

## UNITED STATES AIR SUPREMACY: GOVERNMENT PURCHASING AND SUPPLY CHAIN MANAGEMENT OF THE F-22 RAPTOR

Joshua M. Steinfeld\*

**ABSTRACT.** The F-22 Raptor provided the U.S. military with air supremacy in the 21<sup>st</sup> century. U.S. Federal government purchases of the F-22 and overall supply chain management of the advanced tactical fighter (ATF) development program were met with a continuous stream of obstacles. However, through Defense Technological Industrial Base (DTIB) and related Foreign Military Sales (FMS) initiatives, the ATF program spring-boarded the initial expansion of the U.S. military industrial complex into the formation of a more powerful U.S. military industrial organization and procurement facility. On the other hand, the distribution of intelligence-sensitive air dominant aircrafts to foreign countries gives rise to U.S. national security risks. Classical theory and related approaches to public administration are presented to supplement public procurement and supply chain analysis of the F-22 Raptor, which is on the verge of extinction despite its air-to-air combat superiority. Institutional transformation in the form of *drift*, *conversion*, *layering*, and *displacement* helps provide for an explanation to changes in military leadership strategy and subsequent utilization of resources by military producers and consumers.

---

\* Joshua M. Steinfeld is a Ph.D. student in the School of Public Administration at Florida Atlantic University. His research interests are in the areas of public procurement, public budgeting & finance, and organizational behavior.

## INTRODUCTION

The U.S. Federal government's purchase and supply chain management of the F-22 Raptor highlights bright spots regarding design and supplier alliances but reveals failure in its overall development and procurement. Over 30 years passed between inception of the U.S. Air Force's plan to build the F-22 Raptor, the world's only air-to-air dominant advanced tactical fighter (ATF) jet to feature thrust vectoring, supermaneuverability, and supersonic speed, and the U.S. Federal government's ability to procure the first F-22 for combat use. The new-to-the-world technology and production methods that would be incorporated into the ATF development program demanded the backing and resource commitment of both the Federal government and private sector. The main purpose of this essay is to present a discussion of the challenges, consequences, and externalities that resulted from the U.S. government's procurement and subsequent overseas distribution of ATF's, in particular the F-22 Raptor. First, the main themes of the Federalist debate are presented to provide a conceptual framework for the U.S. Federal governments' procurement objectives regarding expansive ATF development and production programs led by a powerful executive branch. Then, institutional change during the Vietnam War (*drift*), Kosovo War (*conversion*), and Overseas Contingency Operation (*layering*), is discussed to serve as a backdrop for the transformation experienced as a result of the Obama-led procurement phase of the F-22, which surfaces in the form of *displacement*.

Third, the design and development phases of the F-22 Raptor are summarized to emphasize the supplier alliances and prisoner's dilemma that ensued from the Air Force's requirement that contractors invest their own capital into the research & development of the ATF program. A discussion of the Lend-Lease Act follows, which established the emergence of the Defense Technological Industrial Base (DTIB) and related Foreign Military Sales (FMS) programs, indicating that weapons production is not limited for the sole purpose of use by U.S. forces, but instead as a means of profiting through overseas weapons distribution. Next, focus shifts to design and resource externalities, in which titanium shocks that resulted from

the U.S. government's predictable procurement schedule induced the Air Force to redesign the F-22 Raptor; titanium producers were left holding-the-bag when U.S. public procurement objectives regarding the F-22 were halted.

Although procurement performance and efficiency regarding the F-22 has been questionable based on poor development processes, the superior design of the F-22 and related ATF's have had a drastic impact on expanding the DTIB and related U.S. military industrial complex through ATF ramp-up and overseas distribution. Thus, a conflict of interest arises between the desire of U.S. military industrial companies to sell ATF's to foreign countries for profit and sacrificing national security interests in doing so. Nonetheless, a transition from a U.S. military industrial complex, characteristic of the initial objectives of the Lend-Lease Act, has transformed into a military procurement facility that aims to profit from the initial procurement of innovative weapons products, and then the subsequent sale of such products to foreign nations once the technology is deemed inferior. However, there is debate as to when technologies become outdated. For example, it can be argued that the F-35 Lightning II, which is set to replace the F-22 Raptor, is an inferior fighting machine. It is recommended that the F-22 Raptor not be sold by the U.S. government to other nations until it is certain that the F-35 is uniquely dominant over the F-22; which has not yet been determined. Finally, two areas are recommended for further research. First, inquiry as to the strengthening of the U.S. military industrial complex into what may be called the U.S. military industrial organization and procurement facility should be pursued. Second, analyses of the ways in which U.S. Federal investment capacity can be increased to ease financial constraints on both defense and non-defense related capital streams should be conducted to minimize the reliance of the U.S. government on FMS and facilitate the continued development of superior combat fighter jets.

## METHODS

Scholarly research serves as the basis for investigation and analysis of U.S. air supremacy. In contrast to other scholarly works,

the top-secret and classified nature of intelligence in the development, design, production, and distribution of U.S. military air dominant equipment and related technologies requires the exploration of industry specific journals and periodicals that may be intra-organizational in production and readership. Examples of such resources include daily periodicals reported on by U.S. military service personnel that are circulated among other U.S. military service personnel departments. Additionally, in some cases, personal accounts, applied understanding, and simple numerical figures replace the use of empirical data. When dealing with U.S. military primary objective endeavors that involve sensitive and classified information, there is a lack of free-flow and openness of data. However, numerous experienced position-specific military personnel have surfaced through writing in recent years to provide for information gathering and research.

The background underlying the demand for development of the F-22 is presented through use of well-respected literature on U.S. war policy of past military conflicts. Colonial manuscripts also help to position the topic within a broad framework for discussion. In examination of the F-22's design phase, reflection on scientific and technical aspects of the aircraft are highlighted to illustrate the intricacies and challenges to product development. Text and other objective books on purchasing, supply chain management, and procurement supplement the writing to help organize core concepts. Finally, theoretical works on public administration provide support for concluding statements.

## LITERATURE REVIEW

### GOVERNMENT PURCHASING AND FEDERALIST UNDERPINNINGS

The concept of government purchasing raises discussion on Federalism and the debate between the Federalists and Anti-Federalists. The notion that a central authority such as the U.S. President has the ability to dictate large-scale military procurement activities that have exceeded \$700 Billion for a single deal, as in the case of the F-22, is Federalist by origin. Security against foreign danger is one of the fundamental ambitions of civil society. It was a

well-recognized and essential object of the American Union. The powers required for attaining it should be confided to the federal institutions (Madison 1788). *The Federalist Papers*, written by Madison, Hamilton, and Jay, were formal attempts to support the idea of a central Constitutional charter and counter propaganda originating in New York City regarding instability of the Union (Kesler & Rossiter 1999). Opponents of a strong central authority were Anti-Federalists like Virginian Patrick Henry. To paraphrase him would be to say: We have just overthrown a tyrant (King George III of England) only to replace him with the tyranny of another central authority (Henry 1788). The Anti-Federalist Papers were less formally compiled than the Federalist Papers and were presented in Virginia at the Ratification Convention, a state where leaders like George Mason signed the Virginia Declaration of Rights but refused to sign the Constitution. Patrick Henry said the following at the Virginia Ratification Convention: "I firmly believe, no country in the world had ever a more patriotic army, than the one which so ably served this country in the late war. But had the General who commanded them been possessed of the spirit of Julius Caesar or a Cromwell, the liberties of this country [might have] in all probability terminated with the war" (Henry 1788). Henry believed that military leadership by central command posed dangers to the sustainability of freedom.

Both Federalist and Anti-Federalists agreed that American democracy was favorable to British tyranny. The development of a democracy is a long and certainly incomplete struggle to do three things: 1) to check arbitrary leaders, 2) to replace arbitrary leaders with just and rational ones, and 3) to obtain a share of influence and participation in the establishment of policy (Moore 1966). While at a glance it appears that U.S. procurement of military equipment is solely for purposes of security defense, the peddling of aircrafts valued at upwards of \$350 Million for which there is international demand for, challenges the straight security argument. Representative government originated not as a democratic function but as a device by which nondemocratic governments- monarchs, mainly- could lay their hands on national treasure and other resources they wanted, particularly for armament hoarding and trading" (Dahl 1998).

## INSTITUTIONAL TRANSFORMATION AS RAMP-UP FOR ATF PROGRAM

The Lockheed Martin/ Boeing F-22 Raptor, powered by Pratt and Whitney F119 engines, is the result of the Advanced Tactical Fighter (ATF) development program. The ATF development program was created in response to institutional transformations regarding war policy and U.S. military leadership. The Vietnam War, Kosovo War, and Overseas Contingency Operation are examples of conflicts that demonstrate institutional change. The three aforementioned wars are of major focus here because each war demonstrates pivotal, subsequent shifts in U.S. military policy according to predictable institutional transformation such as that demonstrated by Mahoney & Thelen (2010), Slater (2010), & Hacker (2005). The Vietnam War was a conflict characterized by a policy of *drift*. In a policy of *drift*, rules remain formally the same, but their impact changes as a result of shifts in external conditions (Hacker 2005). The U.S. flip-flopping from a policy of financing French bombardment against, to full military support of the Republic of Vietnam, is authoritarian and an example of war policy drift. “An authoritarian regime’s defining institutions are sticky, not entirely stuck...Historical institutionalists have recently shown how regimes’ long-term strength can derive in a highly path-dependent way from the circumstances of their origins” (Slater 2010).

The Vietnam War spanned the administration of 5 U.S. Presidents, each with a different approach to Vietnam. *Drift* at the Presidential level was responsible for the conscious poisoning of Vietnamese civilians. A discussion between President Roosevelt and White House Chief of Staff, Admiral William D. Leahy determined that Agent Orange should not be used against the Japanese because of its toxic qualities. Agent Orange was not used during World War II. Yet, in 1961 President Kennedy signed two orders allowing Agent Orange to be used in Vietnam. One order was to destroy crops, and another order was to defoliate the jungle to take away locals’ hiding places (Moore 2009 August 21). Hundreds of thousands of birth defects in Vietnam have resulted (Griffiths 2003).

“Was the Vietnam debacle caused by a mentality of blinkered militarist authoritarianism- or by a failure to be authoritarian

enough?...Commonly observed failings in public management- and the one most likely to be associated with the egalitarian approach to organization- is a lack of ability to resolve disputes or exert effective authority [to resolve war]" (Hood 1998). U.S. presidential leadership failures in the Vietnam War led to the enactment of the War Powers Act of 1973, which limited the President's power to declare war and established the requirement of Congressional approval within 60 days of any military engagement in which hostilities are involved in order to receive funding for the military activity (Public Law 1973).

The Kosovo War was the watershed event that shifted war policy from *drift* to *conversion*. Conversion occurs when rules remain formally the same but are interpreted and enacted in new ways. This gap between the rules and their instantiation is not driven by neglect in the face of a changed setting (as is true for *drift*), instead the gap is produced by actors who actively exploit the inherent ambiguities of the institutions. Through redeployment, they convert the institution to new goals, functions, or purposes (Mahoney & Thelen 2010).

The high ranking officers of the Armed Forces, after experiencing a bitter defeat in Vietnam, a war they thought could have been won by the U.S. if they had not been forced to fight with one hand tied behind their back, were now determined that the next military conflict would be an example of a steam roll victory facilitated by air supremacy. All military resources and capabilities would be exhausted (Fromkin 1999). "The 49 sorties flown by the B-2 Stealth Bombers during Operation Allied Force (Kosovo) constituted the first ever large-scale effort to mount a long-range offensive from a secure base on American soil. The B-2's took off from Whiteman Air Force Base, Missouri, refueled twice in mid air on the way to Kosovo and twice again on the return leg" (Vickers 2001). The Kosovo War ended just 60 days after the 1<sup>st</sup> U.S. led North Atlantic Treaty Organization (NATO) strike on March 24, 1999 (Elsie 2011). In contrast, the Vietnam War lasted 32 years and the Overseas Contingency Operation (formerly the War on Terror) has been going on for 10 years with no end in sight.

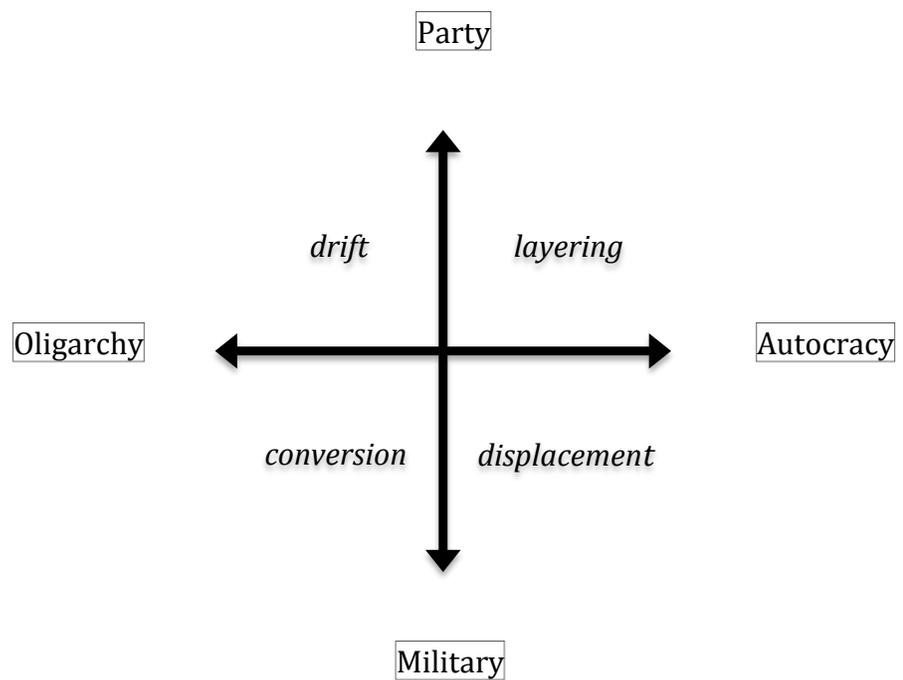
One of President Obama's first initiatives upon election to the Presidency was to change the name of the War on Terror to the Overseas Contingency Operation (Wilson & Kamen 2009). This was

an example of layering by the Obama administration. “With *layering*, institutional change grows out of the attachment of new institutions or rules onto or alongside existing ones. While powerful veto players can protect the old institutions, they can not necessarily prevent the addition of new elements” (Mahoney and Thelen 2010). The name change broadened the scope of the war to facilitate inclusion of potential adversaries. Additional layering took place when President Obama’s cabinet attorneys questioned the very meaning of the word *hostilities* in attempts to circumvent the 60-day funding constraint set forth by the War Powers Act of 1973.

Institutional *displacement* within the U.S. military industrial organization and procurement facility in regards to ATF purchasing and distribution involves the abrupt or gradual shutting down of institutional frameworks such as the F-22 production pipeline (Mahoney & Thelen 2010). *Displacement* can also refer to the deployment of a military dominated organization such as the U.S. military industrial complex (Slater 2010). Instead of building a party that might rival the military, an organization is deployed that has long been dominated by the military. One example of such military dominance of institutions would be to consider the large portion (~40%) defense spending makes up of total U.S. Federal investment outlays.

A three-step shift from *drift* to *displacement* in America’s war policy has evolved toward a tendency of military production. First, in the Vietnam War, *drift* resulted from continuous change of political leadership (five Presidential administrations) and indecisiveness within the military leadership oligarchy, in which case engagement in the Vietnam War was a vehicle for party lines (Figure 1). Next, the Kosovo War hi-lighted the brisk and overpowering bombardment by oligarchic U.S.-led NATO forces, indicating a shift from *drift* to *conversion*. *Layering* by the Obama administration indicated a change in institutional trend toward peaceful, yet authoritarian democracy (autocracy) by changing the name of the War On Terror to the Overseas Contingency Operation. However, President Obama’s challenging of the War Powers Act of 1973 during the April 2011 U.S. invasion of Libya signified movement from *layering* to *displacement* (Figure 1).

Figure 1- Institutional Complexity and Corresponding Agencies



Source: (Slater 2010)

## RESULTS

### PRODUCT DEVELOPMENT

In October 1986, at the beginning of the demonstration and validation stage of prototype development (Dem/Val), the U.S. DOD committed to the purchase of 750 (72 per year) F-22 Raptors. Five

years later, when the first prototype went airborne in August 1991, the DOD reduced its commitment to 648 (48 per year) F-22's. By the time engineering and manufacturing development (EMD) was complete for the first 9 test F-22's in April 2004, the DOD had lowered its procurement commitment to 277 (Handell et. al. 2005). Delays in the supply chain, mostly created by quality issues such as leaky fuselages and on-board computer malfunctions, contributed to the inability of Lockheed Martin and Boeing to deliver the 750 aircrafts originally ordered by the DOD (Coyle 2007).

As recently as the late 1990's, "the F-22 was intended to be the United States' front-line air superiority fighter from its planned initial operational capability in 2005 through the first quarter of the 21<sup>st</sup> century...providing 'air dominance,' i.e., the ability to not only control all friendly airspace but to dominate hostile airspace at any time and place of the U.S./Allied theater commander's choosing" (Aaronstein et al. 1998). The F-22 achieved this goal through a synergy of key characteristics: 1) stealth, 2) supersonic cruise speeds sustained without the use of afterburners, and 3) integrated avionics.

The ATF program began in the early 1970's, originally with air-to-ground as the primary role. Air-to-air missions began to be considered during the late 1970's and since 1982, when the 43<sup>rd</sup> Fighter Squadron had the pleasure of being the first group of pilots to accept F-15 Eagles, the first generation of ATF aircrafts (Bird 2011). The consistent aim of the ATF program has been to provide what is now referred to as air dominance. Although the F-22 is the world's superior aircraft, numerous problems arose related to purchasing and supply chain.

## PRODUCT DESIGN

One key attribute differentiating the F-22 from other aircrafts is radar technology. The radar technology and related tactical advantages of the F-22 are the major reasons why the F-22 is so highly coveted by the U.S. air force and military procurement officials alike. Ben Rich, who headed Lockheed Martin's famed Skunkworks in Burbank, California from 1975 until he retired in 1991, met an exceptional thirty-six-year old Skunk Works mathematician and radar

specialist named Denys Overholser who decided to drop by his office one afternoon and presented him with the Rosetta Stone breakthrough for stealth technology” (Rich 1994). The gift he handed to Rich over a cup of coffee would make an attack airplane so difficult to detect that it would be invulnerable against the most advanced radar systems yet invented, and survivable even against the most heavily defended targets in the world.

Denys had discovered this nugget deep inside a long, dense technical paper on radar written by one of Russia’s leading experts and published in Moscow nine years earlier. That paper was called *Method of Edge Waves in the Physical Theory of Diffraction* by Pyotr Ufimtsev, a chief scientist at the Moscow Institute of Radio Engineering. Ufimtsev revisited a set of formulas derived by Scottish physicist James Clerk Maxwell from a set of century-old manuscripts, which was later refined by the German electromagnetics expert Arnold Johannes Sommerfeld. These calculations predicted the manner in which a given geometric configuration would reflect electromagnetic radiation. The intent of the stealth studies was to explore the practicality of the application of signature reduction techniques without compromising the system’s operational capability (Miller 1976).

A radar beam is a magnetic field, and the amount of energy reflected back from the target determines its visibility on radar. “The scattering cross section is the equivalent area intercepting the amount of power that, when scattering isotropically, produces at the radar a power density, which is equal to that scattered (or reflected) by the actual target” (Sadiku 2010). Ufimtsev has shown us how to create computer software to accurately calculate the radar cross-section of a given configuration as long as it is in two dimensions. By breaking down an airplane into thousands of flat cross triangular shapes and adding up their individual radar signatures, we can get a precise total of the radar cross section. Why only two dimensions and why only flat plates? Computers did not have enough power and memory capacity to allow for three-dimensional designs, or rounded shapes, which would have required a daunting task of calculations by hand.

## SUPPLIER ALLIANCES

The Air Force initiated a series of conceptual design studies of an ATF in a service-wide effort to explore ways of accomplishing tactical interdiction missions. The Air Force chose three separate contractors for parallel studies in 1976. In addition to design studies, the Flight Dynamics Laboratory (FDL) sponsored two other ATF studies in the area now generally called stealth...FDL commissioned Northrop and Lockheed as its Stealth contractors because they had been working on a stealth fighter program sponsored by the Defense Advanced Research Projects agency. The first formal ATF requirements document, TAC ROC 301-73, was issued in draft form on January 26, 1973. At the time, a Required Operational Capability (ROC) document was the primary document used to identify an operational need and request the development of a new capability to meet such a need. The initial version of the ROC reportedly was written around a high-subsonic aircraft operating at medium altitudes” (Sudheimer 1981).

The draft ROC was circulated to ASD, Air Staff, and other Air Force agencies for comment during 1973. Comments indicated a need for better definition of navigation, fire control, and weapon delivery accuracy requirements, and for efforts to improve survivability through electronic counter measures (ECM) and aircraft radar cross section reduction (Ferguson 1996).

Since early 1974, the Air Force Flight Dynamics Laboratory (AFFDL), part of Air Force Wright Aeronautical Laboratories (AFWAL), had sponsored studies by General Dynamics and McDonnell Douglas to help focus laboratory technology on an Air-to-Ground Advanced Fighter (ATGAF). In 1975, the ATF ROC was revised, renaming and expanding the ATGAF studies to Advanced Tactical Fighter Evaluation and Integration. Funding was provided for a \$2.1 Million study program from 1976-1977, and a request for proposal (RFP) was released in February 1976. Government participation grew to include the Aeronautical Systems Division (ASD) of the Air Force Systems Command (AFSCD), the Armament Development Test Center (ADTC) and the Air Force Armament Laboratory (AFATL), National Aeronautics and Space Administration (NASA), and Tactical Air Command (TAC) (Ferguson 1996).

Supplier alliances evolved to compensate for the numerous bureaus and high cost of participation in the proposal process. Sharing tactical and strategic information is central to the overall performance of the supply chain, especially in highly integrated collaborative projects (Mentzer 2001). Seven companies responded to the Air Force's ATF request for information (RFI): Boeing, General Dynamics, Grumman, Lockheed, McDonnell, Northrop and Rockwell. The RFI process required significant investment from contractors (Figure 2).

**Figure 2- Demonstration and Validation (Dem/Val) Costs**

Description	Cost (Fiscal Year 1990) (\$ Millions)
<b>Government Funding</b>	
Airframe	1097
Critical Subsystems	536
JAFE/ATFE*	1946
Simulator	4
INEWS/ICNIA**	241
<i>Government Subtotal</i>	3824
<b>Contractor Contributions</b>	
Airframe	1325
Engine	200
<i>Contractor Subtotal</i>	1525
Total Dem/Val	5349

\*JAFE- Joint Advanced Fighter Engine

\*ATFE- Advanced Tactical Fighter Engine

\*\*INEWS- Integrated Electronic Warfare System

\*\*ICNIA- Integrated Communication, Navigation, and Identification Electronics

Source: (Aaronstein et. al. 1998)

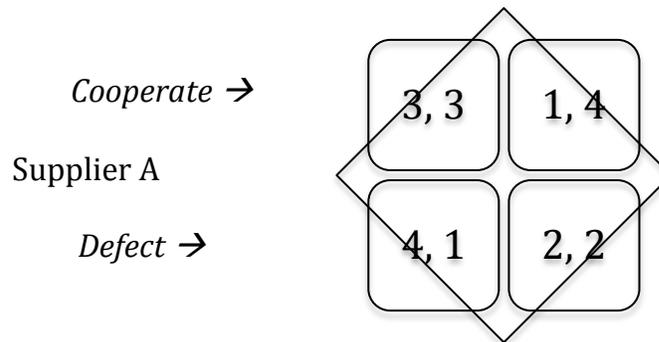
Since, at any time, the U.S. government could reject the RFI proposals or defund the project altogether, the contractors undertook significant financial risk in participating in the RFI process, especially considering it was unknown which contractors, if any, would be awarded the contract. In response, the seven contractors formed an alliance with each other ensuring that each company would be involved in the project in order to recoup their proposal costs at a minimum. The decision to form an alliance is a response to Prisoners' Dilemma. The Prisoners' Dilemma is a situation characterized "by radical uncertainty and interdependent outcomes" (Reisman 1990). If Supplier A cooperates with the alliance, the pay out will be 3 for everyone (Figure 3). If either Supplier A or Suppliers B-Z defect, Suppliers A-Z receive either "1", "2", or "4". Assuming all suppliers are utility maximizers (Hindmoor 2006), the suppliers opt to cooperate, recognizing that a payout of "3" is better than two of the outcomes, "2" and "1", hence "4", is only better than one outcome, "3". The rotated-square standing on a point represents the constant balancing act of managing supplier relationships for the Prisoners' Dilemma to hold true (Figure 3).

### Figure 3- Supplier Prisoners' Dilemma

Suppliers B-Z

*Cooperate*

*Defect*



Source: (Hindmoor 2006)

## DISCUSSION

### POLICY DEPLOYMENT AND ECONOMIES OF SCALE

To address deployment and cost per unit concerns, the Theory of Constraints (TOC) was studied by the F-22 rapid development team and applied to the order, production, and delivery phases of F-22 assembly. The rapid development team was formed to achieve F-22 process transformation. In brief, TOC concludes that changes to most of the variables in an organization usually have only small impacts on overall performance and output. There are few variables for which a significant change in local behavior will affect a significant change in global output. Such a variable is called a constraint. Therefore, if you wish to achieve more of your objectives, you must uncover the constraint, commit attention to the constraint, and follow through with deployment of change (Goldratt 1999). Lockheed-Martin and Boeing addressed numerous process deployment issues such as attempts to accumulate commodities inputs, titanium in particular, during the commodities boom that created metals scarcity since 2003.

Production of the F-22 created extreme volatility in the titanium market. To reduce weight, a new design was incorporated in 1992 that made use of thermoplastics rather than aluminum.

However, some of the reductions in aluminum utilization inevitably had to be off set with increases in *titanium* utilization (Figure 4). The new design reduced aluminum utilization from 35% to 11% of total inputs. Meanwhile, thermoplastics utilization increased from 10% to 20% and titanium utilization increased from 24% to 33% of total inputs.

**Figure 4- Structural Composition of F-22 Raptor**

1975-1992 Design	1992-2009 Design	Difference
35% aluminum	11% aluminum	-24%
24% <i>titanium</i>	<b>33% <i>titanium</i></b>	<b>+9%</b>
5% steel	5% steel	0
13% <i>graphite thermoplastics</i>	15% <i>graphite thermoplastics</i>	+2%
10% thermoplastics	20% thermoplastics	<b>+10%</b>
13% miscellaneous	16% miscellaneous	+3%

Source: (Aaronstein et. al. 1998)

From 1996 to 2003, the price of titanium was constant (Figure 5). In 2004, anticipation of the start of F-22 stock production the following year (2005) resulted in the price of titanium to increase by 49.5%, from \$11,000 to \$17,300 per metric ton. An additional 19.1% price increase, from \$17,300 to \$20,600, occurred one year into production from 2005 to 2006. As the production life cycle faded out from 2006 to 2009, the titanium price fell significantly.

Government stocks of titanium began to fall significantly when prototype production of the F-22 was underway. By the time stock models of the F-22 were ready to be produced, the U.S. government had run out of titanium, which contributed to the increase in titanium prices from 2005-2009 (Figure 5). Through production of the F-22, the U.S. government had significantly

impacted the price of titanium. Industry titanium stocks remained constant from 1996-2007, despite F-22 production (Figure 5). In consideration of government demand and a high titanium price, industry suppliers began to increase capacity, and got stuck holding the bag as the F-22's lifecycle unexpectedly ran out. Industry titanium stocks doubled from 2007 to 2008, and remained high in 2009 (Figure 5).

**Figure 5- Titanium Market Prices Relative to F-22 Production Schedule**

[All values are in metric tons (t) titanium unless otherwise noted]

Year (Annual Averages)	Titanium Price (\$/t)	Government Stocks	Industry Stocks
1996	\$9,660	33,200	4,390
1997	\$9,600	33,100	7,020
1998	\$9,660	31,700	10,600
1999	\$9,370	31,200	7,970
2000	\$8,710	26,300	5,010
2001	\$7,890	18,600	6,340
2002	\$8,020	13,200	11,700
2003	\$7,360	6,420	8,180
2004	\$11,000	2,510	7,660
<b>2005*</b>	<b>\$17,300</b>	0	4,330
2006	<b>\$20,600</b>	0	8,240
2007	\$14,800	0	7,820
2008	\$15,600	0	<b>14,200</b>
<b>2009**</b>	<b>\$13,900</b>	0	<b>15,300</b>

\*- 1<sup>st</sup> Production Year

\*\* - End of Product Lifecycle

Source: (Kelly & Matos et. al. 2010)

Increases in input costs were not the only reason production of the F-22 was constrained. Due to DOD budget constraints, the Air Force was directed to purchase fewer aircraft in lots 7, 8, and 9 than what the manufacturer was actually capable of producing in 2006. That slowdown of production meant a cost increase for each individual jet, one that was mitigated, in part, by the savings realized with multi-year procurement through 2011 (Lopez 2006). A Lockheed-Martin executive vice president and F-22 program manager notes that the current cost for an F-22 stood at about \$137 million. And that number has dropped by 23 percent since Lot 3 procurement. The cost of the airplane is going down. For the next 100 F-22's the average flyaway cost would be \$116 million per aircraft (Lawson 2006). Before President Obama vetoed the most recent 2009 batch of 7 F-22's (Bruno 2009), the deployment of decisions and policies related to the procurement of F-22's became frustratingly staid to producers and consumers alike; both contributing reasons as to why no more F-22's are scheduled to be produced.

#### MILITARY PRODUCERS AND CONSUMERS

In 1941, Congress passed the Lend-Lease Act authorizing the President the ability to send, lend, and lease weapons, aircraft, vessel, and boats to other nations in an attempt to promote the defense of the U.S (Lend Lease Act 1941). This Act signified the establishment of the DTIB and related FMS initiatives. One of the benefits of the formation of the DTIB is that it has facilitated the export of weapons and other war materials providing the U.S. access to and influence on foreign countries and their respective surrounding regions (Beard 1995). The biggest ticket items offered by the U.S. DTIB are ATF's. Surprisingly, sales and distribution of technical and intelligence-sensitive equipment such as ATF's are not limited to U.S. military procurement. Therefore, "a divide has to be bridged, the persistent struggle between the U.S. Department of State and the Department

of Defense. One is a department of diplomats and policy analysts, schooled in language, compromise, and consensus- building...The Department of Defense, on the other hand, sees its responsibilities as primarily in the areas of deterrence and warfare” (Clark 2001). The Lend Lease Act created a new perspective on military equipment production and distribution, one that considered the ability of U.S. allies to enforce strategic interests and the profitability of weapons transactions.

One of the problems regarding U.S. DTIB export of ATF's, especially the unmatched F-22, is that conflicts of interests arise between DTIB producers' desire to produce and sell aircrafts for profit and the U.S. military's goal to maintain technical and intelligence superiority. "Both Congress and the White House see foreign arms sales as creating defense jobs—and, therefore, votes— even if the sales have obviously destabilizing security implications" (Gansler 1995). For example, examine the FMS transactions that have taken place between the U.S. and Saudi Arabia, which represents the largest military sales procurement relationship in the world. The U.S. is willing to export arms to Saudi Arabia in order to assist in the protection of the world's largest oil reserves and export petroleum business. The hope is that the U.S.-Saudi military procurement relationship will amplify the U.S. voice in the Organization of Petroleum Exporting Countries (OPEC) (Molloy 2000). OPEC decisions regarding production targets, capacity utilization, and other upstream oil-drilling activities have a significant impact on the price paid by the world's largest consumer of oil, the U.S.

On 9/11, 19 hijackers killed more than 3,000 U.S. civilians by taking control over 4 U.S. commercial passenger jets, flying 2 aircrafts into the World Trade Center in New York City, one aircraft into the Pentagon in Washington, DC, and a fourth aircraft that crashed in suburban Pennsylvania as a result of heroic passenger attempts to retake control of the aircraft which was believe to be headed to the White House. The Liberal Peace hypothesis, which states that the existence of an import/export relationship between two nations decreases the likelihood they will reach military conflict with each other (Anderton & Carter 2009), may have been disproven on September 11, 2001. Of the 19 hijackers, 15 were from Saudi

Arabia (Nayef 2002), one of the largest U.S. arms consumers. And, although the U.S. and Saudi Arabia are not at war, the origin of the hijackers raises concern regarding cultural conflict between the two nations.

Despite the visible involvement of Saudi Arabian actors in the terrorist attacks of 9/11, the capitalist interests of U.S. DTIB firms continue to cloud global U.S. security objectives. On September 13, 2010, the U.S. Department of Defense (DOD) announced a \$60 Billion deal with Saudi Arabia involving the Saudi purchase of U.S. produced ATF aircrafts and combat helicopters in the largest-ever foreign arms deal. Over the next ten years, the U.S. aims to supply Saudi Arabia with 84 new F-15 fighter jets, 70 upgraded F-15 helicopters, 70 Apache helicopters, 72 Blackhawk helicopters, and 36 Little Bird helicopters. The Saudi purchase of ATF jets and combat helicopters is estimated to involve 77,000 jobs in 44 U.S. states (Hedgpeth 2010). U.S. economic dependency on domestic production and overseas distribution of advanced technology air superiority equipment raises a conflict of interest between financial security and national defense. "Policy is essentially in the hands of an identifiable elite (high-level bureaucrats, business interests, and the military) that is self-centered and does not necessarily reflect the public interest" (Mills 1956). The good news is that no F-22's have been sold to consumers outside of the U.S. military, and the F-22 is far superior to any other ATF in the market. The F-22 has been very successful in test missions, with kill ratios of up to 108:0 against other ATF's during Exercise Northern Edge in 2006...In no-holds-barred simulation runs with F-15's, F-16's and F/A-18 Hornets, F-22 pilots generally 'destroy' their adversaries before their aircrafts detect the Raptor's presence (Tolliver 2006).

The concern is that phasing out of the F-22 may instill the image that it is inferior to newer ATF product offerings like the F-35 Lightning II and therefore it is okay to supply foreign countries with F-22's. The premature distribution of F-22's to foreign nations may lead to major U.S. national security breaches. Not only is the F-35 unproven to be a superior ATF over the F-22, the F-35 was designed for surface-to-air missions, aimed at providing the U.S. military with a one size fits all solution to the needs of multiple branches of U.S.

Armed Forces. The ability for the F-35 to compete with the F-22 in air-to-air combat is uncertain. Furthermore, there are worries that the F-22 problems are being repeated with the F-35, indicating that supply chain bottlenecks are expected. The F-35 is a warplane intended to replace the F-16 and A-10, as well as Navy and Marine Corps fighters. Even though a test version of the F-35, also called the Joint Strike Fighter (JSF), has been grounded for several months, the jet's builder, Lockheed Martin, is seeking DOD permission to fly fewer test hours (Rolfson 2007). The first sign of major production problems and expectation of late delivery for warplanes is an aircraft manufacturer's application to reduce flight time.

#### **AREAS FOR FURTHER RESEARCH**

The Lend-Lease Act of 1941 and subsequent informal formation of the DTIB and related FMS export activities evolved into what is now popularly referred to as the U.S. military industrial complex. "We have been compelled to create a permanent armaments industry of vast proportions. We annually spend on military security more than the net income of all United States corporations...In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military industrial complex" (Eisenhower 1961). The theory underlying the U.S. military industrial complex is that organized U.S. federal socioeconomic activities are dominated by military procurement and related industrial activities in support of national security and economic gain. It is true that military interests dominate the Federal Procurement System. The Armed Services Committee in the Senate and the National Security Committee in the House of Representatives represent two out of only six Congressional committees with oversight on the Federal Procurement System (Figure 6).

**Figure 6- Congressional Oversight of Federal Procurement System**

U.S. Senate	U.S. House of Representatives
Armed Services	National Security
Government Affairs	Government Reform
Small Business	Small Business

Source: (Federal Acquisition Institute 1999)

The administration of war rests in the hands of the U.S. President. The President is Commander-In-Chief of the military (U.S. Constitution 1789). Presidential power to wage war has been used authoritatively in wars marked with institutional change. Displacement has followed as displayed by the repeatedly failed procurement of F-22 Raptors. Meanwhile, “in principle, the President is responsible for implementing procurement statutes and procurement authorization and appropriations. He establishes government-wide procurement policies and procedures through executive orders, makes political and management decisions relative to procurement programs, and appoints agency heads and other officials who have direct or indirect management control over procurement programs and procurement organization” (Drabkin & Thai 2003). The U.S. President not only has the authority to rule over military operations but also has sole discretion over related financing activities and appropriations, allowing the President immense power of influence on the U.S. military industrial complex. The two most influential sources of U.S. Presidential power, the right to exercise authority over the military and the role of manager in the public procurement process, gives rise to two areas for further research that relate specifically to the F-22 and other air dominance product offerings.

First, the U.S. military industrial complex has evolved from the enhancement of DTIB cooperation and FMS transactions that include predictable models and frameworks of organizational participation and advocacy coalition networks that have greatly impacted the demise of the F-22 Raptor and birth of the F-35 Lightning II. Future inquiry of what may be called an ever-growing *U.S. military industrial organization* is warranted to uncover the industry and power

dynamics of pluralistic participants. Resisting acknowledgement of the pressures for economic and political pluralism would be to reject the acceptance of modernity (Dunleavy 1987). ATF attributes such as stealth radar technology and supersonic speed underscore the need to accept a postmodern outlook of market participants. Market biased regimes such as the U.S. are facilitated by direct government policies known as status privileges which serve as legacies for corporatism and authoritarian etatism. The public interest model is only possible when both markets and corporations are crowded out by the state (Esping-Anderson 1990).

Second, the U.S. military industrial organization's procurement of resources strains the U.S. Federal fiscal budget. The main factor attributable to the United States' high defense spending is its large number of overseas interests and allies. Allies contribute to the strength of the Western alliance on what might be called the supply side, but they also typically add burdens on the U.S. on the demand side (O'Hanlon 2009). Research and analysis of ways in which *U.S. federal investment capacity* can be increased through infrastructure investment, portfolio management, and non-conventional investments are areas of interest for future consideration. The economic and financial crisis that hit in 2007 has instilled fiduciary constraint on the U.S. Federal fiscal budget. In response, Congress established the National Infrastructure Development Bank in 2011 and passed a bill called the Infrastructure Investment Fund Act of 2011, with the primary objective to "use fund resources to build a portfolio of transformational investments" (U.S. Senate 2011). In the meantime, defense spending has dramatically decreased from \$518.3 Billion in 2009 (Department of Defense Budget 2009), to an estimated \$237.1 Billion for 2012 (The Budget Documents 2011).

## CONCLUSION

It is difficult to gauge the success of the ATF development program. Congress has refused to purchase F-22's beyond 2011, instead opting for the more versatile, yet clunky F-35 Joint Strike Fighter. Hence the name, the Joint Fighter was designed to fulfill the

needs of Army, Navy, and Air Force, decreasing the likelihood that full utilization of air-to-air combat capabilities was implemented on the F-35. The greater than 30-year ramp-up period of the F-22 contributed to the growth of DTIB and FMS through research and development of air superiority technologies and the export of ATF's. While government purchasing and supply chain management of the F-22 repeatedly fell short of quality expectations, the image of air superiority associated with the F-22's stealth, weapons, and avionics capabilities ensured U.S. air supremacy over the F-22 Raptor's lifecycle.

DTIB expansion has raised questions as to the national security risks associated with providing foreign militaries with intelligence-sensitive technologies. Despite attempts by the Key West Agreement of 1947 and the subsequent Reorganization Act of 1958 to divide major military procurement along bureau lines (Niskanen 1971), the extreme volatility experienced in the titanium markets as a result of F-22 production brings attention to opportunities for market manipulation within activities of DTIB. Military producer and consumer activities need to be put under scrutiny to ensure U.S. maintenance of air supremacy. However, any federal department with authority; whether it is DOD, the Executive Branch, or a Congressional Oversight Committee, is inevitably going to have a role in the U.S. military industrial complex. The flow of funds among U.S. military industrial organization and procurement facilities and other related military business entities are channeled through the purchasing and supply chain management exercise in the form of military equipment, namely ATF aircrafts exceeding \$100 Million per unit.

## FIGURES

### Figure 1- Institutional Complexity and Corresponding Agencies

Slater, D. *Altering Authoritarianism: Institutional Complexity and Autocratic*

*Agency in Indonesia*. Mahoney, J., Thelen, K. (Eds.).  
Cambridge University Press: New York, 2010, 136, 137, 147.

### Figure 2- Demonstration and Validation (Dem/Val) Costs

Aaronstein, D., Hirschberg, J., Piccirillo, A. *Advanced Tactical Fighter to F-22*

*Raptor: Origins of the 21<sup>st</sup> Century Air Dominance Fighter*.  
American Institute of Aeronautics and Astronautics: Reston,  
VA, 1998, 164.

### Figure 3- Supplier Prisoners' Dilemma

Hindmoor, A. *Rational Choice*. Palgrave Macmillan: Hampshire,  
England. 2006,

109.

### Figure 4- Structural Composition of F-22 Raptor

Aaronstein, D., Hirschberg, J., Piccirillo, A. *Advanced Tactical Fighter to F-22*

*Raptor: Origins of the 21<sup>st</sup> Century Air Dominance Fighter.*  
American Institute of Aeronautics and Astronautics: Reston,  
VA, 1998, 188.

**Figure 5- Titanium Market Prices Relative to F-22 Production Schedule**

Kelly, T., Matos., DiFrancesco, C., Porter, K. *Historical Statistics for Mineral*

*Commodities in the U.S., Data Series 2005-140.* U.S. Geology  
Survey, November 18, 2010.

**Figure 6- Congressional Oversight of Federal Procurement System**

Federal Acquisition Institute. (1999). *The Federal Acquisition Process.*

(Washington, DC: Author). In *U.S. Federal Government Procurement: Structure, Process, and Current Issues.* Drabkin, D, Thai, K. Presented at International Purchasing and Supply Education and Research Association's Comparative Public Procurement Cases Workshop, Budapest, Hungary, April 10-13. 2003, 3.

## REFERENCES

- Aaronstein, D., Hirschberg, J., Piccirillo, A. *Advanced Tactical Fighter to F-22 Raptor: Origins of the 21<sup>st</sup> Century Air Dominance Fighter*. American Institute of Aeronautics and Astronautics: Reston, VA, 1998, 1, 10.
- Anderton, C., Carter, J. *Principles of Conflict Economics*. Cambridge University Press: New York, 2009, 48.
- Beard, Lt. Col. M. *United States Foreign Military Sales Strategy: Coalition Building or Protecting the Defense Industrial Base*. Report by Chief of International Aircraft Programs. Maxwell AFB, AL. Air War College, March 1995.
- Bird, Lt. Col. B. *43<sup>rd</sup> Fighter Squadron*. Tyndall Air Force Base. U.S. Air Force: Tyndall AFB, Florida. August 11, 2011, Par. 8.
- Bruno, M. *Senate Backs Obama on F-22 Shutdown*. Aviation Week. McGraw-Hill: New York, 2009, Par. 1-3.
- Clark, W. *Waging Modern War: Bosnia, Kosovo, and the Future of Combat*. Perseus Books Group: New York, 2001, xLii.
- Coyle, P. In *F-22 Design Problems Force Expensive Fixes*. Air Force Times. November 12, 2007.
- Dahl, R. *On Democracy*. Yale University Press: New Haven, CT, 1998, 103, 178.

Defense Industry Daily. Military Purchasing News for Defense Procurement Managers and Contractors. F-22 Raptor: Fiscal Year 2006 Procurement and Events. September 30, 2006.

Department of Defense Budget. Office of the Undersecretary of Defense, Comptroller. Budget Request Summary Justification, 2009. February 4, 2008, 4.

Drabkin, D., Thai, K. U.S. Federal Government Procurement: Structure, Process, and Current Issues. Table 2 from Federal Acquisition Institute, 1999. Presented at International Purchasing and Supply Education and Research Association's Comparative Public Procurement Cases Workshop, Budapest, Hungary, April 10-13. 2003, 3.

Dunleavy, P., O'Leary, B. *Theories of the State: The Politics of Liberal Democracy*. Meredith Press: New York, 1966, 65.

Eisenhower, D. Public Papers of the Presidents. *Dwight D. Eisenhower: 1960-61: containing the public messages, speeches, and statements of the president, January 1, 1960, to January 20, 1961*. U.S. Government Printing Office. 1960, 1038.

Elsie, R. *Historical Dictionary of Kosovo*, 2nd Ed. Historical Dictionaries of Europe, No. 79. The Scarecrow Press: Lanham, 2011, xxix, xLi, xLv, xLvi.

Esping-Anderson, G. *The Three Worlds of Welfare Capitalism*. Princeton University Press: Princeton, NJ, 1990, 103.

Ferguson, P. To Milestone 0 and Beyond. Aeronautical Systems Center Office

and History Department. May, 1996. In *Advanced Tactical Fighter to F-22 Raptor: Origins of the 21<sup>st</sup> Century Air Dominance Fighter*. Institute of Aeronautics and Astronautics: Reston, VA, 1998.

Fromkin, D. *Kosovo Crossing: American Ideals Meet Reality on the Balkan Battlefields*. The Free Press: New York, 1999, 190.

Gansler, J. *Defense Conversion: Transforming the Arsenal of Democracy*. MIT Press: Cambridge, MA. 1995, 4, 16.

Goldratt, E. *Theory of Constraints*. North River Press: Great Barrington, MA, 1999.

Griffiths, P. *Agent Orange: Collateral Damage in Vietnam*. Trolley Ltd: London, 2003, 152.

Hacker, J. Policy Drift: The Hidden Politics of Welfare State Retrenchment. In *Beyond Continuity: Institutional Change in Advanced Political Economies*. Streeck, Wolfgang & Thelen, Kathleen Eds. Oxford University Press: Oxford, England, 2005, 17.

Handell, D., Wright, R., Treiber, K., Gall, I., Staley, G. F/A 22 Cost Reduction Task Force: Key To Raptor Affordability. Presentation by F/A 22 Raptor Lean Team for the MIT Lean Space Initiative. Lockheed Martin: Bethesda, MD, March 23, 2005, Slide 5.

Hedgpeth, D. *Saudis May Get Huge Arms Deal*. The Washington Post. September 14, 2010, par. 2, 7. [<http://www.washingtonpost.com/wp-dyn/content/article/2010/09/13/AR2010091306429.html>].

Henry, P. *Legitimate Government*. Presented at the Virginia Ratification Convention, June 7, 1788. Borden, M., Ed. Michigan State University Press: East Lansing, MI, 1965, par. 1.

Henry, P. *Brutus #10*. Objections to a Standing Army. Presented at the Virginia Ratification Convention and contained in *The Anti-Federalist Papers*, January 24, 1788. Borden, Morton Eds. Michigan State University Press: East Lansing, MI 1965, Par. 8.

Hindmoor, A. *Rational Choice*. Palgrave Macmillan: Hampshire, England. 2006, 109.

Hood, C. *The Art of the State: Culture, Rhetoric, and Public Management*. Oxford University Press: New York, 1998, 40.

Kesler, C., Rossiter, C. *The Federalist Papers*. New American Library: New York, 1999, vii-xii.

Lawson, L. In *Defense Industry Daily, Military Purchasing News for Defense Procurement Managers and Contractors*. F-22 Raptor: Fiscal Year 2006 Procurement and Events. September 30, 2006.

Lend-Lease Act. U.S. House of Representatives, HR 77A-D13, Record Group 233, National Archives. January 10, 1941, (7-8).

Lopez, Staff Sgt. T. *F-22 Excels At Establishing Air Dominance*. Air Force Print News: Washington DC, June 23, 2006, Par. 4.

Madison, James. *The Federalist Papers #41*. January 19, 1788. Rossiter, Clinton

Eds. New American Library: New York, 1961, 252.

Mahoney, J., Thelen, K. *Explaining Institutional Change*. Cambridge University Press: Cambridge, MA, 2010, 17, 20, 23.

Mentzer, J. *Supply Chain Management*. Sage Publishing: Thousand Oaks, CA, 2001, 110.

Miller, B. Advanced Tactical Fighter Studies Set. *Aviation Week and Space Technology*. Jan 19, 1976, (16, 17).

Mills, C. The Power Elite. In *U.S. National Security: Policymakers, Processes, and Politics*. Sarkesian, S., Williams, J., Cimbala, S. 4<sup>th</sup> Ed. Lynn Rienner: Boulder, CO, 2008, 168.

Molloy, Lt. Col. M. U.S. Military Aircraft For Sale, Crafting An F-22 Export Policy. Thesis. School of Advanced Air Power Studies, Air University, Maxwell Airforce Base, Alabama. June 2000, 6.

Moore, B. Social Origins of Dictatorship and Democracy: Lord And Peasant. In *The Making Of The Modern World. The Democratic Route to Modern Society*. Beacon Press: Boston, 1966, 414.

Moore, G. Agent Orange Talking Paper #1. Michigan Agent Orange Commission. Smiths Creek, MI, August 21, 2009, par. 5. [[Http://www.gmasw.com/aotalk1.htm.](http://www.gmasw.com/aotalk1.htm)]

Nayef, Prince. Official: 15 of 19 Hijackers Were Saudi. USA Today and the Associated Press: Riyadh, Saudi Arabia, February 6, 2002, lines 4-9.

Niskanen, W. *Bureacracy & Representative Government*. Aldine Transaction:  
Chicago: 1971, 195.

O'Hanlon, M. *Budgeting for Hard Power Defense and Security Spending Under Barack Obama*. 2009, 26, 27.

Public Law 93-148. War Powers Act. 93rd Congress, H.J. Resolution 542, Joint Resolution Concerning the Powers of Congress and the President, 1973.

Reisman, D. *Theories of Collective Action: Downs, Olson, and Hirsch*. St. Martin's Press: New York, 1990, 161.

Rich, B. *Skunkworks, A Personal Memoir of My Years at Lockheed*. 1994, 19.

Rolfson, B. F-22 Design Problems Force Expensive Fixes. Air Force Times. November 12, 2007.  
[[http://www.airforcetimes.com/news/2007/11/airforce\\_raptor\\_rust\\_071112w/](http://www.airforcetimes.com/news/2007/11/airforce_raptor_rust_071112w/)]

Sadiku, M. *Elements of Electromagnetics*, 5<sup>th</sup> Ed. Oxford University Press: Oxford, England, 2010, 689.

Slater, D. *Altering Authoritarianism: Institutional Complexity and Autocratic Agency in Indonesia*. Mahoney, J., Thelen, K. Eds. Cambridge University Press: New York, 2010, 136, 137, 147.

Sudheimer, R. *Advanced Tactical Attack System Mission Analysis (ATASMA)*. Tactical Research and Techonology. National Aeronautics and Space Administration. NASA-CP-2164, March, 1981.

The Budget Documents. U.S. Federal Fiscal Budget 2012. Office of Management and Budget. U.S. Government Printing Office: Washington, D.C, 2011, 354, 375. [[Http:gpoaccess.gov](http://gpoaccess.gov)].

Tolliver, Lt. Col. W. *The Virginian Pilot*, June 13, 2006. In *F-22 Raptor: Fiscal Year 2006 Procurement and Events*. Defense Industry Daily. Military Purchasing News for Defense Procurement Managers and Contractors. September 30, 2006, par. 8.

U.S. Constitution. (1789). Article I, Section 8. Article II, Section 2. Constitution Society: Austin, TX. [[Http://constitutionsociety.com](http://constitutionsociety.com)].

U.S. Senate. (2011). America Infrastructure Investment Fund Act of 2011. 112<sup>th</sup> Congress, 1<sup>st</sup> Session. May 10, 2011, S.936. (9).

Vickers, M. War Over Kosovo, Revolution Deferred: Kosovo and the Transformation of War. Bacevich, A. & Cohen, E. Eds. The University Press Group: London, 2001, 193, 194.

Wheeler, W. Straus Military Reform Project, Fact Sheet: F-22 Fighter Basics. Center For Defense Information. Washington DC. April 4, 2006.

Wilson, S., Kamen, A. *Global War on Terror Is Given New Name*. Politics Section. The Washington Post: Washington, DC, March 25, 2009.