

The Economic Impact of Redstone Arsenal

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EXECUTIVE SUMMARY: THE ECONOMIC IMPACT OF REDSTONE ARSENAL

Every year, Redstone Arsenal channels billions of dollars of Federal Spending into the Huntsville Metropolitan Area and the outlying region. This volume of spending is enormous relative to the area's population. The \$4 billion-plus in Federal procurement contracts relayed through Redstone Arsenal in Fiscal Year 2010 exceeds total Fiscal Year 2011 Department of Defense contracting volumes in at least 20 U.S. States¹. Redstone Arsenal effectively sends an entire state's worth of defense contracting into the nation's 120th-largest Metropolitan Area. Defense spending of this volume impacts the region in ways that will often be difficult to measure. Accordingly, this report provides a comprehensive picture of the ways in which spending at Redstone Arsenal impacts both the overall size of the Tennessee Valley region economy², as well as the economy's structure and composition – specifically, the region's distinctive skew of employment and contracting towards engineering and research.

To make these estimates, we rely on economic impact analysis. Economic impact models provide detailed information on the flows of economic activity between industries and counties. As a result, economic impact analysis allows us to trace the ways in which spending ripples through a local economy. It is especially useful for cases of federal contracting and procurement such as this one. Using the detailed economic impact model from the Minnesota Implan Group (MIG), we were able to trace spending at Redstone Arsenal as it flowed from the Department of Defense to contractors, subcontractors and the goods and services they purchased; to military and civilian employees and their families; and to the subdivisions, retailers and service providers where Redstone Arsenal employees and workers at defense contractors spent their hard-earned paychecks.

Based on procurement data and employment counts provided by Redstone Arsenal and the Huntsville/Madison County Chamber of Commerce, we estimate the total annual impact of Redstone Arsenal at 90,500 jobs and \$10.56 billion in economic output – approximately 5.9% of the total 2010 Gross Domestic Product (GDP) for Alabama, and nearly half the \$21.56 billion GDP of the Huntsville Metropolitan Area.³ When we expand the impact area to include consumer spending impacts for approximately 7,000 Redstone Arsenal employees who live in 10 counties outlying the core Huntsville area, the total annual impact is \$11.47 billion and approximately 101,000 jobs.

¹ Source: January 23, 2012 query of FY'2010 Department of Defense Prime Awards by state, via usaspending.gov. Search results available at: <http://1.usa.gov/w6XDZd>.

² Defined as Madison, Limestone, Lawrence and Morgan Counties, except where noted otherwise.

³ All figures in this report are inflation-adjusted to 2011. The United States Bureau of Economic Analysis places statewide GDP at \$178 billion in 2010, and Huntsville Metropolitan Area GDP at \$20.9 billion for the same year. Please note that because economic impact analysis adds together impacts from multiple rounds of spending, the total economic impact of the region will significantly exceed total GDP. The figure listed here provides a means of comparing the relative importance of Redstone Arsenal to the local economy, relative to other key industries.



The Economic Impact of Redstone Arsenal

Table 1: Total Economic Impact of Redstone Arsenal (RSA) on Four-County Huntsville Area

Figures denote total value of goods and services produced as a result of RSA activity

	Procurement	Redstone Arsenal Personnel	Procurement + Personnel
Direct Impact: Federal spending on Redstone Arsenal personnel and contracts	\$4,093,884,000	\$2,777,754,000	\$6,871,638,000
Indirect Impact: Contractors' spending on materials, services and subcontracts	\$1,049,513,000	\$0	\$1,049,513,000
Induced Impact: Economic activity generated as employees of Redstone Arsenal and its contractors spend their income	\$1,277,127,000	\$1,371,503,000	\$2,648,630,000
Total Impact:	\$6,420,524,000	\$4,149,257,000	\$10,569,780,000

Table 1 shows the cumulative economic impact of the two main economic 'levers' at Redstone Arsenal: procurement of goods and services, and pay to military personnel, Department of Defense civilians and on-post contractors.⁴ The table also shows the three mechanisms through which those activities stimulate the 4-county Tennessee Valley region (consisting of Limestone, Madison, Lawrence and Morgan Counties):

- **Direct Impact** denotes the dollar value of spending steered into the local economy from the outside. For contracting and procurement, this is the dollar value of the contracts exacted through Redstone Arsenal. For personnel, this figure marks the total estimated value of employee compensation.
- **Indirect Impact** denotes the subsequent growth in economic activity at local firms that supply goods and services to those contractors. Engineering and aerospace firms generate significant indirect impacts by purchasing software, sheet metal, consulting services, lab tests and related goods from other firms in the Tennessee Valley region. We estimate that the \$4.09 billion in local contracts generates an additional \$1.05 billion of economic activity through these purchases. Note: because the Implan model covers only private-sector employment, we do not estimate the indirect impacts of on-post personnel. Instead, the \$4.09 billion in contracting entered into the model covers those goods and services.
- **Induced Impact** denotes the business activity that occurs when Redstone Arsenal personnel, and employees of firms supplying goods to the Arsenal, spend their paychecks. While direct and

⁴ We separate on-post contractors – individuals who work alongside uniformed and DoD civilian personnel at Redstone Arsenal – from the contractors who provide services and goods generated off-post. This approach avoids potential double-counting, and allows us to trace the industry-specific economic impacts of the various goods contractors produce.

The Economic Impact of Redstone Arsenal

indirect impacts vary based on the types of goods and services being produced, induced impacts typically vary much less. Regardless of total pay levels, workers spend their income on the same bundle of goods: housing, transportation, consumer purchases, education, entertainment, etc. Because Redstone Arsenal personnel are numerous and generally well compensated, the \$1.37 billion they generate in induced economic activity in the Tennessee Valley region exceeds the induced impact from employees of off-post contractors (listed in the “Procurement” column in Table 1 and Table 2).

This \$10 billion in annual economic activity generates a substantial volume of employment in the area. We estimate that Department of Defense spending on Redstone Arsenal produces approximately 90,500 jobs in the four-county area – nearly one job for every 4.5 residents, regardless of age or labor force status (Table 2):

Table 2: Total Employment Impact of Redstone Arsenal on Four-County Huntsville Area

Figures denote total employment generated through Arsenal operation and procurement

	Procurement	Redstone Arsenal Personnel	Procurement + Personnel
Direct Impact: Federal spending on Redstone Arsenal personnel and contracts	26,123	33,439	59,562
Indirect Impact: Contractors’ spending on materials, services and subcontracts	8,263	0	8,263
Induced Impact: Economic activity generated as employees of Redstone Arsenal and its contractors spend their income	10,935	11,734	22,669
Total Impact:	45,321	45,173	90,494

These composite estimates represent the simplest distillation of a complicated set of questions and estimates about Redstone Arsenal and its impact on the region. The report that follows investigates those questions in detail. It provides detailed accounts of the top industries impacted by Redstone Arsenal, of the total employee compensation and tax revenues attached to the Arsenal, and of the data, methods and assumptions we used to generate our results. Equally important, it frames those results in terms of relevance to key planning and policy decisions in the area.



INTRODUCTION

Redstone Arsenal represents a tremendous economic engine for the four-county Tennessee Valley region. Federal support for the Arsenal – provided primarily through Department of Defense activities – funds highly paid civilian positions. It routes billions of dollars each year to Tennessee Valley-area contractors, who generate significant economic activity as they provide goods and services to support the arsenal. And by funding substantial research in engineering and aerospace, Redstone Arsenal has helped Huntsville to develop a labor force with a uniquely high concentration of engineers and knowledge-industry professionals. This in turn leads to productive knowledge spillovers that improve the competitiveness and market position of area firms not attached to the Arsenal.

The substantial impact of Redstone Arsenal and other federal activities in the region effectively make Huntsville a company town. The overwhelming importance of federal spending to the economy brings significant opportunity and risk. While the Tennessee Valley region contains remarkably high concentrations of knowledge and production industries for an area of its size, the mechanics of economic development in the area are uniquely complicated. Huntsville has few obvious peers against which to draw comparisons and assess its economic evolution. Similarly, the fact that so much economic activity originates in federal spending, means that the relationships between firms are governed by contracting and reporting mechanisms often absent in private industry. It also means that key local businesses are less likely to be footloose and mobile than those who do not rely on public contracting. Charting these complicated relationships, and identifying the key industries that respond to activity at Redstone Arsenal, is a valuable step in better understanding the organization of the local economy.

At the same time, building so much economic activity around a single source carries with it considerable risk. After rising steadily throughout the 2000s, federal defense spending levels have come under pressure, and the Department of Defense is currently debating options for making deep budget cuts. While it appears likely that Redstone Arsenal will remain well funded in the near future, budget levels and funding priorities remain fluid by definition. Future changes in the military's mission, in the direction of research, and in the type of armed response sought from the armed forces, could result in substantial economic impacts on the local community. Documenting the overall importance of Redstone Arsenal to the economy, as well as the ways in which Arsenal spending ripples through the region, is an essential first step to determining responses to potential spending adjustments in the future.

With these questions in mind, we organize the measurement of Redstone Arsenal's Economic Impact into two sections. Section One describes the different Redstone Arsenal activities that impact the Tennessee Valley region, and discusses the assumptions and techniques we use to model those impacts. Section Two provides detailed estimates of impacts, sorting by different types of origins, different outputs, and different impacted industries. Section Three provides lists of the industries most impacted by Redstone Arsenal in terms of output, employment and labor income. In the event of future changes at Redstone Arsenal, these lists will help to identify the extent, scope and location of the resulting changes to the local economy. In addition to impacting government contractors with well-known names, changes at Redstone Arsenal will impact everything from the demand for housing to restaurant activity to the demand for accounting and business support services. This section helps to identify some of the



The Economic Impact of Redstone Arsenal

less well-known aspects of Redstone Arsenal's impact on the region. Section Four provides generalized multipliers local analysts can use to quickly estimate the total economic impact of future changes at Redstone Arsenal. Finally, we provide supplementary information in two appendices designed to inform future assessments of the local economy.

I. WHAT REDSTONE ARSENAL DOES, AND HOW IT IMPACTS THE ECONOMY

Every year, Redstone Arsenal spends billions of dollars in federal funds within the Tennessee Valley region. Because those funds originate in nationwide tax collections, the Arsenal represents an enormous redirection of outside funds into the local economy. In this way, the federal spending-dependent local economy functions similarly to the economies of the classic company town, such as Detroit. Just as every vehicle sold by General Motors (GM) brings outside spending into the Michigan economy (or every bottle of Coke purchased at a convenience store sends profits to Atlanta), every federal contract and civilian position at Redstone Arsenal represent a net benefit to the Tennessee Valley Region. Economists refer to this as the *direct impact* of industry growth.

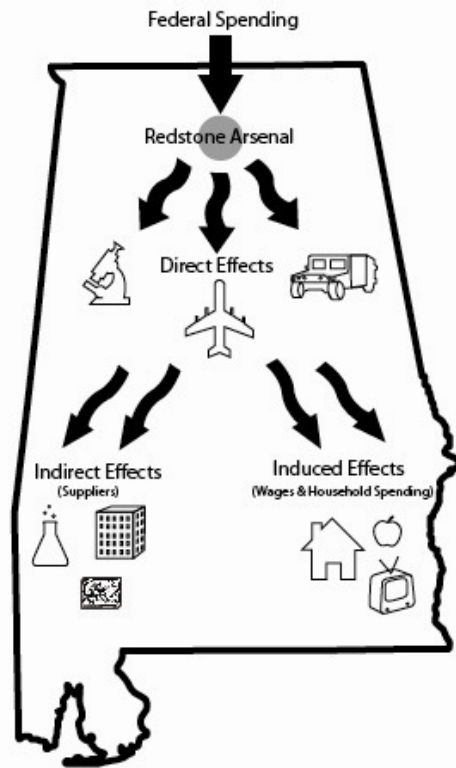
The similarities run deeper. The day-to-day operation of a core industry ripples through the economy in crucial, but often invisible ways. For every vehicle GM assembles, it purchases axels, tires, seats, engineering diagrams and a host of other products and services from suppliers spread throughout the Detroit area – generating jobs and profits in a number of dependent industries along the way. The analogy holds with federal contracting. In order to perform its research functions, Redstone Arsenal lets a multitude of contracts throughout Huntsville and the Tennessee Valley region. It funds engineering and aerospace firms, and those firms buy sheet metal, consulting services and office space from other businesses in the region. And *those* businesses in turn buy goods and services from others. For every dollar of sales, most industries trigger another \$0.30 to \$0.50 in local economic activity. These economic impacts – termed *indirect impacts* or “backwards linkages” by economists – represent a crucial component of the total economic impact of Redstone Arsenal.

Employee compensation is the final piece of the puzzle. Employees of Redstone Arsenal and its contractors, just like assembly line workers at GM, spend their paychecks on housing, food, transportation, and other goods. Although considerably smaller than the direct and indirect impacts of Redstone Arsenal, workers' spending nonetheless generates significant ripple effects. Any effort to comprehensively measure the impact of Redstone Arsenal needs to take such spending – labeled *induced impacts* – into account. Figure 1 summarizes the three basic types of economic impacts attached to growth at Redstone Arsenal.



The Economic Impact of Redstone Arsenal

Figure 1: Tracing the Economic Impact of Redstone Arsenal



Adding up these various economic flows requires a detailed map of transactions between industries and counties. The Minnesota IMPLAN Group (MIG) provides the industry-standard tools for making these daunting calculations. MIG begins with data from national sources, then adds local information to provide a comprehensive map of economic relationships. Using the Implan software, we can determine how much economic activity \$1,000 in contracts from Redstone Arsenal generate in Limestone County; which industries they generate it in; the amount of wages paid out through those contracts; and the related economic activities in other industries and other Huntsville-area counties.

At its core, Implan fashions a practical approach to teasing out total economic impacts. But operating the economic model, and tailoring the available data on Redstone Arsenal to fit the model's needs, requires dozens of adjustments, assumptions, calculations and other steps. In order to help the consumers of our estimates assess their value and their strengths and weaknesses, we spell out our methods in detail. Some of this detail appears in the report appendices. Here, we outline key pieces of information, assumptions, and calculations.



The Economic Impact of Redstone Arsenal

Assembling Data on Redstone Arsenal

The typical approach to economic impact analysis involves collecting information on the growth of an industry, plugging that information into the model, and tracing the resulting economic impacts. Unfortunately, the information Implan provides on the private sector is much more detailed than its public sector accounts, which provide no detail on the purchases and spending of the military or the federal government. To compensate for the limited information in the model, we obtained extremely detailed data to put into it. Redstone Arsenal personnel provided detailed information on procurement – which maps the “indirect impacts,” or local contracting omitted from the Implan model – and on total employment and compensation for Redstone Arsenal Personnel. Putting these two sources together, we were able to develop a full picture of the Arsenal’s local spending.

Contracting: Redstone Arsenal personnel provided us with county-by-county totals for the Arsenal’s \$5.3 billion in procurement in 2010. We made two key adjustments to this figure. First, because some of the workers employed on Redstone Arsenal Contracts also work on-post – and thus show up in counts of Arsenal Employment – we subtracted the \$1.343 billion in salaries paid to contractors employed on Redstone Arsenal from the procurement total. This resulted in an “adjusted” procurement figure of \$3.956 billion. We then further adjusted this figure to account for the fact that a small portion –one-half of one percent – of Redstone Arsenal procurement contracts go to firms operating outside the four-county Huntsville area. Accordingly, we multiplied the \$3.956 “adjusted” figure by .995, arriving at a final estimated figure of \$3.936 billion in procurement in Limestone, Madison, Morgan and Lawrence Counties.

The next challenge was inputting this number into the Implan model. In principle, we could use the North American Industrial Classification System (NAICS) codes attached to contracts issued by Redstone Arsenal to attach each contract to a specific industry. However, self-reported NAICS codes provide imperfect information on a firm’s activities. In consultation with officials from Redstone Arsenal and the Huntsville/Madison County Chamber of Commerce, we identified “typical” activities conducted under Redstone Arsenal contracts, and parceled out the \$3.936 billion in procurement among those activities. Table 1 details how we divided up the procurement spending:



The Economic Impact of Redstone Arsenal

Table 1: Assigning Redstone Arsenal Procurement to Industries

Industry	Percent of Procurement ⁵	Procurement Amount	
		2010	Inflation-Adjusted to 2011
Aircraft manufacturing	10.0	393,642,658	409,388,364
Guided missile and space vehicle manufacturing	10.0	393,642,658	409,388,364
Accounting, tax preparation, bookkeeping, and payroll services	3.0	118,092,797	122,816,509
Architectural, engineering, and related services	38.0	1,496,235,743	1,556,085,172
Custom computer programming services	8.5	336,170,830	349,617,663
Computer systems design services	7.7	303,498,489	315,638,429
Management, scientific, and technical consulting services	12.0	472,371,190	491,266,037
Scientific research and development services	10.7	422,772,215	439,683,103
Total	100	3,936,426,579	4,093,883,642

These activities capture the essential services and products provided to Redstone Arsenal. Inputting these figures into Implan as changes in industry sales allows us to trace their full impact on the local economy.

Employment at Redstone Arsenal. The employment of military personnel, federal civilians and select contractors (in addition to the contractors represented in Table 1) on Redstone Arsenal represents the annual transfer of billions of dollars of salary and compensation into the local economy. In order to account for the full economic impact of Redstone Arsenal, we need to account for two separate factors: the dollar value of wages and equivalent compensation, and the subsequent economic activity induced by Redstone Arsenal employees and their families as they spend their income. Under the typical approach to economic impact analysis, we would simply enter all wages and compensation for these workers into the Implan model of the four-county Huntsville area. However, the data from Redstone Arsenal broke down military, civilian and contracting employment by county of residence. This allows us to more accurately chart where the spending from these employees will hit the ground.⁶ Table 2 presents the available information on Redstone Arsenal employees:

⁵ We arrived at this distribution of procurement in cooperation with representatives of Redstone Arsenal and the Huntsville/Madison County Chamber of Commerce. We jointly decided to assign 10% of procurement to aircraft manufacturing and 10% to guided missile and space vehicle manufacturing. We allotted the remaining 80% of procurement across 6 engineering and design-related industries, based on each industry's share of total employment in the four-county region. These industries represent a probable mix of procurement activities in the area. Because the industries are similar in their use of workers with advanced degrees and the work they do, reassigning procurement from one industry to another would have a relatively small impact on final results.

⁶ For example, wages spent in Madison County, the economic heart of the region, are likely to be spent at businesses that buy products locally and pay local workers. Wages spent in Morgan County, or further from



The Economic Impact of Redstone Arsenal

Table 2: Employment and Estimated Salary of Redstone Arsenal Workers, by County

County	Employment			Salary (\$)		
	Military	Civilians/ Contractors	Total	Military	Civilians/ Contractors	Total
Madison	791	27,561	28,352	69,755,070	2,430,706,485	2,500,461,556
Limestone	57	1,979	2,035	4,788,272	166,853,572	171,641,843
Morgan	45	1,559	1,603	3,908,522	136,197,552	140,106,074
Marshall	40	1,408	1,448	3,446,462	120,096,479	123,542,942
Total	933	32,506	33,439	81,898,326	2,853,854,088	2,935,752,415

The numbers in Table 2 reflect a handful of important adjustments. Redstone Arsenal provided County-level data on employee residence and total salary, but those data did not distinguish different types of employees. Personnel figures from the Army Stationing and Installation Plan showed that just 2.7% of Redstone Arsenal employees were military personnel as of Fiscal Year 2011. We applied this number to the total employment counts to estimate military employment by County. Because the pay of on-post contractors is based on the pay grades of Department of Defense civilians performing similar work, we treated civilians and contractors as a single class of personnel. We then entered total compensation by County into Implan, using the industry codes for military (military personnel) and federal government (civilians and contractors).

Under some circumstances, it could be advisable to add a further round of analysis to these estimates – such as importing family-structure information from the Census to modify the spending assumptions for Redstone Arsenal households, or adjusting procurement spending based on the service-type codes attached to Redstone Arsenal contracts. But these adjustments would be likely to impart a high ratio of error and uncertainty, and their potential payoff in terms of accuracy would be small. The approach outline above represents the optimal balance of detail and simplicity.

II. THE ECONOMIC IMPACT OF REDSTONE ARSENAL

After accounting for direct, indirect and induced impacts, we estimate the total economic impact of Redstone Arsenal on Limestone, Madison, Morgan and Lawrence Counties at \$10.57 billion per year. Table 3 summarizes the contributions of procurement and personnel to this total:

Huntsville, will likely leak out of the region more quickly, as local businesses have stronger ties to firms outside the four-county Huntsville area. County-by-county counts of Redstone Arsenal personnel allow us to incorporate these realities into the model.

The Economic Impact of Redstone Arsenal

Table 3: Total Economic Impact of Redstone Arsenal, 2010

Figures denote total value of goods and services produced as a result of RSA activity

	Procurement	Redstone Arsenal Personnel	Procurement + Personnel
Direct Impact: Federal spending on Redstone Arsenal personnel and contracts	\$4,093,884,000	\$2,777,754,000	\$6,871,638,000
Indirect Impact: Contractors' spending on materials, services and subcontracts	\$1,049,513,000	\$0	\$1,049,513,000
Induced Impact: Economic activity generated as employees of Redstone Arsenal and its contractors spend their income	\$1,277,127,000	\$1,371,503,000	\$2,648,630,000
Total Impact:	\$6,420,524,000	\$4,149,257,000	\$10,569,780,000

Dollar totals reflect total value of goods and services purchased

Overall, procurement generates approximately one and one-half times as much local activity as payroll. This owes to the large volume of total procurement from Redstone Arsenal, and to the indirect impacts of contracting – the extensive local purchases Redstone contractors make to fulfill their contracts. As discussed in Section I, the desirability of treating procurement as a distinctive economic activity means that we estimate \$0 in indirect economic impacts for Redstone Personnel. In reality, those indirect impacts are covered in the Arsenal's substantial procurement budget, but they could not be modeled that way.

Given that Redstone spends approximately \$1.25 billion more in procurement than on personnel costs, it might be surprising that personnel spending carries a greater induced impact. This reflects the capital-intensive nature of Redstone contracting: while Redstone Arsenal's payroll goes directly to wages, substantial portions of the procurement budget support materials acquisition and the purchase of goods rather than labor. The \$1.28 billion in induced impacts from procurement results from the relatively high pay scales – and significant consumer spending – of the engineers and technicians employed on Redstone contracts.

Table 4 translates these aggregate industry growth figures into employment. While the \$2.78 billion in payroll at Redstone arsenal translates into 33,439 jobs on-post (and an additional 11,700 in industries that respond to the consumer needs of those workers), the \$4.093 billion local procurement budget generates approximately 7,300 fewer jobs. Again, this reflects the capital-intensive nature of procurement contracts, and the reality that a substantial portion of procurement spending goes to materials acquisition and the purchase of services.



The Economic Impact of Redstone Arsenal

Table 4: Total Employment Impact of Redstone Arsenal, 2010

Figures denote total employment generated through Arsenal operation and procurement

	Procurement	Redstone Arsenal Personnel	Procurement + Personnel
Direct Impact: Federal spending on Redstone Arsenal personnel and contracts	26,123	33,439	59,562
Indirect Impact: Contractors' spending on materials, services and subcontracts	8,263	0	8,263
Induced Impact: Economic activity generated as employees of Redstone Arsenal and its contractors spend their income	10,935	11,734	22,669
Total Impact:	45,321	45,173	90,494

Through direct employment, procurement, and the spending of on-post workers and employees of contractors, Redstone Arsenal accounts for approximately 90,500 jobs in the four-county area – nearly 35% of the total December, 2011 employment of 261,100. Impact of this magnitude suggests the need to map the Arsenal's local footprint as fully as possible. The rest of this report takes up that task, beginning with a measure of wages. The inter-industry accounts in Implan – the web of transactions between firms, government and workers – allow us to estimate the total labor income, or employee salary and benefits, paid as the result of Redstone Arsenal. We estimate that residents of the four-county region earn nearly \$6.4 billion in annual wage payments from Redstone Arsenal and its associated activities (Table 5):

Table 5: Labor Income from Redstone Arsenal and Associated Activities, 2010

Total wages, salary and benefits paid to employees of Redstone Arsenal, its contractors and other impacted local businesses

Source of Impact	Total 2010 Labor Income Earned
Procurement	\$3,060,700,711
Personnel	\$3,333,204,918
Total	\$6,393,905,629

Note: Labor Income totals include direct, indirect and induced impacts

Like any large economic engine, Redstone Arsenal generates substantial tax revenues in its home region. While the tax-revenue estimates provided by Implan are typically less accurate than its industry estimates, they nevertheless provide a good starting point for assessing tax revenue impacts. Our findings suggest that procurement and personnel at Redstone Arsenal cumulatively generate



The Economic Impact of Redstone Arsenal

approximately \$361.6 million in state and local tax revenues per year, a figure that compares well with outside estimates (Table 6):

Table 6: State and Local Tax Impacts from Redstone Arsenal and Associated Activities, 2010

Total tax revenues generated through activities at Redstone Arsenal and impacted contractors and local businesses

Source of Impact	Total Tax Revenues
Procurement	\$196,763,157
Personnel	\$164,805,329
Total	\$361,568,486

*Note: Tax revenue totals include direct, indirect and induced impacts
The Implan software does not differentiate tax revenues by type of economic activity.*

By every big-picture measure, Redstone Arsenal accounts for a remarkably large portion of the Tennessee Valley region economy. For many of the measures detailed above, its influence is larger than the influence of a dominant employer in a company town. Understanding the size of these impacts is a crucial first step towards assessing policy options around the local economy. But in addition to size, economic development efforts often address issues of economic *structure* – of the comparative size of individual industries, and of the linkages between certain key firms. We take up this question below.

III. IDENTIFYING KEY INDUSTRIES AND IMPACTS

The web of economic relationships we used to assess Redstone Arsenal’s impact on the Tennessee Valley regional economy also allows us to identify particular industries and sectors likely to be impacted by shifts in procurement and personnel. The Implan model provides employment and output estimates for hundreds of industries. This means that industry-by-industry listings are useful in theory, but the need to sort through a large set of industries often dilutes the impact of the information. In this section, we provide tables of the 20 most heavily impacted industries for each type of activity at Redstone Arsenal. These tables provide a starting point from which local analysts can begin to investigate the Huntsville economy.

While economists measure industry size in terms of output – that is, the value of total goods and services provided – most policymakers treat employment as the key metric. Table 7 lists the top 20 industries impacted by Redstone Arsenal. The employment column denotes the total amount of industry employment in the 4-county Tennessee Valley region attributable to Redstone Arsenal and its day-to-day activities, contracting, and employee payroll. This is only a partial list of the impacted sectors, and it serves to illustrate the key private-sector industries that benefit from Redstone Arsenal’s presence.



Table 7: Top 20 Most Impacted Industries by Employment, 2010

Industry	Employment
Federal govt. non-military	32,506
Architectural, engineering, and related services	11,599
Food services and drinking places	4,509
Computer systems design services	3,835
Management, scientific, and technical consulting services	3,697
Scientific research and development services	2,960
Custom computer programming services	2,716
Employment services	1,730
Accounting, tax preparation, bookkeeping, and payroll services	1,673
Real estate establishments	1,510
Offices of physicians, dentists, and other health practitioners	1,479
Federal govt. military	1,143
Retail Stores - General merchandise	946
Nursing and residential care facilities	909
Retail Stores - Food and beverage	858
Guided missile and space vehicle manufacturing	767
Retail Stores - Motor vehicle and parts	756
Wholesale trade businesses	722
Private household operations	682
Retail Stores - Clothing and clothing accessories	636

As expected, the federal government is the industry most strongly impacted by Redstone Arsenal. Our estimate of the Arsenal’s impacts identifies several other significantly impacted industries, especially architectural, engineering and related services. Our findings suggest that this high-wage sector is responsible for employing 11,600 individuals as a result of Redstone Arsenal’s activities. The other significantly impacted industries reflect the large contributions of defense contracting and consumer spending to the local economy. Computer systems design services; management, scientific, and technical consulting services; scientific research and development services; custom computer programming services and guided missile and space vehicle manufacturing cumulatively employ more than 15,000 area workers as a result of Redstone Arsenal contracts. At the same time, consumer spending from Redstone employees (and from employees of the industries stimulated by Redstone contracts) contributes thousands of extra jobs in real estate, food services, medical care and other industries. These industries are key recipients of consumer spending in *any* economy. Table 7 simply highlights the extra activity these businesses receive as a result of Redstone Arsenal’s presence in the local economy.

Table 8 provides an alternate measure of the industries impacted by Redstone Arsenal, identifying the top-20 impacted sectors in terms of total labor income –wages and compensation – paid:



Table 8: Top 20 Most Impacted Industries by Labor Income, 2010

Industry	Income
Federal govt. non-military*	\$2,853,854,216
Architectural, engineering, and related services	\$1,015,262,005
Computer systems design services	\$358,029,662
Management, scientific, and technical consulting services	\$297,421,453
Scientific research and development services	\$286,008,662
Custom computer programming services	\$233,372,008
Guided missile and space vehicle manufacturing	\$135,822,838
Offices of physicians, dentists, and other health practitioners	\$123,121,936
Federal govt. military*	\$81,898,331
Accounting, tax preparation, bookkeeping, and payroll services	\$78,691,296
Food services and drinking places	\$75,408,259
Aircraft manufacturing	\$52,497,252
Wholesale trade businesses	\$51,216,067
Employment services	\$35,021,627
Retail Stores - Motor vehicle and parts	\$33,095,617
Monetary authorities and depository credit intermediation activities	\$32,494,480
Real estate establishments	\$32,201,613
Retail Stores - General merchandise	\$27,249,748
Nursing and residential care facilities	\$26,575,892
Retail Stores - Food and beverage	\$22,200,684

*We replaced Implan-generated estimates of income with actual income figures reported by Redstone Arsenal.

By taking total income, rather than raw employment accounts, into account, Table 8 provides a different perspective on the industries impacted by Redstone Arsenal. Food services, retail and other consumer industries still appear on this list. But due to their significantly lower pay rates, they appear further down the list. Instead, research and development-focused industries dominate the top 10, and the large role played by some sectors absent from Table 5 – such as aircraft manufacturing – becomes apparent.

Table 9 presents a more traditional picture of the impacted industries, listing the top 20 in terms of output, or total volume of business. All things being equal, capital-intensive industries – those that use a high ratio of raw materials and technology relative to labor – will appear higher on this list than on the list of high-employment or high labor-income industries:



Table 9: Top 20 Most Impacted Industries by Economic Output, 2010

Industry	Output
Federal govt, non-military	\$2,695,146,565
Architectural, engineering, and related services	\$1,631,598,013
Management, scientific, and technical consulting services	\$540,623,638
Imputed rental activity for owner-occupied dwellings*	\$494,936,904
Scientific research and development services	\$456,326,965
Guided missile and space vehicle manufacturing	\$450,311,583
Aircraft manufacturing	\$428,977,779
Custom computer programming services	\$353,798,258
Computer systems design services	\$329,504,796
Food services and drinking places	\$227,990,848
Offices of physicians, dentists, and other health practitioners	\$199,416,006
Real estate establishments	\$196,205,516
Accounting, tax preparation, bookkeeping, and payroll services	\$144,961,267
Wholesale trade businesses	\$136,226,727
Monetary authorities and depository credit intermediation activities	\$118,275,204
Federal govt, military	\$82,607,368
Telecommunications	\$80,529,284
Insurance carriers	\$77,000,490
Pharmaceutical preparation manufacturing	\$68,355,963
Federal electric utilities	\$67,862,064

*This sector accounts for rental activity – the confusing “imputed” in the title reflects Implan’s internal accounting mechanisms.

This list of impacted industries can help policymakers to identify strategically important sectors that account for much of the crucial work in the region’s defense contracting activities. Sectors with smaller payrolls and employment counts, but significant volumes of business, are crucial to local economic activity, even if they contribute a comparatively small amount of jobs and income.

IV. ESTIMATING THE IMPACT OF FUTURE CHANGES AT REDSTONE ARSENAL

There is no way to predict future shifts in funding and funding priorities at Redstone Arsenal. Realistically, changes three, five or ten years in the future will require an updated economic modeling exercise, and ideally one that takes advantage of future refinements to the Implan software models. But while this definitely limits the future uses of this study, there are several productive ways to put the estimates in this report to use in the mid-range future. One useful approach is to convert the impact estimates from this study into unit multipliers – generalized estimates of total changes in economic impact – that can be used to quickly estimate the overall magnitude of announced changes at Redstone Arsenal.

We begin by providing a procurement multiplier. All things being equal, a \$10 million change in procurement spending in the 4-County core Huntsville area will result in the following impacts (Table 10):

**Table 10: Estimated Impact of \$10 million in additional procurement
Four-County Huntsville Region**

Impact Type	Employment	Labor Income (\$)	Output (\$)	Tax (\$)
Direct	64	5,348,510	10,000,000	n.a.
Indirect	20	841,792	2,486,193	n.a.
Induced	27	850,834	2,961,934	n.a.
Total	111	7,041,136	15,448,127	452,537
Multiplier	1.74	1.32	1.54	n.a.

Estimates based on 2010 activities at Redstone Arsenal.

These figures can easily be scaled up or down to match the size of the projected change in procurement activity. While the overall employment level may seem small, this is an expected result. As discussed above, procurement from Redstone Arsenal typically focuses on capital-intensive industries. While employees of those industries are well-paid (a fact that leads to significant induced spending and a high employment multiplier for procurement), the total number of workers employed per level of output is small compared to other industries.

A change in the level of employment on-post will yield different results (Table 11):

**Table 11: Estimated Impact of 1,000 new On-Post Military/Civilian/Contractor Employees
Four-County Huntsville Region**

Impact Type	Employment	Labor Income (\$)	Output (\$)	Tax (\$)
Direct	1,000	87,794,632	128,609,416	n.a.
Indirect	0	0	0	n.a.
Induced	373	11,885,943	41,349,111	n.a.
Total	1,373	99,680,575	169,958,527	5,864,351
Multiplier	1.37	1.14	1.32	n.a.

Estimates based on 2010 activities at Redstone Arsenal.

As discussed earlier, limitations in the Implan model force us to attribute all indirect impacts for on-post workers to procurement. In reality, changes in employment should almost always be accompanied by changes in procurement, and analysts in the Huntsville region would do well to analyze the changes jointly. On its own terms, Table 11 suggests that for every 1,000 new civilians on-post, the region will gain \$99.7 million in labor income, \$170 million in total economic output, and approximately 1,373 jobs. Local analysts should expect these impacts to be greater if the employment growth skews towards civilians who occupy advanced General Schedule grades, and lower if the changes bring a large number of enlisted troops or entry-level civilians to the region. By their nature, these numbers cannot be comprehensive, but they offer starting points from which local planning agencies can quickly ascertain the size of future economic development challenges related to changes at Redstone Arsenal.





APPENDIX

Appendix 1: Assumptions

This economic impact study depends on the use of input-output models of the economy. Input-output models trace the purchasing relationships among businesses, government, and consumers to provide a full accounting of the way spending flows through a regional economy. By accounting for linkages across industries and other economic sectors, studies that use these models are able to document the multiple ways in which a change in one industry impacts other industries and consumers.

Like any other economic model, an input-output model is a simplification of the complex world. In order to convert the complexities of economic life into a fixed set of mathematic relationships, the parties who construct the model – as well as the parties who use it – are required to make several central assumptions that will not hold in all situations. The first assumption is that economic impacts are “linear,” and that they provide constant returns to scale. Under this assumption, if \$1 of new business in the Huntsville area triggers \$2 in total economic activity, then \$100,000 will trigger \$200,000, and \$10 million will trigger \$20 million and \$1 billion will trigger \$2 billion. In practice, this is not likely to be the case. A plant operating at full capacity might not be able to increase its capacity without undertaking aggressive capital investment, hiring new workers in a tight labor market, or acquiring expensive new property – realities that will impact the ratio of total economic activity to the direct impact. These common business practices are examples of the “non-linear” reality of business. But to simplify the use of the input-output model, we assume a fixed relationship between direct economic impacts and indirect and induced impacts.

A second key assumption is that supplies are unconstrained. In other words, input-output models assume that Industries have unfettered access to raw materials and that their output is limited only by the demand for their products. In the world of business, rising demand creates scarcity. Just as the housing boom of the mid-2000s drove up prices for construction materials and China’s rising industrial output has created scarcities in concrete and energy supply, diverting hundreds of millions in federal contracts to a region will inevitably create some shortages in labor, materials, services and raw inputs. Our analysis is not able to take these factors into account.

A third key assumption is that firms do not substitute inputs for one another. Input-output analysis will not be as accurate in cases in which a long-term spike in costs or a shortage in supply causes businesses to develop new suppliers or make their products differently (by substituting advanced machinery for labor, for example). Our analysis can only establish how spending would flow through the economy at a fixed point in time, not how the structure of the economy would change as a result of that spending. The limitations inherent in input-output modeling make local knowledge of economic circumstances more valuable. If key industries operate under unusual or special conditions, please let us know so that we can refine our analysis and ensure that the data and analyses you receive are as accurate as possible.



The Economic Impact of Redstone Arsenal

Appendix 2: Alternate Economic Impacts based on a 14-County Commuting Shed

Approximately 99% of Redstone Arsenal’s procurement contracts go to firms in the Madison-Limestone-Morgan-Marshall County region. But the high pay levels of Redstone Arsenal jobs relative to those in the surrounding region induce nearly 7,000 workers to commute in from 10 other counties nearby in Alabama and Tennessee. This means that an economic impact estimate for the four-county core region will discount the \$189 million these workers spend near home. As a supplement to the analysis in the body of the report, this appendix provides estimates of the total economic impact of Redstone Arsenal across that 14-county region.

Expanding the analysis to cover these 10 “collar” counties increases the total estimate of economic impact by approximately \$600 million. Table 2.1 summarizes our entries into IMPLAN for those 14 counties. In each case, we apportioned the total number of employees residing in a county by the overall share of military vs. civilian/contractor employees on-post.

Table 2.1: Distribution of Redstone Arsenal Employment in 14-County Region, 2011

County /State	Employment			Salary (\$)		
	Military	Civilians/ Contractors	Total	Military	Civilians/ Contractors	Total
Madison	791	27,561	28,352	69,755,070	2,430,706,485	2,500,461,556
Limestone	57	1,979	2,035	4,788,272	166,853,572	171,641,843
Morgan	45	1,559	1,603	3,908,522	136,197,552	140,106,074
Marshall	40	1,408	1,448	3,446,462	120,096,479	123,542,942
Jackson	8	272	280	673,371	23,464,475	24,137,845
Cullman	7	229	235	477,917	16,653,644	17,131,561
Lauderdale	5	185	191	385,849	13,445,398	13,831,247
Lawrence	1	52	54	115,890	4,038,323	4,154,212
Colbert	1	49	51	113,576	3,957,700	4,071,276
DeKalb	1	41	42	83,831	2,921,213	3,005,044
Other AL ⁷	5	191	197	453,316	15,796,380	16,249,696
Tennessee ⁸	35	1,205	1,240	2,976,190	103,709,240	106,685,430
Sub-total	997	34,731	35,728	87,178,265	3,037,840,461	3,125,018,726
Adjusted Total ⁹	991	34,540	35,531	86,724,950	3,022,044,081	3,108,769,030

⁷ RSA employees whose place of residence is not specified in Alabama are assumed to be out of the 14-county region and as a result, they are not included in the model.

⁸ The 1,240 Redstone Arsenal employees living in Tennessee are assumed to reside in Lawrence, Giles, Lincoln, and Franklin Counties.

⁹ “Adjusted Total” reflects the total minus employees who live in Alabama, but outside the 10 Alabama counties listed in Table 2.1. These 197 employees are excluded from the estimate of impact.



The Economic Impact of Redstone Arsenal

Entering these adjusted employment totals into Implan yields the following results (Table 2.2):

Table 2.2: Summary Impacts (2011 dollars)

Impact Type	Employment	Labor Income (\$)	Output (\$)	Tax (\$)
Direct	62,086	5,425,542,507	7,035,343,193	n.a.
Indirect	9,427	396,684,781	1,132,479,991	n.a.
Induced	29,712	960,754,026	3,300,681,632	n.a.
Total	101,225	6,782,981,315	11,468,504,816	399,690,821

Table 2.3 lists the top 20 industries impacted, in order of employment.

Table 2.3: Top 20 Most Impacted Industries by Employment

Industry	Employment
* Employment and payroll only (federal govt. non-military)	34,540
Architectural, engineering, and related services	11,738
Food services and drinking places	5,178
Computer systems design services	3,927
Management, scientific, and technical consulting services	3,904
Scientific research and development services	2,958
Custom computer programming services	2,841
Employment services	2,286
Offices of physicians, dentists, and other health practitioners	1,851
Accounting, tax preparation, bookkeeping, and payroll services	1,830
Real estate establishments	1,561
Nursing and residential care facilities	1,256
Retail Stores - General merchandise	1,141
Retail Stores - Food and beverage	1,037
* Employment and payroll only (federal govt. military)	991
Wholesale trade businesses	980
Private household operations	949
Retail Stores - Motor vehicle and parts	936
Guided missile and space vehicle manufacturing	763
Monetary authorities and depository credit intermediation activities	718

Table 2.4 provides an alternate measure of the industries impacted by Redstone Arsenal, identifying the top-20 impacted sectors in terms of total labor income –wages and compensation – paid:



The Economic Impact of Redstone Arsenal

Table 2.4: Top 20 Most Impacted Industries by Labor Income

Industry	Income (\$)
* Employment and payroll only (federal govt. non-military)	6,782,981,315
Architectural, engineering, and related services	3,022,044,084
Computer systems design services	1,011,735,122
Management, scientific, and technical consulting services	361,662,216
Scientific research and development services	300,904,936
Custom computer programming services	290,601,377
Offices of physicians, dentists, and other health practitioners	230,939,607
Guided missile and space vehicle manufacturing	143,132,692
* Employment and payroll only (federal govt. military)	135,119,546
Food services and drinking places	86,724,955
Accounting, tax preparation, bookkeeping, and payroll services	83,918,367
Wholesale trade businesses	80,168,857
Aircraft manufacturing	61,226,233
Employment services	52,348,016
Monetary authorities and depository credit intermediation activities	45,225,583
Retail Stores - Motor vehicle and parts	37,595,182
Nursing and residential care facilities	37,291,279
Private hospitals	36,803,813
Retail Stores - General merchandise	32,906,820
Real estate establishments	32,284,985

*We replaced Implan-generated estimates of income with actual income figures reported by Redstone Arsenal.

Table 2.5 presents a more traditional picture of the impacted industries, listing the top 20 in terms of output, or total volume of business. All things being equal, capital-intensive industries – those that use a high ratio of raw materials and technology relative to labor – will appear higher on this list than on the list of high-employment or high labor-income industries:

Table 2.5: Top 20 Most Impacted Industries by Economic Output

Industry	Output (\$)
* Employment and payroll only (federal govt. non-military)	2,853,983,800
Architectural, engineering, and related services	1,633,931,819
Imputed rental activity for owner-occupied dwellings	569,802,740
Management, scientific, and technical consulting services	553,989,730
Scientific research and development services	460,656,832
Guided missile and space vehicle manufacturing	447,979,867
Aircraft manufacturing	427,758,307
Custom computer programming services	355,259,114
Computer systems design services	333,588,329
Food services and drinking places	257,079,616
Offices of physicians, dentists, and other health practitioners	233,191,473
Real estate establishments	191,940,480
Wholesale trade businesses	164,206,739
Accounting, tax preparation, bookkeeping, and payroll services	149,224,694
Monetary authorities and depository credit intermediation activities	136,766,028
Telecommunications	120,082,179
* Employment and payroll only (federal govt. military)	87,475,792
Insurance carriers	78,703,141
Other state and local government enterprises	74,580,864
Federal electric utilities	73,479,401

*This sector accounts for rental activity – the confusing “imputed” in the title reflects Implan’s internal accounting mechanisms.

