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DEFENDING THE F-22

by

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In Partial Fulfillment of the Graduation Requirements

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The purpose of this paper is to establish the critical need for the continued development and introduction of the F-22 Raptor as the air superiority fighter for the joint forces of the United States military as they enter the 21st century. Air superiority is the first and primary mission for the air component commander where soldiers, sailors, marines, and airmen are involved in combat. Without it, our forces will be subject to potentially devastating attacks from the air, limiting their ability to attack the enemy at a place and time of their choosing and leaving them vulnerable in their rear echelons. This paper will review military risk, joint and service doctrine, and highlight the emerging threat to our capability to provide air superiority for the joint force commander. It will then define the characteristics, roles, and missions of the F-22 and support its development and introduction into service with a brief comparison to other service options.

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## *Preface*

As I acknowledge those individuals who helped me complete this paper, my purpose for writing it will become clear. Colonel John “Lurch:” Gorman, my principal advisor, allowed me to move at my own pace and more importantly, adjust the thesis of the paper as the year wore on. Initially conceived as a paper to debate the capability, or lack thereof, of the United States military to provide air superiority in two major theaters of war, the topic proved too broad for a paper of this scope. About the time I came to this conclusion, Captain (USN) J.R. Sanders, my instructor for the Navy and Marine Corps Expeditionary Forces elective, provided me an article from the Naval Proceedings Magazine entitled “Catch the F-22” and suggested I write a rebuttal to it as partial fulfillment for the elective’s academic requirements. This article was ludicrous. It completely misstated the capabilities of the F-22 and Navy’s proposed option, the Joint Strike Fighter, and suggested that there were no emerging threats to our joint air forces that warranted developing this new and expensive stealth aircraft. After a small amount of research and some simple statement of facts, I easily debunked the entire article.

After consultation with Dr. Tom Hughes, my instructor for the Evolution of Tactical Air Power elective, I expanded the paper further and turned it in as partial fulfillment for his course elective’s academic requirements. He suggested that I submit the paper for publishing in the Air Power Journal and, based on our previous discussions of the

research writing project, further expand the paper to satisfy course requirements for graduation from Air War College. That is how the paper came to its final form.

For all those who feel there is no need for a fighter aircraft designed primarily for the air superiority role, I'll ask you to wake up and smell the roses. The multi-role fighters employed in Vietnam, although holding their own, didn't ring up any impressive air superiority numbers. In contrast however, the single-role F-15 went undefeated in Operation Desert Storm and accounted for all but a few of the kills claimed in this brief conflict. It was no accident. The F-15 was superior in range, payload, and most importantly, avionics to every air superiority aircraft in theater and accomplished its job completely. Fielding the F-22 will ensure this level of capability well into the 21st century. Selecting any other path of fighter aircraft development, particularly as it applies to the air superiority role, will subject our forces to unacceptable levels of risk..

Finally, I would like to thank my wife, Stephanie, and my sons, John and Steven, for keeping my spirits high during the academic year.



*Abstract*

The purpose of this paper is to establish the critical need for the continued development and introduction of the F-22 Raptor as the air superiority fighter for the joint forces of the United States military as they enter the 21st century. Air superiority is the first and primary mission for the air component commander where soldiers, sailors, marines, and airmen are involved in combat. Without it, our forces will be subject to potentially devastating attacks from the air, limiting their ability to attack the enemy at a place and time of their choosing and leaving them vulnerable in their rear echelons. This paper will review military risk, joint and service doctrine, and highlight the emerging threat to our capability to provide air superiority for the joint force commander. It will then define the characteristics, roles, and missions of the F-22 and support its development and introduction into service with a brief comparison to other service options.

## **Chapter 1**

### **Introduction**

*The contest for air superiority is the most important contest of all, for no other operations can be sustained if this battle is lost. To win it we must have the best equipment, the best tactics, the freedom to use them, and the best pilots.<sup>1</sup>*

General William W. Momyer, USAF (1978)

### **The Position**

Nothing could better state the position of the joint United States military forces, particularly the Air Force. The Air Force needs the F-22. So does the Army, Navy, and the Marine Corps, although not in the sense of physically owning the aircraft. The F-22 will become the primary air superiority fighter for all of the United States' joint military forces well into the 21<sup>st</sup> century. The purpose of this paper is to identify the rationale and requirement to develop and employ the F-22 within the next ten to fifteen years. It will open with a discussion of the national, joint, and service requirements that mandate gaining air superiority from the commencement through the cessation of hostilities. It will then discuss the current threats that will challenge the F-22 and the inherent capabilities the F-22 will possess that will enable it to defeat this imposing threat.

Having established the need for this next generation air superiority fighter, the paper will review the roles the

F-22 is expected to fulfill. Finally, the paper will conclude with an analysis of the number of F-22s required to meet future military obligations and the potential procurement plan the government is considering for future modernization, including the Joint Strike Fighter. Your conclusion will be obvious. The Air Force needs the F-22 and must press its development and introduction into service - now! As you prepare to debate the pros and cons of this expensive and controversial program, view for a moment, the concept of risk.

## **Risk**

Imagine, for a moment, a battle scene from Operation Desert Storm along the winding road leading north from Basra, Iraq. Conjure in your mind pictures from any media source ... CNN, Newsweek, Time ... the images will all be the same. The Iraqi road, now more commonly referred to as the "Road of Death," was literally covered with the charred remains of humans and the vehicles they once occupied. This road was the direct result of air dominance, the level of air superiority projected by the coalition's air forces during one of the most successful air campaigns of all time. Air dominance allowed the relatively "low technology" aircraft, such as the A-10 Thunderbolt II, to attack targets with impunity. They did so with such vengeance and firepower that the resultant carnage astounded even the most hardened of military critics and reporters.

In his presentation during the 1998 Air and Space Power Doctrine Symposium, Dr. Richard P. Hallion pitched a case for risk and doctrine.<sup>2</sup> He unequivocally stated that air

superiority was an absolute prerequisite for all phases of combat, from the introduction of forces during the halt phase to the conclusion and final removal of all forces. Failure to grant this level of air superiority would impede the movements of the ground armies and leave them vulnerable to attack from the air. He then asked the audience to envision the “Road of Death” and asked if we, the soldiers and citizens of the United States, would be willing to stomach a similar loss of personnel and equipment in any future battle. The answer is clearly NO. Failure to modernize our combat air forces, particularly as they are needed to provide air dominance in the 21st century, may leave us vulnerable to this type of attack, a risk we do not want to assume.

Discussion of our national grand strategy will lay the groundwork for the remainder of this paper.

## Notes

<sup>1</sup> Hallion, Richard P. Storm Over Iraq: Air Power and the Gulf War, (Washington, Smithsonian Institute Press, 1992): 27.

<sup>2</sup> Hallion, Richard P. Lecture on *Decisive Force: Air and Space Power in the 21st Century*. Air and Space Power Doctrine Symposium. Maxwell Air Force Base, Alabama, 2 March 1998.

## **Chapter Two**

# **COMMAND PERSPECTIVE OF THE AIR SUPERIORITY MISSION**

*If air dominance is achieved and joint forces can operate with impunity throughout the adversary's battlespace, the Joint Commander will prevail quickly, efficiently and decisively.*

Joint Vision 2010

### **National Strategy**

The strategy of engagement and enlargement is the central theme of the May 1997 Clinton administration's *A National Security Strategy for a New Century*. President Clinton states that his "foremost mission, and constitutional duty" is to protect "the

security of our nation – our people, our territory and our way of life."<sup>1</sup> He further states

that "we must maintain a strong and ready military" which will be achieved by "selectively

increasing funding for weapons modernization."<sup>2</sup> The July 1997 Defense Planning Guidance maintains that the United States military must focus the "modernization effort in order to replace aging systems and incorporate cutting-edge technologies into the force to ensure continued U.S. military superiority over time."<sup>3</sup> Although appropriate forces are required to counter a variety of challenges to our national security including regional,

state-centered, and trans-national threats of limited scope, these same forces must be able to deter, and when necessary, defeat “large-scale, cross-border aggression in two distant theaters in overlapping time frames,” the so-called two major theater wars (MTW) scenario.<sup>4</sup> However, with the continuous and dramatic post-Desert Storm military draw down, this will only be possible through joint employment of our military forces.

### **Joint and Service Doctrine**

In *Joint Vision 2010* (JV2010), General John M. Shalikashvili, the then-Chairman of the Joint Chiefs of Staff, states that the four operational concepts of dominant maneuver, precision engagement, full dimensional protection, and focused logistics are the keys to “achieving dominance across the range of military operations.”<sup>5</sup> The F-22 will have a major impact on the ability to provide full dimensional protection, which is defined in JV2010 as the

“control of the battlespace [necessary] to ensure our forces can maintain freedom of action during deployment, maneuver and engagement, while providing multi-layered defenses for our forces and facilities at all levels. Full-dimensional protection will enable the effective employment of our forces while degrading opportunities for the enemy. It will be essential, in most cases, for gaining and maintaining the initiative required to execute decisive operations.”<sup>6</sup>

The Air Force holds steady on this course and maintains in *GLOBAL ENGAGEMENT: A Vision for the 21<sup>st</sup> Century Air Force* that “Superiority in air and space - control over what moves through air and space - delivers a fundamental benefit to the Joint Force.”<sup>7</sup> It further goes on to explain that air superiority is the basis for full dimensional protection and is crucial to the outcome of any battle. The F-22 has been designed from the ground up with this concept in mind, and will master the defensive and

offensive counter air roles (DCA and OCA, respectively) and to a lesser extent the suppression of enemy air defense (SEAD) and strike roles to include theater missile defense (TMD) ... all critical to the air superiority mission.

### **The Uncertain Future**

Unfortunately, many of the critics of the F-22 view it as an unnecessary tool for the post-cold war environment. They are quick to point out the apparent lack of a formidable enemy for the United States. All too often they state that no country is capable or willing to develop a military force of sufficient size to challenge our technological and qualitative edge. During the Air and Space Power Doctrine Symposium, Lt General Rhodes, the Commanding General for the Marine Corps Combat Development Command, boldly stated that the Air Force “had it all wrong” since they were concentrating their efforts on space, stealth, and future technologies which essentially would be unusable in 95% of the projected scenarios that would involve U.S. combat forces.<sup>8</sup> What about the other 5%? Did the United States predict the rapid breakdown of the former Soviet Union? Did the United States adequately foresee Iraq’s invasion of Kuwait? Is the United States certain that North Korea will not invade the south? Are we certain the Iraq will not make yet another claim to Kuwaiti territory? The simple answer is NO. As the world moves into the 21st century, a century certain to be marked by an ever-increasing consumption of food, oil, and water, countries will stand up and fight for their survival. The question is not IF the United States will engage militarily, but WHEN and WHERE these fights for national survival will occur. The threats that the F-22 will be expected to face in these future battles are growing in quality and quantity.



## Notes

<sup>1</sup> William J. Clinton. A National Security Strategy for a New Century, (Washington, The White House, May 1997): i.

<sup>2</sup> Ibid, ii.

<sup>3</sup> William Cohen. Defense Planning Guidance, FY 1999-2003, (Washington, Secretary of Defense, 2 Jul 97): 16.

<sup>4</sup> A National Security Strategy for a New Century, 12.

<sup>5</sup> John M. Shalikashvili, General, USA. Joint Vision 2010, (Washington: Department of the Joint Chiefs of Staff, 1997): 1.

<sup>6</sup> Ibid, 22.

<sup>7</sup> Ronald R. Fogleman, General, USAF and Sheila E. Widnall, Secretary of the Air Force. GLOBAL ENGAGEMENT: A Vision for the 21st Century Air Force, (Washington: Department of the Air Force, 1997):10.

<sup>8</sup> Rhodes, Lt General, USMC. Lecture on *Decisive Force: Air and Space Power in the 21st Century*. Air and Space Power Doctrine Symposium. Maxwell Air Force Base, Alabama, 2 March 1998.

## **Chapter Three**

### **The Threats**

*A variety of threats from airborne and ground-based systems, when coupled with the aging and nonstealthy nature of U.S. air superiority forces (the F-14, F-15, F-16, and F-18 fighter families, all of which date from the late 1960s or early 1970s) pose serious concerns for the future of American air superiority.<sup>1</sup>*

Richard P. Hallion and Michael Irish

The United States will face a wide variety of current and new, sophisticated air-to-air and surface-to-air weapons systems that will challenge its ability to gain air superiority as it moves into the 21<sup>st</sup> century. Many of these threats already exist or are in advanced phases of military research and development by countries such as the United Kingdom, France, Sweden, China, Israel, Russia, and Germany. In addition, it is not wholly impossible that the United States could fight an adversary armed with American built equipment. The current fleet of aging and non-stealth aircraft are rapidly losing their qualitative edge over their potential adversaries. The F-22 has been designed from the ground up with these future threats in mind.

#### **Air-to-Air Threats**

Several strong challengers exist today. The Mig-29 Fulcrum and the Su-27 Flanker are two excellent examples of Russian fourth generation aircraft. The small, powerful

Mig-29, coupled with the AA-11 Archer heat-seeking air-to-air missile and its integrated helmet-mounted sight is arguably one the best close-in fighters in the world. It's larger cousin, the Su-27, has all the power and agility of the Mig-29 and has two notable and significant advantages over today's western air superiority fighters...it has an extremely large combat radius and the longest-range air-to-air missile in the world in the AA-10 Alamo.<sup>2</sup> The Mig-29 and the SU-27 are in service with 41 air forces throughout the world and have been exported to Iraq, India, North Korea, Malaysia, Vietnam, and China, as well as all the former Soviet Union countries.<sup>3</sup> Iraq and North Korea are two likely countries that the United States could face in the two MTW scenario. Future fifth generation aircraft are already in production. These include the Eurofighter 2000 and two derivatives of the Su-27, the Su-30, and Su-35. These aircraft will all possess thrust-to-weight, maneuverability, and speed advantages over our current front-line fighters and will enjoy the use of sophisticated systems including helmet-mounted sights, infrared search and track, and internal countermeasures. They will carry a new array of air-to-air missiles including the Israeli built Python IV, European Advanced Short Range Air-to-Air Missile (ASRAAM), French built MICA and IRIS-T, and Russian AA-X-12.<sup>4</sup> In short, they will pose a significant air-to-air threat for our joint forces. The surface threat is also a growing concern.

### **Surface-to-Air Threats**

The capability of surface-to-air missile (SAM) and antiaircraft artillery (AAA) is expanding at an alarming rate and accounted for all but one of the 38 determinable aircraft losses in Operation Desert Storm.<sup>5</sup> The primary concern in this area is the

proliferation of the double digit SAMs, including the SA-10, SA-11, SA-12, SA-13, SA-14, SA-17, and the SA-19. These new weapons are characterized by significant improvements in engagement envelopes and electronic counter measures. Intelligence estimates indicate that by the year 2005 the number of countries possessing these modern weapons will increase from its current number of 14 to 22.<sup>6</sup> Our third and fourth generation aircraft will assume incredible risks in the face of these odds. The technological capabilities designed into the F-22 have been developed with all of these threats in mind and in essence, by capability alone, the F-22 will be the first sixth generation aircraft to enter service. Its capabilities will be unmatched.

## Notes

<sup>1</sup> Daniel Goure and Christopher M. Szara. Air and Space Power in the New Millennium, (Washington: The Center for Strategic & International Studies, 1997): 99.

<sup>2</sup> “Soviet Operational Missiles and Rockets” and “What Air-to-air Missiles are in Service,” [www.umcc.umich.edu](http://www.umcc.umich.edu), 1997 (The US Navy’s AIM-54 Phoenix missile system employed on the F-14 Tomcat has a larger employment envelope but is not normally employed against fighter-sized targets.)

<sup>3</sup> Defense Planning Guidance, FY 1999-2003, 35.

<sup>4</sup> Ibid, 37.

<sup>5</sup> Thomas A. Keaney and Eliot A Cohen. Gulf War Air Power Survey, Volume V, (Washington, Government Printing Office, 1993): (One aircraft loss was attributed to a Mig-25. Seven other aircraft losses were officially listed as “unknown” with no reported enemy aircraft in the vicinity of the loss.)

<sup>6</sup> Daniel Goure and Christopher M. Szara. Air and Space Power in the New Millennium, (Washington: The Center for Strategic & International Studies, 1997): 100.

## Chapter Four

### Characteristics of the F-22

*The F-22 program is developing the next-generation air superiority fighter for the Air Force to counter emerging worldwide threats. It is designed to penetrate enemy airspace and achieve a first-look, first-kill capability against multiple targets. The F-22 is characterized by a low-observable, highly maneuverable airframe; advanced integrated avionics; and aerodynamic performance allowing supersonic cruise without afterburner.<sup>1</sup>*

1997 Air Force Issues Book

The F-22 has been developed around three primary characteristics ... stealth, supercruise, and fused avionics, none of which are entirely new technologies. What is unique is the degree to which these technologies have been incorporated into the airframe and the synergistic effect they will have.

#### Stealth

The buzz word **stealth** is actually the concept of reducing the radar cross section, engine heat, and other electronic signatures common to all aircraft. The ultimate goal of stealth would be to reduce these signatures to a point where they are no longer detectable by modern tracking systems. The F-15 for example, which is comparable in size to the F-22, has a radar cross section of approximately ten square meters, one that is easily detectable by aircraft and SAM systems at very long ranges. By applying low observable,

first generation stealth technology, to the F-15, were it still in production, it would be possible to reduce the radar signature to less than one square meter, a significant improvement. This is the tip of the iceberg as stealth technology has taken this to new levels of improvement. The F-117, the second generation of stealth aircraft, roamed over Baghdad night after night during Operation Desert Storm and was never targeted by Iraqi air defense systems. Although untested in combat, the B-2, the third generation of our stealth aircraft, has incorporated even newer technology than the F-117. The F-22 will incorporate a fourth generation of stealth technology which will reduce the radar cross section still further providing it the capability to pass silently through enemy radar well into the 21<sup>st</sup> century. The other stealth characteristics of heat and electronic emissions have received equal attention by the production engineers. The inevitable result will be bad news for the F-22's adversaries. Their best detection device will be their eyes. These eyes will have long been closed by the F-22's weapons, launched from essentially "nowhere." The F-22 will not only be able to hide, it will be able to hide in a hurry.

### **Supercruise**

Supercruise is the ability to sustain supersonic flight without the use of gas-guzzling afterburner power settings. It will provide the F-22 unprecedented increases in speed, range, and endurance that will significantly reduce its exposure to enemy defenses, and increase its lethality throughout the entire enemy Integrated Air Defense System (IADS).

### **Fused Avionics**

Fused avionics is the final compliment to the F-22. This fusion will give the F-22 pilot a level of situation awareness never before seen in combat aircraft. The F-22 will

combine onboard information such as radar, radar warning receiver, and interrogation friend or foe (IFF) with off-board information from a wide variety of other information senders. These senders will include other fighters in the area, AWACS, Joint Stars, Rivet Joint, Compass Call, information from the Naval Aegis System, and overhead intelligence from satellites. The F-22 will have a 360 degree view of the battle area from surface to infinity.<sup>2</sup> Combined with stealth and supercruise, the F-22 will roam the battlefield and, guided by off-board sensors, target the enemy unannounced. Primary weapons will include a combination of six AIM-120 Advanced Medium Range Air-to-Air Missiles (AMRAAM) and two AIM-9X for the air-to-air configuration and two Joint Direct Attack Munitions (JDAM), two AMRAAM, and two AIM-9X for the air-to-ground configuration.<sup>3</sup> All of this will give the F-22 its unprecedented capability in the OCA and DCA roles, and to a limited extent, the SEAD and TMD roles.



## Notes

<sup>1</sup> Ronald R. Fogleman, General, USAF and Sheila E. Widnall, Secretary of the Air Force. Air Force Issues Book, (Washington: Government Printing Office, 1997): 60.

<sup>2</sup> Dan Sullivan. "Compilation of F-22 Questions and Answers Staffed by HQ USAF/XORFS," (Washington: The Pentagon, 1997), 5. [Available upon request of author]

<sup>3</sup> Ibid, 10.

## **Chapter Five**

### **F-22 Roles and Missions**

*A future key asset to our Air Expeditionary Force, the F-22 will improve [the] flexible, tailored, rapid-response force, filling theater commanders' needs across the spectrum of conflict whether conducting Global Attack missions or protecting peacekeeping forces. With its stealth and supercruise, the F-22 can safely penetrate and persist deep in enemy airspace to eliminate enemy command and control aircraft, gather information, or conduct precision strikes on key information-related targets, contributing to the joint effort to gain Information Superiority.<sup>1</sup>*

1997 Air Force Issues Book

#### **Defensive Counter Air**

The F-22 will accomplish two primary missions in the DCA role ... the classic fighter role of shooting down enemy fighters and the newer role of destroying incoming cruise missiles. In its defense against incoming fighters, the F-22 will be one of three participants of the IADS, the other two being long-range missile engagement zones (MEZ) by the Hawk and Patriot systems and short range air defense zones (SHORAD) using a variety of air defense weapons. Relying on its supercruise, the F-22 will be able to cover a large volume of airspace and remain airborne for long periods of time, characteristics which will greatly expand its role in the IADS. The cruise missile threat poses a new challenge for modern fighter aircraft as they have become increasingly more

difficult to detect due to significant improvements in low observable technology. By using a variety of off-board sources, the F-22 will identify and engage cruise missiles and whenever possible, the cruise missile carriers themselves that will be unaware of the F-22's presence. Again, supercruise will permit the F-22 to cover very large distances in a very short time. The result will be a significantly higher probability of kill than that demonstrated by the F-15, a capability which is currently extremely limited. The F-22's prowess in the OCA role will be even more significant.

### **Offensive Counter Air**

In either a fighter sweep or a classic close escort, the F-22 will surprise the enemy by arriving unannounced in the battlespace. Similar to Operation Bolo during the Vietnam conflict where seven Migs were destroyed in a single air battle, enemy fighters will find themselves engaged with an air superiority fighter, the F-22, when they only expected strikers laden with heavy loads of air-to-ground munitions and limited air-to-air weapons for self defense.<sup>2</sup> In either scenario, the F-22 will accomplish its primary mission, gaining and maintaining air superiority for the joint force commander (JFC). From this point on and throughout the remainder of the conflict, the F-22 can expand its support for the JFC by accomplishing SEAD and TMD.

### **Suppression of Enemy Air Defenses and Theater Missile Defense**

In the SEAD role, the F-22 will still escort fighters to the target areas as it will retain a portion of its air superiority weapons. However, using a variety of onboard and off-board sensors, the F-22 will be able to target enemy SAMs and other command and control facilities associated with the IADS using the JDAM. Finally, in a role similar to

that played by the F-15E in Operation Desert Storm, the F-22 will seek out and destroy theater surface-to-surface missiles as they are prepared for launch. Hiding over enemy territory, the F-22 will use its fused information to locate these threats and its supercruise to quickly close within the range of the JDAM. The result will be a real capability to engage and destroy these weapons before they can be launched. These capabilities will only be a pipe dream if the United States does not procure a sufficient number of F-22s to accomplish this cross section of missions.

## Notes

<sup>1</sup> Ronald R. Fogleman, General, USAF and Sheila E. Widnall, Secretary of the Air Force. Air Force Issues Book, (Washington: Government Printing Office, 1997): 61.

<sup>2</sup> William W. Momyer, General, USAF (Retired). AIR POWER in THREE WARS (WW II, Korea, Vietnam), (Washington: Government Printing Office, 1978): 146.

## Chapter Six

### How Many F-22's Should We Buy?

*A state's capacity to apply air power as an instrument of national policy may be measured against four criteria. The first is the breadth and depth of its aerospace industrial base, capable of quantity production. Second, within that industrial base is the capacity for research and development which can identify and exploit science and advanced technology. Third is the capacity and inclination of a government to allocate resources to an air force and thereafter be prepared to use it to protect or project national interests. Fourth is the size and quality of the air force or air forces themselves. Only the USA meets all those criteria and even the most cursory comparison with a handful of other states illustrates its overwhelming pre-eminence.<sup>1</sup>*

Air Vice Marshall Tony Mason

There are two simple models to use to determine a practical number of F-22s necessary to accomplish the mission. Both of these models represent the number of F-22s initially programmed by the Air Force during its preliminary beddown concept. Due to political and economic concerns however, these numbers have been reduced.

#### Previous Force Structure

The first method is based on the current Air Force force structure. Currently, twenty percent of Air Force aircraft are programmed for the air superiority role. Since, the Air Force has reduced its total number of fighter equivalent wings to just over twenty (20.21) with an active portion of 12.17 and a reserve component of 8.04, twenty percent of this

approximates four fighter wings of air superiority fighters.<sup>2</sup> This also satisfies the requirement to fight two, nearly simultaneous MTWs. Using Desert Storm as an example MTW where two fighter wing equivalents of air superiority F-15s attacked Iraq from bases in Saudi Arabia and Turkey, the Air Force has established that it will need four fighter wing equivalents of F-22s to meet future obligations. This accounts for 288 F-22s as a fighter equivalent wing numbers 72 combat coded aircraft. Sixty four additional aircraft will be needed for training to include three, eighteen aircraft squadrons for initial and follow on pilot training and ten aircraft for the Fighter Weapons School. Thirty-five aircraft will be used for pilot and maintenance training at each of the active F-22 squadrons. Eight aircraft will be used for continuing test and evaluation and for future developments and modifications. Finally, 43 aircraft will be developed as attrition reserve to maintain a stable force structure through the life of the aircraft. The total is 438.<sup>3</sup>

### **Current Inventory**

The second, less scientific but easier method to grasp, is to compare the number of F-22s required to replace the F-15Cs currently in the inventory. Figure One shows a complete breakdown of all F-15Cs in the active and guard/reserve component of the Air Force. The total of 438 aircraft does not include any aircraft currently used for test and evaluation. Since no more F-15s are on the production line, and the older models have been placed into storage at Davis Monthan AFB, Arizona, the only available attrition reserves will come from a squadron at Eglin AFB, Florida, which closed on the 1st of December 1997. Changes however, are already in the wind.

| F-15 Inventory        |                |                |                         |                |                |
|-----------------------|----------------|----------------|-------------------------|----------------|----------------|
| Active Duty Squadrons |                |                | Guard/Reserve Squadrons |                |                |
| Location              | # of Squadrons | Total Aircraft | Location                | # of Squadrons | Total Aircraft |
| Spangdahlem           | 1              | 20             | Portland                | 1              | 18             |
| Lakenheath            | 1              | 20             | St Louis                | 1              | 18             |
| Kadena                | 3              | 60             | New Orleans             | 1              | 18             |
| Elmendorf             | 2              | 40             | Jacksonville            | 1              | 18             |
| Eglin                 | 2              | 40             | Hawaii                  | 1              | 18             |
| Langley               | 3              | 60             |                         |                |                |
| Mountain Home         | 1              | 20             |                         |                |                |
| Tyndall               | 3              | 78             |                         |                |                |
| Fighter Wpns          | 1              | 10             |                         |                |                |
|                       | Total          | 348            |                         | Total          | 90             |
|                       |                | Grand Total    |                         |                | 438            |

Figure One

The Air Force has already dropped the procurement of F-22s from its current level of 438 to 339. This plan may come about as a simple result of politics, economics, and future capabilities as the next generation of replacements such as the Joint Strike Fighter (JSF) are fielded to replace the inventory of F-16s.<sup>4</sup> A primary critic and opponent of the F-22 is the United States Navy.

### The F-22 vs the Joint Strike Fighter

The United States Navy has long been an opponent of the F-22. They have suggested that the program is too expensive and that the two aircraft they support, the Joint Strike Fighter and the F-18E/F will easily meet the needs of the joint force commander well into the future. In 1997, Senator Levin, a Democratic Senator from Michigan and ranking minority member of the Senate Armed Forces Committee, tasked the Air Force and Navy to perform a comparison between these aircraft. To eliminate as much bias as possible,



the Air Force compared the F-22 to a notional convention fighter, termed the Enhanced Conventional Fighter (ECF) with reduced radar signature requirements, weapons load, and combat radius similar to that proposed for the Joint Strike Fighter and utilized the extensive array of computer data processing, modeling, and simulation provided by the “Skunk Works” facility in Palmdale, California.

The simulation involved two packages of fighter aircraft and cruise missiles attacking a high priority target defended by an advanced Integrated Air Defense System (IADS) in the 2010 timeframe. Both packages were appropriately armed and utilized the necessary support aircraft to provide air superiority, suppression of enemy air defenses (SEAD), and tanker support. The results were nothing short of amazing.

The first package required 66 ECF aircraft in both the air superiority and strike missions, 4 EA-6B for SEAD, 6 KC-10s for tanker support, and 72 cruise missiles to successfully destroy the notional target. The second package required only 20 F-22s flown in air superiority, strike, and SEAD roles, two KC-10s, and 16 cruise missiles to achieve the same level of success. Attrition by the IADS further increased the disparity between the two packages. In the first package, 30 ECFs were downed by enemy fighter and surface-to-air threats. Comparatively, only 2 (statistically 1.7) F-22s were lost. Suddenly, economics take on a whole new meaning.<sup>5</sup>

### **Economics of the F-22**

Both the F-22 and the Joint Strike Fighter will eventually go into production. The first F-22 squadrons are scheduled to achieve operational status by 2005. The Joint Strike Fighter is scheduled to enter the inventory around 2010. Economically, the F-22 looks

imposing with its current price tag of \$71 Million per aircraft, the so called high end of the “high low” mix of F-22s and JSFs. Future procurement of JSF, the so called low end of the “high low” mix, is set at 2,852 aircraft with 1,763 for the Air Force, 609 for the Marine Corps, and 480 for the Navy, each with a price tag of approximately \$50 Million.<sup>6</sup> The high end F-22s will cost just over \$31 Billion. The low end JSFs will cost just under \$142 Billion. The American public will forget the cost of the F-22 long before they get over the JSF bill. Both aircraft are necessary.

The F-22 will replace the aging fleet of F-15s primarily in the air superiority role. As the current strike aircraft, including the F-16 and the F-18 E/F begin to reach end of their operational usefulness due either to age or technological limitations, they will be replaced by the Joint Strike Fighter. The F-22 will provide the stealth and firepower to reign supreme over the IADS. The Joint Strike Fighters, will provide the firepower required by the ground forces commander.

## Notes

<sup>1</sup> Tony Mason, Air Vice Marshall. AIR POWER A Centennial Appraisal, (London, Bookcraft (Bath) Limited, 1994): 236.

<sup>2</sup> Defense Planning Guidance, FY 1999-2003, 66.

<sup>3</sup> “Compilation of F-22 Questions and Answers Staffed by HQ USAF/XORFS,” 14.

<sup>4</sup> Defense Planning Guidance, FY 1999-2003, 85.

<sup>5</sup> Bruce Carlson, Brig General, USAF. Briefing to Mr F. Creighton Greene, Jr on “Comparison of F-22 and Enhanced Conventional Fighter (ECF) Employment.

<sup>6</sup> “Compilation of F-22 Questions and Answers Staffed by HQ USAF/XORFS,” 21.

## **Chapter Seven**

### **Conclusion**

These arguments point in one direction. The United States has embarked on a strategy of engagement and enlargement, one where its military may be required to fight in two nearly simultaneous MTWs. In combat, the Air Force will be expected to gain and maintain air superiority over an ever increasing number of more capable fighter and surface-to-air weapons systems to meet the joint goal of full dimensional protection and service competencies of air superiority and precision engagement. The aging F-15s will soon meet the end of their life expectancies. The F-22 is the replacement. Incorporating the exciting new technologies of stealth, supercruise, and fused avionics, the F-22 will master the air superiority role and provide decisive support to the SEAD and TMD roles. The force structure of F-22s proposed in this paper will allow the F-22 to lead the joint employment team of Army, Navy, Marines, and Air Force well into a future full of uncertainty.

## *Glossary*

|        |  |
|--------|--|
| AIM    | Air Intercept Missile                    |
| AMRAAM | Advanced Medium Range Air-to-Air Missile |
| ASRAAM | Advanced Short Range Air-to-Air Missile  |
| AWACS  | Airborne Warning and Control system      |
| DCA    | Defensive Counter Air                    |
| ECF    | Enhanced Conventional Fighter            |
| IADS   | Integrated Air Defense System            |
| IFF    | Interrogation, Friend or Foe             |
| JDAM   | Joint Direct Attack Munitions            |
| JFC    | Joint Forces Commander                   |
| JSF    | Joint Strike Fighter                     |
| JSOW   | Joint Standoff Weapon                    |
| MEZ    | Missile Engagement Zone                  |
| MTW    | Major Theater of War                     |
| OCA    | Offensive Counter Air                    |
| SAM    | Surface-to-Air Missile                   |
| SEAD   | Suppression of Enemy Air Defenses        |
| SHORAD | Short Range Air Defenses                 |
| TMD    | Theater Missile Defense                  |

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