a decrease in consumer spending and a reduced need for health and educational services as the population diminishes. In order to get a full picture of what kind of excess skilled workforce will be available in the area as a consequence of the closure of the Shipyard, the occupational detail of the jobs currently occupied at PNS is described under the section Occupational specialties above.

Statewide, the model's occupational group most affected by the closure of the Shipyard would be Sales, office and administrative occupations. Sales, office and administrative occupations are hit hard from the starting point with a job loss of 401 in 2005. The drop is due to a decline in consumer spending (because of the drop in income), and a decline in the immediate demand by the Shipyard (goods and services purchased by PNS). In general, it is also a very large occupational group with a large presence among many industries. By 2021 less than half of the lost jobs would be recouped. As the long term effects are driven by population growth, and jobs in these occupations will not recover. Food preparation and serving related occupations are also hit hard with a loss of 150 jobs statewide in 2005. These losses are due to a decline in consumer spending reflecting a decrease in per capita personal income.

Job losses in Construction and extraction occupations are 101 in 2005, and worsen to 130 in 2007 before the group starts to recover. By 2021 job losses have diminished to 78. These job losses respond both to a decrease in personal income as well as a decrease in population. A decline in population lessens the need for housing, and the demand for new construction would be down. Remodeling of existing homes would respond to a decline in disposable personal income.

Both Healthcare occupations and Education, training and library occupations are driven by the size of the population. When the population contracts, demand for occupations related to primary education and primary health care diminishes. In stage (three) of the simulation process, some of the lost wages were migrated back into the regional economy to represent retirees who remain in the area. This is the reason why the healthcare occupations are recovering from a loss in 2005 of 50 jobs to a loss of 27 jobs in 2009 and then starts increasing the job losses more permanently. By 2021 the healthcare occupations are 71 fewer than if the PNS had not closed. As the population declines faster by 2009, jobs in Education, training, and library occupations decline at a faster rate as well.

Demand for Goods and Services and Gross Regional Product

The Portsmouth Naval Shipyard closure simulation reduces the final demand for goods and services in New Hampshire in 2005 by \$197.3 million. Some of these losses are exported to other economies as imports from the rest of the U.S. fall by \$95.4 million and imports from foreign countries fall by \$0.3 million.

New Hampshire's Gross Regional (or State) Product (GRP) falls \$133.8 million below the baseline in the first year. It does not recover to the baseline forecast levels through the simulation period.

Wages

In the event of the closure of the Portsmouth Naval Shipyard, losses in total wage and salary disbursements for New Hampshire would initially be \$71.5 million. This loss would expand to \$106.3 million by 2021. This amount is in nominal dollars, and the increasing loss over time is partly due to inflation. The Retail trade industry suffers the biggest losses in wage and salary disbursement, followed

by losses in Construction. A fifth of the losses in private nonfarm wage and salary disbursement is in Retail trade and another ten percent of the losses are in Construction.

Employees in Strafford County would be hardest hit. Their average annual wage rate would be lowered by \$123.51 in nominal dollars by 2010, the bottom of the trough. The closing's effect on the average annual wage rate is smaller at the statewide level, but it is interesting to note, it would still take the state until 2019 to get back to the pre-closing wage level. In the short-term, the average annual wage rate is actually higher in 2005 for both Rockingham and Strafford counties, and for New Hampshire as a whole, and would remain higher for Rockingham County in 2006. The reason is that, when Military employment was taken out, most of the jobs lost were in retail. Both are segments of the economy with a lower than the average wage rate, and by eliminating these jobs the average of the remaining jobs will see an increase.

Income

Losses in per capita real personal income and per capita real disposable personal income follow a very similar pattern, with slightly bigger losses in per capita real personal income. Strafford County is hit the hardest by the closure of PNS with an immediate economic impact in 2005 of \$426 fixed 1996 dollars in per capita real personal income and \$358 fixed 1996 dollars in per capita real disposable personal income. [The Econometric Model uses 1996 as a baseline for income figures; \$1 in 1996 had approximately the same purchasing power as \$1.22 in 2005. Therefore, \$426 in fixed 1996 dollars would translate into about \$521 in current 2005 dollars; \$358 in fixed 1996 dollars would translate into about \$438 in current 2005 dollars.]

As more people move away from the area due to lack of employment, per capita personal income gradually begins to recover. This rising per capita personal income happens despite a decline in total personal income because there is a smaller population over which to spread the total income. It would take until 2017 for per capita real personal income in Strafford County to recover enough to be at the level it would reach if the Yard were not closed. New Hampshire's per capita real personal income and per capita real disposable personal income are negatively affected by \$77 and \$68, respectively, in 2005, but it will take the state until 2021 to reach the same income level in fixed dollars in the case if the Yard were not closed. Per capita real personal income in Rockingham County follows the same pattern as the state, just starting with a loss of \$150 in fixed 1996 dollars in 2005 and with a loss of \$58 in fixed 1996 dollars by 2021. Rockingham County suffers long-term declines in per capita real personal income and per capita real disposable income, compared to the levels attained if the Yard does not close.

Population and Labor Force

Population and labor force both continue to decline relative to the control forecast throughout the period of the simulation. The sudden loss in the wages of commuters plus the loss of military personnel and their dependents has an immediate sharp impact on population levels. The labor force impact does not occur as rapidly. It builds as the secondary effects of the economic shock churn through the economy. Ultimately, the loss of population exceeds the labor force considerably since members of the labor force who move away take dependents with them.

State and Local Revenues and Expenditures

According to the REMI New Hampshire Econometric Model baseline, close to 60 percent of local revenues in New Hampshire come from property taxes and another 22 percent come from State intergovernmental funds. At first, losses in local revenues are driven by losses in Other charges and revenues, but by 2008 losses are primarily driven by losses in property taxes.

A majority of the local expenditures are used to fund elementary and secondary education (including libraries), and another ten percent fund the police, fire and corrections. Declines in expenditures are apportioned in line with the level of spending. In general, both local revenues and expenditures are driven by the size of the population. Likewise drops in revenues are primarily from the loss of property taxes, drops in expenditures are from lower spending on education and other public services. This explains why declines in local revenues statewide are smaller than declines in local expenditures by 2016. In Strafford County drops in local revenues are smaller than declines in local expenditures by 2010. In other words, more money is spent on education and other local services than is collected in property and other local taxes, compared to the baseline.

The difference between state revenues and expenditures more than makes up for the deficit in local finances both in Strafford County and Statewide. Most of the state revenues come from federal intergovernmental, other charges and revenues, and employee retirement. The rest of the revenues are from varying sources like corporate income tax, education charges, and other sales tax. Most of the losses in revenues in 2005 are from other charges and revenues and employee retirement, but by 2013 federal intergovernmental revenue carries the largest share of the losses.

A quarter of the State's expenditures is used to fund intergovernmental expenditures and another 17 percent is spent to fund higher education. With the closure of the Shipyard, state expenditures on welfare and insurance trust are higher compared to the baseline until 2012, thereby offsetting other drops in State expenditures by about a million dollars in the first year after closure.

Appendix A.

The REMI Model ¹⁶

REMI Policy Insight® is a structural model, meaning that it clearly includes cause-and-effect relationships. The model is based on two key underlying assumptions from mainstream economic theory: households maximize utility and producers maximize profits. Since these assumptions make sense to most people, lay people as well as trained economists can understand the model.

In the model, businesses produce goods to sell locally to other firms, consumers, investors, and governments, and from purchasers outside the region. The output is produced using labor, capital, fuel, and intermediate inputs. The demand, per unit of output, for labor, capital, and fuel depends on their relative costs, since an increase in the price of any one of these inputs leads to substitution away from that input to other inputs. The supply of labor in the model depends on the number of people in the population and the proportion of those people who participate in the labor force. Economic migration affects the population size. People will move into an area if the real after-tax wage rates or the likelihood of being employed increases in a region.

Supply and demand for labor determine the wage rates in the model. These wage rates, along with other prices and productivity, determine the cost of doing business for each industry in the model. An increase in the cost of doing business causes either an increase in prices or a cut in profits, depending on the market for the product. In either case, an increase in costs would decrease the share of the local and U.S. market supplied by local firms. This market share, combined with the demand described above, determines the amount of local output. Of course, the model has many other feedbacks. For example, changes in wages and employment impact income and consumption, while economic expansion changes investment, and population growth impacts government spending.

Figure 2-1 is a pictorial representation of REMI Policy Insight®. The Output block shows a business that sells to all the sectors of final demand as well as to other industries. The Labor and Capital Demand block shows how labor and capital requirements depend both on output and their relative costs. Population and Labor Supply contribute to demand and to wage determination. Economic migrants in turn respond to wages and other labor market conditions. Supply and demand interact in the Wage, Prices, and Profits block. Prices and profits determine market shares. Output depends on market shares and the components of demand.

The REMI model brings together all of the above elements to determine the value of each of the variables in the model for each year in the baseline forecast. The model includes all the interindustry interactions that are included in input-output models in the Output block, but goes well beyond an input-output model by including the linkages among all of the other blocks shown in Figure 2-1.

In order to broaden the model in this way, it was necessary to estimate key relationships. This was accomplished by using extensive data sets covering all areas in the country. These large data sets and two decades of research effort have enabled REMI to simultaneously maintain a theoretically sound model structure and build a model based on all the relevant data available.

The model has strong dynamic properties, which means that it forecasts not only what will happen but also when it will happen. This results in long-term predictions that have general equilibrium properties. This means that the long-term properties of general equilibrium models are preserved while maintaining accurate year-by-year predictions and estimating key equations using primary data sources.

Figure 2-2 shows the policy simulation process for a scenario called Policy X. The effects of a scenario are determined by comparing the baseline REMI forecast with an alternative forecast that incorporates the assumptions for the scenario. The baseline REMI forecast uses recent data and thousands of equations to generate projected economic activity for a particular region. The policy variables in the model are set equal to their baseline value (typically zero for additive variables and one for multiplicative variables) when solving for the baseline forecast. To

¹⁶ The following discussion of the REMI model was taken from material prepared by Regional Economic Models, Inc., page 1.

show the effects of a given scenario, these policy variables are given values that represent the direct effects of the scenario. The alternative forecast is generated using these policy variable inputs.

Figure 2-2 shows how this process would work for a policy change called Policy X.

Figure 2-2 Policy X Scenario

For this study, the Policy X is the closure of the Portsmouth Naval Shipyard. The impact is assessed relative to the expected growth in the region's economy assuming no closure and growth as forecasted to 2021 by REMI.

Appendix B.

Portsmouth Naval Shipyard Civilian Occupations by General Schedule Group/Federal Wage System Family on February 24, 2005

General Schedule

Number	Occupation Family/Group	Number
GS-0800	Engineering And Architecture Group	1,008
GS-1600	Equipment, Facilities, And Services Group	199
GS-0300	General Administrative, Clerical, and Office Services Group	132
GS-1300	Physical Sciences Group	119
GS-1100	Business And Industry Group	75
GS-1700	Education Group	65
GS-1900	Quality Assurance, Inspection, And Grading Group	45
GS-2200	Information Technology Group	32
GS-0500	Accounting And Budget Group	29
GS-0000	Miscellaneous Occupations Group	26
GS-2000	Supply Group	22
GS-1000	Information And Arts Group	9
GS-1400	Library And Archives Group	8
GS-0600	Medical, Hospital, Dental and Public Health Group	7
GS-2100	Transportation Group	5
GS-0900	Legal And Kindred Group	3
GS-0200	Human Resources Management Group	1
GS-1500	Mathematics And Statistics Group	1
	GS Subtotal	1,786

Federal Wage System

FWS-5300	Industrial Equipment Maintenance Family	357
FWS-3800	Metal Work Family	272
FWS-4100	Painting And Paperhanging Family	267
FWS-4200	Plumbing And Pipefitting Family	220
FWS-2800	Electrical Installation And Maintenance Family	204
FWS-5200	Miscellaneous Occupations Family	182
FWS-3400	Machine Tool Work Family	167
FWS-3700	Metal Processing Family	154
FWS-2600	Electronic Equipment Installation And Maintenance Family	135
FWS-4300	Pliable Materials Work Family	66
FWS-3600	Structural And Finishing Work Family	48
FWS-5800	Transportation/Mobile Equipment Maintenance Family	45
FWS-3100	Fabric And Leather Work Family	37
FWS-5700	Transportation/Mobile Equipment Operation Family	25
FWS-4700	General Maintenance And Operations Work Family	16
FWS-6900	Warehousing And Stock Handling Family	14
FWS-3300	Instrument Work Family	13
FWS-4800	General Equipment Maintenance Family	9

FWS-5400	Industrial Equipment Operation Family	6
FWS-7000	Packing And Processing Family	6
FWS-3500	General Services And Support Work Family	5
FWS-6500	Ammunition, Explosives, And Toxic Materials Work Family	2
	FWS Subtotal	2,250
	Shipyard Total	4,036

Note: PNS provided additional detail by GS series and FWS occupation which was converted to O*NET occupations for comparison to New Hampshire occupational data.

Appendix C.

Portsmouth Naval Shipyard Civilian Employment by Standard Occupational Classification (SOC)

SOC Code	Occupation	PNS Employment ¹	Portsmouth, Dover,	
			Rochester Area Estimated Empl. ²	Statewide Estimated Empl. ²
11-3011	Administrative Services Managers	6	170	1,010
11-3021	Computer and Information Systems Managers	3	420	1,360
11-3031	Financial Managers	1	560	3,090
11-3040	Human Resources Managers	10	150	850
11-3051	Industrial Production Managers	46	130	1,030
11-3061	Purchasing Managers	10	70	410
11-3071	Transportation, Storage, and Distribution Managers	2	80	410
11-9041	Engineering Managers	105	230	990
11-9121	natural Sciences Managers	6	n/a	90
13-1081	Logisticians	5	n/a	n/a
13-1111	Management Analysts	29	310	1,150
13-2011	Accountants and Auditors	3	550	2,870
13-2031	Budget Analysts	10	n/a	100
15-1041	Computer Support Specialists	4	370	1,840
15-1071	Network and Computer Systems Administrators	19	280	1,010
15-1081	Network Systems and Data Communications Analysts	7	80	410
15-2021	Mathematicians	1	n/a	n/a
17-2041	Chemical Engineers	2	n/a	70
17-2071	Electrical Engineers	38	90	830
17-2072	Electronics Engineers, Except Computer	11	70	690
17-2081	Environmental Engineers	8	n/a	160
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	29	n/a	60
17-2112	Industrial Engineers	42	100	720
17-2121	Marine Engineers and naval Architects	25	n/a	n/a
17-2131	Materials Engineers	6	40	250
17-2141	Mechanical Engineers	184	280	1,480
17-2161	Nuclear Engineers	180	n/a	n/a
17-3011	Architectural and Civil Drafters	45	160	710
17-3023	Electrical and Electronic Engineering Technicians	102	140	1,050
17-3025	Environmental Engineering Technicians	35	n/a	80
17-3026	Industrial Engineering Technicians	45	50	360
17-3027	Mechanical Engineering Technicians	266	30	420
19-2031	Chemists	8	60	160
19-2041	Environmental Scientists and Specialists, Including Health	5	n/a	280
19-4031	Chemical Technicians	72	30	150
19-4051	Nuclear Monitoring Technicians	4	n/a	n/a
23-1011	Lawyers	2	250	1,480
23-2011	Paralegals and Legal Assistants	1	NP	590
25-1194	Vocational Education Teachers, Postsecondary	57	NP	200
25-4010	Archivists, Curators, and Museum Technicians	1	30	150
25-4021	Librarians	4	180	910
25-4031	Library Technicians	4	110	690

27-1024	Graphic Designers	1	110	570
27-3031	Public Relations Specialists	3	90	450
27-3042	Technical Writers	2	50	240
27-3043	Writers and Authors	2	60	180
29-2071	Medical Records and Health Information Technicians	2	n/a	840
29-9010	Occupational Health and Safety Specialists and Technicians	15	n/a	160
33-1012	First-Line Supervisors/Managers of Police and Detectives	2	80	360
33-9032	Security Guards	5	180	2,220
43-1011	First-Line Supervisors/Managers of Office and Administrative Support Workers	3	1,250	7,420
43-3031	Bookkeeping, Accounting, and Auditing Clerks	8	1,510	9,270
43-3051	Payroll and Timekeeping Clerks	5	90	680
43-5011	Cargo and Freight Agents	5	50	120
43-5061	Production, Planning, and Expediting Clerks	58	200	1,120
43-5081	Stock Clerks and Order Fillers	15	1,120	8,540
43-6011	Executive Secretaries and Administrative Assistants	19	1,090	5,980
43-6014	Secretaries, Except Legal, Medical, and Executive	39	1,160	7,680
43-9011	Computer Operators	4	90	440
43-9022	Word Processors and Typists	3	30	400
43-9051	Mail Clerks and Mail Machine Operators, Except Postal Service	1	50	760
43-9061	Office Clerks, General	14	1,910	10,230
47-1011	First-Line Supervisors/Managers of Construction Trades and Extraction Workers	201	290	2,470
47-2031	Carpenters (Boat Builders and Shipwrights)	41	NP	4,410
47-2111	Electricians	153	420	2,140
47-2131	Insulation Workers	33	n/a	n/a
47-2152	Plumbers, Pipefitters, and Steamfitters	129	NP	2,300
47-2211	Sheet Metal Workers	45	120	650
47-3013	Helpers--Electricians	35	n/a	300
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	41	n/a	160
47-3019	Helpers - Construction Trades, All Others	10	n/a	230
47-4041	Hazardous Materials Removal Workers	3	40	80
49-1011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	103	420	25,650
49-2092	Electric Motor, Power Tool, and Related Repairers	7	n/a	640
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	93	50	300
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	36	30	100
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	11	380	100
49-9041	Industrial Machinery Mechanics	250	170	130
49-9042	Maintenance and Repair Workers, General	7	720	1,340
49-9069	Precision Instrument and Equipment Repairers, All Other	4	n/a	100
49-9093	Fabric Menders, Except Garment	35	n/a	n/a
49-9096	Riggers	92	n/a	n/a
49-9098	Helpers--Installation, Maintenance, and Repair Workers	103	150	730

51-1011	First-Line Supervisors/Managers of Production and Operating Workers	93	550	52,080
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	3	n/a	50
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	3	n/a	690
51-4041	Machinists	117	340	180
51-4111	Tool and Die Makers	9	70	570
51-4121	Welders, Cutters, Solderers, and Brazers	98	170	460
51-4192	Lay-out Workers, Metal and Plastic	106	n/a	n/a
51-7031	Model Makers, Wood	6	n/a	n/a
51-8031	Water and Liquid Waste Treatment Plant and System Operators	5	110	100
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	38	510	80
51-9122	Painters, Transportation Equipment	152	n/a	500
51-9198	Helpers--Production Workers	243	240	530
51-9199	Production Workers, All Other	51	280	1,370
53-1031	First-Line Supervisors/Managers of Transportation and Material-Moving Machine and Vehicle	3	120	480
53-7021	Crane and Tower Operators	22	n/a	170
53-7061	Cleaners of Vehicles and Equipment	6	120	1,680

1 Portsmouth Naval Shipyard civilian employment on February 24, 2005

2 Estimated area and statewide employment are based on the November 2003 New Hampshire Occupational Employment and Wages survey by the Occupational Employment Statistics (OES) Program

n/a - not available

NP - indicates that the estimated employment is not publishable