

DESCRIPTION  
OF  
OUR FAILING DEFENSE ACQUISITION  
SYSTEM

AS EXEMPLIFIED BY THE  
HISTORY, NATURE AND ANALYSIS  
OF THE  
USAF F-22 RAPTOR PROGRAM

A NATIONAL TRAGEDY — MILITARY AND ECONOMIC

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HISTORY, NATURE, AND ANALYSIS  
OF  
THE USAF F-22 RAPTOR PROGRAM<sup>1</sup>

A CLASSIC EXAMPLE OF OUR FAILING DEFENSE ACQUISITION SYSTEM<sup>2</sup>

EXECUTIVE SUMMARY

The F-22 Raptor acquisition provides a classic example of the inability of our Department of Defense to develop and field a modern weapon relevant to our present and foreseeable wars. The saga of its course through conception, design, development and testing is the subject. Almost every ill in the DoD system is made manifest by the F-22 acquisition. Resolutions to the problems are clear, and they are remarkably simple.

The F-22, an outgrowth of the Advanced Tactical Fighter (ATF), was conceived as the air superiority aircraft to replace the F-15 fleet, and to give the US the ability to conduct Offensive Counter Air Operations deep inside Russia during the Cold War. To this end, the ATF was designed to possess 4 major characteristics (so called requirements, really desires) — 1. Extremely High Airbattle Maneuverability and Performance, 2. Very High Stealth, 3. A Significant Supersonic Cruise Combat Radius, and 4. Exceptionally Modern High-Technology Avionics to support lethality and to provide pilot awareness for survivability.

The set of requirements were (predictably) too ambitious to be met. A cost limit placed on each aircraft was \$35M, to purchase a fleet of 750 to 800 aircraft for \$40B. To help maintain the cost limit and to ensure its extremely high performance, a weight limit was set at 50,000 lbs. The desires and constraints violated basic laws of physics and aeronautical engineering, and could not be met. The immediate results were that the weight (typically) swelled to 63,000 lbs and the cost soared for two reasons — a) the cost was grossly underestimated by Air Force Systems Command, and b) it was continually misrepresented to seduce operational Air Force commanders, The Congress, and The Public into believing the aircraft was affordable.

The cost distortions rose from its advocacy limit of a Total Program Cost of \$50 Million to the most recent statement by the Chief of Staff of the USAF of \$257M. Despite an increase of funding from \$40B to \$70B, the number of purchasable aircraft fell from the initial combat need of 750 aircraft to 275 aircraft and the evidence is that it will likely drop to 180 or 150 aircraft. These force levels cannot provide air superiority against any major world power. Hence the current fleets of fighters—the F-16, F-15, and the USN F-18 (two of these weapons systems are still in production) cannot be replaced. The planned cost misrepresentations were distorted by a factor of 5!

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<sup>1</sup> This very short summary of the Raptor is backed by two reports that not only greatly deepen the analysis, but constitute proof of all that is presented here. 1. *MILITARY ANALYSIS of the USAF F-22 RAPTOR ACQUISITION, ITS OPERATIONAL FUTURE — A NATIONAL TRAGIC COMEDY* by Col. Riccioni, 2004, 66 pages. 2. *REVIEW of the F-22 PROGRAM, FACTORS for DECISIONS*, by Col. Riccioni, in concert with *Government Oversight POGO*, 18 pages.

<sup>2</sup> Other histories can serve as well — The utterly inadequate and overrun B-1B; the unbelievably expensive, overrun B-2; the cancelled DIVADS gun system; the cancelled Crusader mobile heavy artillery for the Army; a stealthy A-12 strike aircraft for the USN, cancelled for lack of progress and escalating costs; the dangerous and operationally disappointing Marine AV-8B; and currently, the exorbitantly expensive, ill conceived, flawed V-22 Osprey.

***The 4 major characteristics were not met.*** The soaring weight increase ruined two of the requirements. The 26 percent increase in gross weight led to a wing loading and thrust-to-weight ratio that are totally comparable to those of the F-15C. That means ***there was no increase in performance or maneuverability for reasons of physics.*** The weight increase caused a decrease in fuel fraction from a very proper 36 percent to 29 percent—a little low even for a subcruising fighter. ***The highly touted Supercruise characteristic was failed.*** The USAF hides it behind an aspect of supercruise rather than stating its supersonic radius with combat allowance and landing reserves. The 50-year-old F-104A-19 can match the F-22's supersonic cruise radius! ***Stealth was not fully achieved*** because in being the largest fighter in the sky it is the most visible. It is “visible” to infrared sensors and identifiable by its sound. Its radar can be sensed by high-tech Russian sensors. Its radar signature is admittedly small in the forward quarter but only to airborne radars. The aircraft is detectable by high-power, low-frequency ground based radars. ***The avionics system is a semi-success,*** but it was improperly integrated and uses old state of the art chips. It will require complete replacement and redesign into a *federated system* using modern chips.

***The major failing of the aircraft lies in its design mission.*** With its unprecedented enormous delay in development *spanning two and one half decades, the existing and future enemies changed natures! Insurgents, guerrillas, and dangerous illegals do not threaten the West with fighter aircraft.* The only countries that could mount an aerial threat are our friends. Or they are countries that will never attack the US like India and China. Nor should a *sane United States* that was tested on that side of the world in Vietnam and lost, attack China without a survival reason. ***Terrorists are the only extant and foreseeable threats.*** Result—***Air superiority via fighter aircraft is an anachronism. There is simply no need for a small or large fleet of F-22s.***

Finally realizing this, the advocates of the F-22 changed the justification for the Raptor (chameleon-like), into many mutations (a charade) — all of the ideas either specious, or unnecessary.<sup>3</sup> The last thing the US needs is another ill-conceived air-to-surface attack aircraft in light of the existence of the \$350M Joint Strike Fighter (JSF) program, the A-10, and the F-18E. Nor can the Raptor be transformed into a useful interceptor or supersonic/hypersonic long-range bomber. None of these transformations will dig the insurgents out of the night desert, jungle, or our streets.

An extensive operational test of the F-22 was completed and the reported results fulfilled the glowing transcendent descriptions made before the test. Despite classification, it can easily be deduced that the test was scripted and its results foreordained. Nor do the results reflect the real battle potential of the F-22.<sup>4</sup>

It is easily concluded the only real use for the Raptor is to cancel it and use the remaining \$40B to \$50B to fund a weapon relevant to our current enemies. A Raptor in nature is a bird of prey. When the prey is eliminated, the natural Raptor that feeds on it dies. Not so with weapons—when the F-22 Raptor has its prey eliminated, it immediately goes on *artificial life-support* — new justifications are conjured for it by the advocates.

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<sup>3</sup> Treated in detail in this report, and in great depth in the Tragic-Comedy, Riccioni, op. cit. Charade means *absurd pretense*, Oxford Dict.

<sup>4</sup> Completely described in the full report, and proven in my previous works, Riccioni, op. cit.

The Department of Defense lacks the insight and courage to do what is right for a set of programs that total some \$X Trillions.

Many of DoD's flaws are revealed: Change induced by an excessive development time; lack of sufficient insight into world affairs to realize that things have changed; lack of courage and conviction born of patriotism to take the correct action; failure of the DoD and the military services to give contractors the freedom to describe the art of the possible without prejudice to them; failure to hold accountable the contractors that make promises which lie outside the scope of physics and the art of the possible; and failure of service monitors and test pilots to report the facts and to take the appropriate corrective action.

***Resolution to most of these problems is For All to tell The Truth despite what it may lead to.  
Without the truth, we are led to Chaos and Insanity.***

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## I INTRODUCTION

The objective of this study is to inform (really to alert) The Congress and The Public of the undesirable state of the Acquisition System of the Department of Defense using the F-22 as the example. It is in this system that the desires of the military services are transformed into realization. It is here that the system breaks down in achieving its purpose. The reasons for the breakdown must be revealed. The system's manifold problems are reviewed. The reader will gain an unprecedented insight into aircraft acquisition in general, and into the F-22 program in particular.

The F-22 Raptor, a modern air-superiority fighter intended to replace the existing F-15 fleet, is *a classic example* of the inadequacies and traps in the acquisition system. Other histories can serve as well — like the utterly inadequate and overrun B-1B; the unbelievably expensive, overrun B-2; the cancelled DIVADS gun system; the cancelled Crusader mobile heavy artillery for the Army; a stealthy A-12 strike aircraft for the USN, cancelled for lack of progress and escalating costs; the dangerous and operationally disappointing Marine AV-8B; and currently, the exorbitantly expensive, ill conceived, flawed V-22 Osprey. This analysis of the Raptor is a condensed version of a previous report — a rich, very complete 66-page report of the failure of the acquisition system with the F-22. It is a companion study to a formal, *definitive engineering/operational analysis* of the F-22 running to 18 pages. These two reports, swollen with data and analyses, *prove the statements* made in this condensation.<sup>5</sup> Note that the advocates' reports invariably *provide only opinions — propaganda full of unsubstantiated claims, and distortions. Most media reports* on the F-22 lack depth of insight into the program and into military flight operations. They contain only the information released to them by the frightfully biased program office and the USAF. Neither checks nor balances are provided.

The F-22 is the manifestation of the US Air Force's *Advanced Tactical Fighter Program (ATF)*. It was spawned during the Cold War, circa 1970, to replace the F-15 fleet. It was to provide air superiority over Europe's skies.<sup>6</sup> To this end — large numbers of the aircraft (750 to 800) were deemed *necessary for offensive Counter-Air Operations deep in Russia*. Its mission defined the *requirements* (really *desirements*) for the aircraft and the funding for the program.<sup>7</sup>

The aircraft's *design* rested on four pillars — **1. Extremely High Airbattle Maneuverability and Performance**, **2. Very High Stealth**, **3. A Significant Supersonic Cruise Combat Radius**, and **4. Exceptionally Modern High-Technology Avionics** to support its lethality and to provide pilot awareness for survivability. The combination *appeared* sound if the conflicting desires could be met. *Then emerged a large distortion*. The promise made by Research and Development Command, specifically the ATF System Program Office (SPO), to the Air Staff, to Air Combat Command, to The

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<sup>5</sup> 1. *MILITARY ANALYSIS of the USAF F-22 RAPTOR ACQUISITION, ITS OPERATIONAL FUTURE — A NATIONAL TRAGIC COMEDY* by Col. Riccioni, 2004, 66 pages. 2. *REVIEW of the F-22 PROGRAM, FACTORS for DECISIONS*, by Col. Riccioni, in concert with *Program on Government Oversight POGO*, 18 pages. Both reports are available on request from POGO, Washington DC, and (to some) from me.

<sup>6</sup> Two failed *concepts* in Tactical Air Command (TAC) preceded it—the FBX Strike Bomber and the *TAC 2000* Fighter Study. The first violated the laws of Thermodynamics and was ill conceived operationally. The second was incompetent.

<sup>7</sup> *Requirements* are relatively *hard* elements for a modern fighter based on realistic analysis of the enemy and the art of the possible. *Desirements* are usually cavalier concepts that ignore the realities of war, combat, and physics, passing as Requirements.

Congress and The Public, was that ***the ATF would cost not one dollar more in Total Program Cost (TPC), than the F-15C*** it was to replace. The ATF, now the F-22, was given a ceiling of ***\$35 million (\$35M)*** for its Unit Flyaway Cost (UFC).<sup>8</sup> To ensure adherence to the cost ceiling and to ensure its very high performance, ***it was to weigh not a pound more than 50,000 lbs.***<sup>9</sup> The Total Program Funding was \$40B. Indeed, \$40B could buy 800 fighters at \$50M each. Remember the obvious — ***numbers constitute a vital, dominant characteristic for an air superiority force designed to provide air superiority anywhere in the world.*** Then came the claims. Northrop and Lockheed submitted their proposals with their unit flyaway costs just a little less than the prescribed limit of \$35M, and their weights a few tens of pounds less than 50,000. Had either limit been exceeded that contractor risked elimination from the competition. This is another great flaw of the acquisition system: ***It forces the contractors to compete in making promises they cannot fulfill. Spin is in! The Truth is irrelevant. When The Truth is lost — the results are Chaos and Insanity.***

## II HISTORY of F-22 PROGRAM COST DISTORTIONS

Given the expressed weight and cost “limits” on the ATF (now the Raptor), what really happened? What happened was inevitable: The weight limit had to be ignored, of course. It was inconsistent with the totality of the alleged requirements. The aircraft swelled from 50,000 lbs to 63,000 lbs—a 26 percent error with grievous results, as will be shown.<sup>10</sup> In weak attempts to reduce weight, the “requirements” were constantly adjusted — downwards, of course. They became so-called “*rubber requirements.*” ***Thirdly, the cost was consistently and intentionally misrepresented.*** It had to be for program survival. ***The idea that a new advanced fighter, designed for stealth (which makes it bigger and heavier), with exotic, complex avionics (making it bigger and heavier), with novel very-high-thrust advanced engines (making it bigger and heavier), would be no more expensive than the older, lighter, smaller, lower technology F-15C, was a pipedream, a fantasy that should have been obvious to The Congress and the USAF, if not to The Public.***

How bad was the cost distortion? While I worked for Northrop, a vice president ordered me to make an independent estimate of our paper proposal for the F-23. Even using its *unrealistic* light weight, with an *unrealistic* avionics suite weighing ***only half*** that of the older, smaller Northrop F-18A, my best evaluation was a unit flyaway cost of \$69M — essentially ***twice*** that quoted in the paper proposal to the USAF. It could be no different at Lockheed, our competitor. Prototypes of the two aircraft, the YF-22 and the YF-23, were then built, flown, competed, and evaluated. The YF-22 was selected.<sup>11</sup>

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<sup>8</sup> The UFC does not include the up-front cost of Research and Development (R&D). The public must pay for both the aircraft and R&D, so the Total Program Cost which includes both, is the real cost—allegedly, \$50M.

<sup>9</sup> To save weight—“***Not a pound [of aircraft weight was to be used] for Air-to-Ground [operations]***” this important **edict** was made by the System Project Commander, then Col., later General Fain. Insightful? We shall see its impact.

<sup>10</sup> For years I struggled along with inferred data. This data was inferred from the few scraps of **real** information released by the USAF. An analytical writer, Jim Stevenson, produced the logic for the inferred data. Our data were essentially right on! We were at most 3 percent pessimistic on the weight. A four star general called to inform me that his **Secret** reports proved me wrong, but the USAF was off (optimistic) by 26 percent. Rhetorical — How can this be? And why was the weight classified?

<sup>11</sup> When **all** things are considered, it was probably a correct decision.

*In the very week* that the simpler, unrealistically equipped prototype aircraft flew (read lighter and simpler than the production version), the USAF informed The Congress that to buy 750 aircraft the total program funds had to be raised to \$70 Billion — *essentially double the original quote!*<sup>12</sup> No one noticed. No one complained. Our compliant, vote-sensitive Congress allocated the funds.

On the occasion of the first routine System Acquisition Review (the formal SAR), the USAF claimed it could afford to spend only \$63.4B on the program and could buy only 680 F–22s. So the Unit Total Program Cost (UTPC) went from an initial \$50M estimate to \$93M. What changed? We’ll see.

The USAF response to a request by President Clinton to conduct the so-called “Bottoms Up Review” of the cost of all our weapons systems resulted in a USAF recomputation. The USAF declared that only 480 aircraft could be purchased, ***but still for the same \$63.4B***. The UTPC was \$132M, and the fleet size to replace the F–15 became shaky. Why the new assessment? We’ll see.

Next, in 2001, the USAF conducted a routine off–site Quadrennial Defense Review to re-evaluate the cost of the F–22 *without distractions*. The USAF then ***unabashedly*** claimed it could buy ***only 339 aircraft, and still for the same \$63.4B!*** And since the Flight Test Development Program was about ***a decade behind schedule*** due to the complexity of the aircraft, six aircraft had to be sacrificed to fund the flight test development program. Dividing 333 into \$63.4B results in a unit aircraft cost of \$190M, or ***four times the original statement*** to The (compliant) Congress and to the unknowing Public. Of course the cost distortions didn’t end there.

No one seemed alarmed by this obscene never-ending cost increase, so I accepted an invitation extended by the Government Accountability Office (GAO), and a Washington, DC organization – *Project On Government Oversight* (POGO) – to brief selected congressmen; a few congressional staff members; some 25 media reporters; the GAO, “watchdogs of the nation”; the Congressional Budget Office (CBO); and the Director of all Military Testing and Evaluation (DOTE), the honorable, dedicated, and very competent Dr. Phil Coyle, on a) ***The Real Nature of the Raptor*** and b) ***the Horrendous Distortions of the Cost of the Aircraft***. While briefing the CBO, a perspicacious member interjected with the statement — “Col. Riccioni, the USAF will be lucky to get more than 175 F–22s.” Wow! — ***Not 333 but 175!*** — And very prescient as will be seen! This tragic-comedy didn’t end there, either.

*In 2004 the USAF reinstated the funding level to \$70B*, at which point the Chief of Staff of the USAF, four star General Joseph Jumper, made the pronouncement that the USAF was planning to buy 275 F–22s at \$257M a copy!<sup>13</sup> ***This is escalation (read distortion) by more than a factor of five!*** Reader, be aware that estimating the cost of aircraft is not a difficult task.<sup>14</sup> The aircraft didn’t increase in cost all this time; it was the same aircraft as that in the SAR and in the Clinton Bottoms Up Review. ***The increases were studied information releases. They were gradual approaches to the cost to inure all to***

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<sup>12</sup> Else the fleet size would be cut in half to 375 —*unthinkable at this point in time—it could jeopardize the program.*

<sup>13</sup> Of course this report of the horrendous cost increase was preceded ***by the “usual pronouncements”*** of the very high quality justifying the F–22. This, despite the fact that its formal operational evaluation had not yet begun. He also reminded all of the gathering obsolescence and age of the F–15 fleet. As it should be—more later.

<sup>14</sup> Any good cost analyst can evaluate the cost of a proposed aircraft with less than 30 percent error, and with good data evaluate a flying aircraft to less than 15 percent error. Yet the Air Force is making 400, 500, and 600 percent errors.



***the pain of our vanishing tax dollars. Their sole purpose—to keep this obscenely expensive program alive!***

The war in Iraq laid bare (made manifest) the real enemies the USAF faces. The cost of this war generated serious talk of shrinking the buy to 180 and possibly even to 150 aircraft. But the money will still be gone because the unit cost increases significantly as the quantity purchased is reduced. Only cancellation can save the remaining \$40B to \$50B. Some government officials ***are recommending cancellation of the program.*** Operationally, acquiring only 150 to 180 aircraft means the USAF will use some 70 - 80 aircraft for training and home defense, 40 - 50 for the European theater, and 40 - 50 for the Pacific theater. These numbers combined with the usual low maintenance readiness for flight of complex stealthy aircraft reduces the operational availability of the fleet to insignificance.<sup>15</sup>

Further, fellow Citizens and members of The Congress, ***this escalation of cost typifies all our military programs.***<sup>16</sup> The same phenomena of *weight increase, cost escalation* (read distortion), and *performance reduction*, are currently being demonstrated by the Joint Strike Fighter acquisition program. But *Cost* determines the number purchasable. For completeness, there remain the important elements of *Effectiveness* and *Cost-Effectiveness*. These are addressed in Part III.

### III WHAT OUR NATION GETS FOR MORE THAN \$70 BILLION

What will the \$70B Raptor program and an additional \$1B per year for maintaining a very small fleet of F-22 Raptors contribute to our national defense? First of all — ***the raison d’etre for the aircraft disappeared: The cold war has long been over!*** Secondly, the aircraft’s requirements fell far short of achieving ***that dream.*** *The promises, the four pillars, need review.* ***Real Stealth*** is measured against its ***five signatures*** — ***infrared, sound, visual, electronic emissions, and radar signature reduction*** to enemy fighter radars and enemy ground-based radars.<sup>17</sup> The F-22 is the biggest fighter in the sky and is the first to be seen visually. ***This is anti-stealth.*** If cruising supersonically, two signatures give it away and identify it—the inescapable *infrared signature* and its *loud supersonic booms*. Infrared sensors have come a long way. The US Navy routinely equips its fighters with them and the Russians have good ones for sale. Netted computers can track its sound. Its big powerful radar designed to see the enemy at long distances and despite minimizing detection of its own emissions can be detected by existing high-tech Russian radar detectors. Also, *it is physically impossible* to design shapes and radar absorptive material ***to simultaneously defeat*** low power, high-frequency enemy *fighter* radars, and high power, low-frequency *ground based* radars. Unnoticed by all the air superiority advocates is that ***air superiority is primarily a daytime operation, and stealthy airplanes are stealthy only at night***—hence the dark grey stealthy F-117’s name — *Nighthawk*. The F-22 Raptor is not very stealthy. ***But, then, stealth is meaningless operating against the small undeveloped nations that we fight — as are air superiority aircraft.***

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<sup>15</sup> ***The sole reason*** that I initiated a program in the USAF, the Lightweight Fighter which matured as the F-16, was to augment the numbers that the USAF could buy instead of procuring an all F-15 force. ***The number of fighter wings in the USAF was doubled.*** Numbers, numbers, numbers, ... Then, I was the leading advocate of air superiority in the USAF.

<sup>16</sup> Research the tales and agonies of weight increases for the F-111, F-15A, B-1B, B-2, & the current trauma—the JSF.

<sup>17</sup> The USAF defines stealth with ***only one partial*** signature—*radar*—and that ***only in its forward quarter, and only to enemy fighter radars at the same altitude.*** ***This very limited definition*** fits the USAF’s penchant for head-on attacks.

The advocates of stealth have never understood that *it isn't design to stealth* that makes aircraft unsensed by the enemy. ***It is the cost of design to stealth that reduces the operational force to the point that it will seldom be in operation.*** Proof — we possess only 21 stealthy B-2 bombers instead of the 135 that the fully funded program was to buy!<sup>18</sup> Can one win a war ***against a powerful country*** with 21 bombers *that fly at half the frequency of the B-52 Stratobomber?* Of course not. We can only fight small, very weak nations like Somalia, Serbia, Vietnam, Panama, Afghanistan, Iraq, and teeny Grenada — so we do. They fight us asymmetrically — making our expensive preparations for war fruitless. We win these campaigns about half the time. And even after winning, we sometimes lose the war.

Due to its ***very large 26 percent gain in weight***, the Raptor has a *very ordinary* thrust-to-weight ratio and wing loading, comparable to the F-15C. Hence, ***its maneuverability, acceleration, and rate of climb are comparable to the performance of the F-15C*** — for reasons of basic physics.<sup>19</sup> Its supersonic cruise potential allowing sufficient fuel reserves for supersonic combat and other requirements, is very low because this radius is heavily dominated ***by its deficient fuel fraction.*** *Fuel fraction* is the fraction of the total aircraft weight that is fuel, measured at take-off.<sup>20</sup> To make it look good, advocates compare the Raptor with the worst *supercruiser* fighter in our military, the F-15C. The F-22 probably doubles the small ***operational*** supersonic radius of the F-15C at 1.6 Mach. But so does the 50 year old, diminutive F-104A with the J79-19 engine. The USAF constantly claims that the F-22 has a large supersonic cruise radius, but they lack insight into the subject of efficient supersonic cruise. And never, not even hardly ever, *does the USAF quote its real measure—its supersonic radius on a practical supersonic combat mission with standard landing fuel reserves and fuel required for high-speed combat. Supercruise fighters are a legacy that Col. John R. Boyd and I left the USAF.*<sup>21 22</sup> In summary, The Raptor is not the promised advance in *fighter performance and supersonic cruise range.* *It is somewhat stealthy*, but in performance it is similar to an F-15C with advanced avionics; and is merely comparable to the latest Russian aircraft.

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<sup>18</sup> Of the three aircraft shot down during our incursion into Serbia, one was an F-16 flown by a pilot doing other than he was directed to do, and two were the most stealthy F-117 Night Hawks, one of which staggered back to its home base never to fly again, so it is seldom counted. With our extensive use of Suppression of Enemy Air Defenses (SEAD) ordinary aircraft survive just as well as the stealthy ones. Some claim that the Raptor has the signature of a bird. True, but only in the forward quarter, co altitude, and only to enemy fighter radars. It is quite visible to ground based radars.

<sup>19</sup> This was corroborated by a Lockheed test pilot who allowed that the F-22 essentially had the air battle performance of the F-15C and the F-16 with the largest GE engine. Since this is physics, his corroboration is unnecessary, ***but at least he told The Truth! Remarkable to say the least.***

<sup>20</sup> Breguet's range equation reveals that *fuel fraction dominates radius of action of anything that flies.* A USAF Lt. Col. claimed that the USAF does not track fuel fraction for its lack of importance. F-22 advocates never discuss fuel fractions. They claim that the ability to fly supersonically in non-afterburning thrust defines a supercruiser. In total contradiction to this, the SR-71 "Blackbird," the longest-range supersonic cruise aircraft in the world, flies ***only*** on its ramjet—its afterburner.

<sup>21</sup> While assigned to the Flight Dynamics Laboratory at Wright Patterson AFB, the Flight Mechanics Division in my command, assisted by NASA, did 90 percent of the exploratory work on supersonic cruise fighter design. I chaired the first (Secret) supersonic cruise fighter conference and laid the groundwork for the second. The supercruise concept ***had to be forced into the USAF.*** Now it is loved, espoused, and claimed, but it eludes the USAF.

<sup>22</sup> Supersonic cruise fighters need a higher fuel fraction than do subcruising fighters. It should be at least 32-33 percent and ideally 35 percent and above. ***That of the F-22 is lower than that of two fair subcruiser fighters, the F-4E and the F-15C, guaranteeing that the claims supercruise in the F-22 are specious.*** *Specious* means —*Deceptively attractive.*

*The capability of the F-22's electronic suite unquestionably exceeds that of the F-15C. Both aircraft carry the same weapons and are comparably lethal. However Lockheed made two grievous errors in designing the electronics suite for the F-22. **First Error**— the F-20 has an “integrated” avionics suite (as opposed to the “federated system” in the F-23), which means all its components are designed to work together in harmony, but generally, **only** with those components. Hence, modern, better components cannot be merely plugged in to replace most of the old components without a great deal of reprogramming. “Plug-and-Play” replacement is possible with a federated or modular system. **Second error** — inexplicably, old state-of-the-art computer chips were used in its composition. In short, a major (and until now, *unheralded*) modification is required to bring its avionics suite into modernity. This hidden major expense and arduous multi-year task will be delayed until the aircraft is committed to full production. *Of course, public awareness of this expense couldn't possibly be allowed to threaten the program.**

***But the major point relative to this program remains — The USAF has no need for an upgraded air superiority aircraft. There is no air superiority problem facing the US today anywhere in the world!***<sup>23</sup> Of course one can be conjured, but it is difficult. Countries having many fighters – usually US fighters – are England, France, Italy, Denmark, Belgium, Israel, and Japan. They are not going to war on us. Neither will Russia or a benign India. China will not attack the US, nor should we attack China.<sup>24</sup> However, F-22 advocates seeking to justify an air superiority war, would have us involved in defending the political affiliation of a mere 15 million Taiwan Chinese against almost 1.5 billion Mainland Chinese. Further, on the subject of numbers, our “swarms” (large fleets) of F-15s and F-16s assisted by the versatile A-10, may have a chance to defend Taiwan — but a couple of squadrons of F-22s with a sortie rate about half that of the others will never even be noticed by the Mainland Chinese commanders, nor will they care. Numbers count! ***F-22 advocates must learn to count. Proper counting seems to be a lost art.***<sup>25</sup>

It goes unnoticed that our mighty, imperial US has been engaging only small, backward countries — ***and not always winning. Our foreseeable enemies are in the*** in the desert regions. The deserts range from Casa Blanca across all of North Africa to Egypt, through the Middle East and into parts of Russia, and Saudi Arabia, to Pakistan and parts of India. The Iraq war made it clear that ***terrorists are at war with the West.*** Fundamentalists have openly expressed their intention to conquer the West and place it under a single Caliphate — not an “*impossible dream.*” Western nations operate as if this war doesn't exist. But it does. And it defines our real enemies for at least the next two decades – *terrorists, angered by Western behavior, religiously motivated, politically directed, and seemingly irrational in a Western sense—an enemy difficult for the US to understand.*<sup>26</sup>

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<sup>23</sup> Verification of this of this was provided by a leading F-22 advocate. While giving me an F-22 presentation, he candidly admitted that there was no air superiority problem facing the US anywhere in the world — a staggering truthful admission. My *MILITARY ANALYSIS of the USAF F-22* covers the lack of air superiority enemies in great detail. Riccioni, op cit.

<sup>24</sup> The US was unable to win a war with a tiny nation of 70 million Vietnamese on the very low end of the GNP scale on that side of the world. We would be well advised not to engage and enrage 1.5 billion Chinese, unless for clear reasons.

<sup>25</sup> “The Great Soul”—Mohandas Gandhi—understood the importance of numbers. He knew that 250,000 colonial English could not control a recalcitrant India's 300,000,000 nonviolent population. I used to think that his counting was brilliant, but that was really a no-brainer. It was *his understanding of the British and his recourse to nonviolence* that were brilliant.

<sup>26</sup> Some members of Congress make remarkably bad statements about weapons revealing their unawareness about our real enemies.

***The salient point is that — our new enemies do not generate air superiority problems!*** They indulge in insurgent wars using terrorist tactics, and *in winning, find no need for air superiority aircraft.*<sup>27</sup> For instance, Afghanistan’s Mujahideen were able to control the skies above their rag-tag insurgents. They swept the air clean of Russian gunship helicopters and air-to-surface fighters, ***using very inexpensive US supplied, shoulder-launched, infrared Stinger Missiles. So can our military.***

The conclusion is immediate — ***air superiority aircraft better than the F-15 and F-16 are unnecessary.*** If our USAF fleets are getting long in the tooth we still have the comparatively low cost F-16 and F-18 in production. The F-15 can be placed in production. *There simply is no need for a new air superiority aircraft. But, if there were, the tiny fleet of F-22s we will purchase cannot provide it!* Their ineffectiveness against guerillas, combined with their low numbers and low readiness rates, result in an unreasonably expensive, militarily useless, industrial-military program that will not increase our offensive air power. *Clearly this agenda of the Department of Defense is not born of a requirement for defense or offense. The DoD acquisition system is flawed for its inability to check itself and inability to take corrective action.* This awareness is born out in the Part IV — the ever-changing set of justifications generated purely to keep this unrewarding program alive.

#### IV EVER-CHANGING JUSTIFICATION — THE CHARADE<sup>28</sup>

The changing course of history during *the F-22’s unreasonably long development* made the program utterly irrelevant. The desperate effort to save this major defense/economic program generated a bizarre set of endlessly changing justifications.

“The Charade” — Initially the advocates and proponents scoured the world for enemy countries that could conceivably generate an air superiority threat to the US. Even friendly countries that bought or were given our latest fighters because the US believed they needed our military support were considered as possible future threats, including Japan, Germany, Israel, Pakistan, Canada (a possible threat?), Venezuela, Italy, Denmark, England, and Belgium. They suggested that some of these nations might turn on us. So, they said “*it is clearly necessary*” that we build better performing US fighters to defeat our best current fighters, the F-15, the F-16 and the F-18. Yet, curiously, ***Lockheed sought license to sell the F-22 abroad — and it was granted! Now this is a truly beautiful ploy. Their real intent is to have the US committed to a perpetual arms race — with Itself! Then the US will be committed to continually justify new aircraft, useless for our defense, to cope with a possible threat of our own creation!*** This is unquestionably one of the slickest scams ever perpetuated on the paying public by the “*Titanium Quadrangle*” (TQ is comprised of *The Military, The Congress, The Contractors, and The Pantheon of Pundits and Advocates*).<sup>29</sup> Unnecessary weapons waste our nation’s assets. History reveals that ***no nation ever became great by producing waste.***<sup>30</sup> Unnecessary trucks and C-130s can be useful for other purposes, but not unnecessary weapons. A few nations other than those cited above have many fighter aircraft, but the US is not going to war with Russia nor will we attack

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<sup>27</sup> For the cost of a modern Sukhoi 27 fighter, guerillas can arm more than a million insurgents— a much more powerful force, to them. A million properly trained and directed, dispersed armed guerillas can defeat a larger army of occupation.

<sup>28</sup> *Charade* means — ***an absurd pretense***; Oxford Illustrated Dictionary.

<sup>29</sup> The *Titanium Quadrangle* is much more powerful than President Eisenhower’s *Military Industrial Complex*, the MIC.

<sup>30</sup> The US is currently spending ***trillions of dollars*** on weapons irrelevant to our defense.

benevolent India. China is not going to attack the US. ***Nor should we attack China, unless she threatens our national survival.***

Finally, *after decades* of parading the *air superiority charade*, it became evident to all that this was a dog “that would not hunt” — The Charade wasn’t selling. *A new justification (pretense) had to be articulated!* The USAF will justify it as an air-to-surface aircraft. So, conceptually it was transformed into a fighter-bomber— the FB–22. Without reflection, this sounds rational. Air superiority fighters with low wing loadings and high thrust-to-weight can carry and maneuver with large weapon loads. But, from here the thinking goes completely awry.

What is wrong with this concept? Col. Fain, the former SPO commander, committed a grievous strategic error in ***dictating*** — “*Not a pound [was to go] for air-to-ground.*” Competent aircraft designers know that it is much more difficult to convert a stealthy aircraft to the air-to-surface role than a conventional high performance fighter. The FB–22 is limited by its small internal weapons bay designed purely for its airbattle missiles. Its bay is half that of the F–117 Nighthawk that is the F–22’s stealth competition.<sup>31</sup> The FB–22 can fit only two 1000 lb precision weapons into its bay; the F–117 routinely carries two 2,000 lb weapons. If the F–22 is modified to carry weapons externally on its wings, *two key pillars are lost* — *stealth* and *supercruise*. If the weapons are packaged in a special low radar signature external pod, its already low fuel fraction will deny it adequate range. ***Forgotten*** is that the USAF is reducing its F–117 fleet apparently for lack of need, so why gain an FB–22 that is half as effective? ***Forgotten*** is that the US has just committed itself to the stealthy air-to-surface Joint Strike Fighter, the J–35 — allegedly a thoroughbred fighter-bomber in the largest production award in history ***\$350,000,000,000 dollars (\$350B)*** to be spent over 10 years. So why add another \$100B for the FB–22?<sup>32</sup> ***Not mentioned*** is the expense of the modifications required of the Raptor for air-to-surface use — including a new avionics suite, armor, and redundant controls. ***Forgotten*** is that the world’s greatest air-to-surface fighter bomber for use in the desert already exists— the slow, ugly, most versatile, most effective aircraft, proven in the Desert Storm Campaign — an aircraft with the proper *loiter* and *ubiquity* and *weapons carriage* for the combat in the desert regions—***the A–10*** — affectionately known as the “***Warthog***.” Its unique 30 mm cannon firing depleted uranium rounds ***is unmatched by any other aircraft***. This is truly a precision weapon ***generating much less collateral damage than precision bombs***. ***Forgotten*** is the extensive air-to-surface potential of the US Navy’s large F–18E fleet. So why the FB–22?<sup>33</sup> The USAF is beginning to realize that the FB–22 is another unsuitable manifestation of “The Charade.”

What came next? Convert it to a long-range supercruising, fast response bomber. Of course! Other aircraft can’t do this. ***Neither can the existing F–22***. But by redesigning the wing, enlarging the aircraft, placing added fuel in a new delta wing, it can be done. Its range will not match any of the heavy bombers and the internal bomb load will remain very low. The new F/A–22 (F/A for Fighter Attack) is certainly very pretty. Is there a downside? External under-wing bomb carriage will lose the

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<sup>31</sup> Its non-stealthy competition is the much more capable F–15 Strike Eagle that has the performance of the F–22.

<sup>32</sup> ***Answer: the Raptor is not in fulfillment of a defense need; it is purely a commercial venture!***

<sup>33</sup> Interestingly, it is easy to reveal the full lack of insight into fighter aircraft in our military services. Four aircraft that make up the bulk of the USAF and the USN ***had to be forced*** on the recalcitrant services — the F–117, A–10, F–16 and the F–18. The USAF wanted the fairly good but expensive F–15s forever. And the USN wanted F–14s forever to the exclusion the F–18. The F–14 fleet defense aircraft in the Navy for many campaigns, fired only two Phoenix missiles in anger — both missed. The F–14 / Phoenix integrated system was retired after 30 years without having served.

F-22's stealth that is implicit in the new JSF—the J-35. But most importantly, The F/A-22 is no longer an F-22. ***It is a completely new aircraft!*** Only the engines, the canopy, and the fuselage reference line will be common and interchangeable. New aircraft take years to develop. At the progress rate of the F-22, it will take decades and *many tens of billions* of dollars to design, develop, equip with new avionics, and test.<sup>34</sup> But this *redesign transforming a fighter to a bomber was tried before and found wanting — for generic reasons.*

General Dynamics, now part of the Lockheed corporation, designed just such a bomber variant of the F-16 – the F-16XL – flew it and tested it, and the USAF rejected it both as a fighter and as a bomber. A major reason for its lackluster performance was its very high structural weight fraction. High, because it was a modification of an exiting airframe designed to a different purpose. So with its excessive weight, and its reduced thrust-to-weight ratio, it was capable of very tight turns, but at horrendous, unprecedented energy loss rates, making it easy to defeat.<sup>35</sup> External bomb carriage has no relevance to an F/A-22 for then it loses ***both*** stealth and its supersonic cruise speed — the very characteristics that once justified its existence. But where is the need? Fighting dispersed insurgents in the alleyways of Baghdad and Tikrit can hardly justify it. Bombing insurgents is not very effective. The insurgents “*bomb*” us more effectively and much more precisely — using human bombers — in asymmetric warfare.

***“The Charade” then, is the set of flailing efforts just to keep an irrelevant program alive.*** One ploy, one modification may survive, but if it doesn't, new concepts will be formulated—like an interceptor version of the F-22. The issue has been raised. It may be necessary to intercept and shoot down our hijacked passenger aircraft loaded with passengers being used as weapons. *The most recent ploy* is to redefine its primary mission as a cruise missile destroyer. *Aviation Week and Aerospace Technology quotes a Lt. Col Stapleton:* “A primary mission for the F/A-22 is slated to be cruise missile interception well behind enemy lines.” He goes on to describe the employment philosophy to disrupt *waves of cruise missiles* using sophisticated tactics.

Where does one find the enemy lines that define battle operations against terrorists? The lines simply don't exist. The concept of battle lines is several wars back in history. Infiltrating terrorists and terrorist organizations do not generate lines between protagonists. And the terrorists have no need for cruise missiles. Concepts of the *Forward Edge of the Battle Area*, the famous “*FEBA*,” weren't relevant even in the now-distant Vietnam War. These operations are steeped in World Wars-I & II, and in the containment of the Sino-Soviet Pact and Communist expansion — concepts that ended or became unfashionable *decades ago*. ***The advocates are still planning for Third Generation Wars while the world has transitioned to Fourth Generation Warfare! This is a complete mismatch of weapons and enemies.***

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<sup>34</sup> At least the now useless heavy, complex thrust reversers can be thrown away. They were never of real value anyway allowing the F-22 to do exceptional combat maneuvering at helicopter speeds and below, in visual, close-in maneuvering.

<sup>35</sup> It is very clear that the pundits arriving at these specious concepts are neither skilled in guerilla warfare nor in aircraft design. What is necessary for a new fighter attack design? A clean sheet of paper — or better a cleared mind, a decade or two of time, and possibly another \$200B to \$300B funding for an adequate fleet to fight a major country. Which major country? Possibly, by the year 2025, such a country will exist.

Further, implicit in the intercept mission is the basic *invalid assumption* of having Raptors *in the air in the right places at the right time*, like they always do in preplanned exercises. The Fighter Attack F/A-22 will be so low in numbers, and so few will be available for reason of its lower maintenance ready rate (MRR) that its chances of being able to perform the mission are very low. It is easier for an enemy to proliferate an area with cruise missiles and to use clever tactics, than it is to defend the domain with F-22s or any other interceptor. *The inability of the Raptor to provide rapid response, ubiquity, and presence are its Achilles heel for any form of interceptor mission.*<sup>36</sup> And this is true regardless of the “magical” capabilities of its avionics suite that become useful only when it is in the right place at the right time. Next, proponents will consider equipping the F-22 with a powerful laser beam to destroy inbound intercontinental nuclear tipped ballistic missiles.<sup>37</sup> This is conceptually possible with both the F-22 and the F-15, *but terrorists are our current and foreseeable threats. They are not conjured enemy fighter aircraft, not cruise missiles, and not ballistic missiles.* The guerillas’ weapons — rifles pistols, booby traps, and homemade mines and bombs— are much harder to refute, much easier for them to afford, and much easier to employ surreptitiously. *They are unaffected by any type of F-22.*

The latest modern lust (or ploy) is for *a totally new concept* is a long-range supersonic, or even hypersonic, bomber. It, too, has no relationship whatever to Fourth Generation Warfare. This phenomenon of continually and irrelevantly changing justifications, roles, and designs is the tactic of chameleons varying their coloration to blend into their changing environment. *Both do it for survival.* The charade is a comic-tragedy. Regrettably, *it works in a non-thinking democracy—the tragic aspect.* *It is always necessary to generate chimerical threats to excite the unknowing public and gain their approval.* However, it is now clear that *the USAF and the USN are and will be awash in air-to-surface fighters.* The Raptor cannot contribute to this role. But *to be fair* and mostly *to be complete*, we must review the claims made by the USAF for the operational capability of the aircraft borne of recent operational testing.

## V DISTORTED OPERATIONAL EVALUATIONS

Advocates have long been making wild laudatory claims for the operational prowess of the F-22 in air battles. This, to lend credence to its quality in *the air superiority mission—the mission now established to be militarily irrelevant.* Operational evaluation is rife with possibilities for distortion. Properly, it should be treated in great detail and in historic depth. And it is, in my 66-page report on The Military Analysis of the Raptor.<sup>38</sup> It makes for exciting reading for fighter operations are inherently exciting. And it is fascinating to see aircraft and their weapons *completely misanalyzed* in the last four decades *by all three services.* Here, I will only skip off *a few wave tops.*

*Long before the Raptor was given any formal operational evaluation, the polemics began to flow — because they must.* The shaky program must be “justified.” The claims of quality, the superlatives describing the Raptor, exceeded the exaggerations Hollywood normally makes of its new movies.

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<sup>36</sup> The novel, high thrust engines of the F-22 are notoriously slow to start and ready for operation. This problem cannot be removed by redesign. The time saved in high-speed flight is nullified by normal launch delays and slow system starts.

<sup>37</sup> There is literally no end to the conjurable missions. For instance, it is being considered for the ISR mission—*Intelligence* [gathering], *Surveillance*, and *Reconnaissance*. This is the mission that the much less costly, pilotless, long range, high endurance *Global Hawk* currently does to a level of excellence that *can never be matched by any fighter.*

<sup>38</sup> Col. Riccioni, op cit. It provides the reader more insight into air battles than possessed by most fighter pilots.

Typical are the remarks of a Major General William R. Looney, III. The General, in Research and Development Command and not in the operational evaluation loop, declared the Raptor to be a “*Transformational Leap*” over the F-15 Eagle, whatever that means.<sup>39</sup> To his credit he explains himself — “F-22s attack from 10 miles up at much faster speeds. Stealth technology helps hide them from adversaries’ radar, while their own radar can spot targets from many miles away. *The F-15s are all dead before the fight has hardly even started.* The [F-15] pilots don’t even look at their radar now to try to find the F-22 because they’ll never see it, so they’re looking out (through their canopies) trying to see a contrail, trying to see a glint in the sky.” The Chief of Staff General Joe Jumper made similar claims. What more is there to know? There seems to be little *need* for an operational test.

The ever-dutiful clique fortified this. Lt. Col. Stapleton, F-15 pilot and instructor in the F-22, commented: “This airplane kicks the crap out of everything we’ve got right now. I don’t think any [adversary] is going to get close enough to see us for the next 10 years. When we go out and fly against F-15s, [which has been one of our best fighters for the past 30 years], it is a complete mismatch. The first thing the F-15 pilots hear is ‘Fight’s on.’ The next thing they hear is, ‘You’re all dead.’ The F/A-22 isn’t going to win 51 to 49. It’s to be 100-to-0 or nothing. The last thing in the world we want is a fair fight.”<sup>40</sup> ***This fighter’s performance cannot be improved upon! Lt. Col. Stapleton’s remarks cannot be improved upon.*** Generalship is assured. ***The ultimate air superiority fighter is born.*** It beats any Hollywood death ray. A two-sided air war can no longer occur. No grand, interesting combat films can be made since its adversaries cannot see the F/A-22 and there is too little action to record. Indeed, since the adversaries are so easily destroyed *without* the heavy demands of maneuvering close-in combat, one can envision ***modifying the F/A-22 into an autonomous unpiloted aircraft*** or controlled from a remote ground station. These are possible. *Non-pilots may become aces! It could even save the F-22 program!*

There are related reports supporting the F-22 program. “A series of articles indicated how badly East Indian pilots flying late model Russian Aircraft beat our best pilots flying F-15s. An ‘expert’ declared that the Chinese have a better aircraft in the Russian advanced Flanker and are firing a missile much superior to our AMRAAM. This flurry of alarmist articles appearing at a critical time for the future of the F-22 may be accurate or it may be more distortions to justify the F-22 acquisition.” Note this reporter’s last sentence. How trenchant. Clearly the existing F-15 Eagle must be denigrated for the F-22 to be accepted as its *necessary* replacement. But except for *stealth* and the avionics suite (which must to be replaced), it has been established that ***the F-22 and the F-15 are equals in maneuverability, performance, and lethality.***

Finally, after many delays, the operational test results are in. *And they are as grand as expected:* The F-22 is now declared “operationally effective and potentially suitable,” and noted that its effectiveness against simulated air defenses and F-16s was “overwhelming.” While the Air Force wouldn’t release any numbers, those close to the program said exchange ratios were near 80-to-one and even when conventional aircraft were carrying new electronically scanned radars and helmet mounted sights, “It didn’t make much difference,” says an experienced fighter pilot. “No adversary aircraft survived an engagement with the Raptor,” the Air Force reported. Analysts listed only minor shortfalls.

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<sup>39</sup> Secretary of Defense Donald Rumsfeld frequently uses the word “transformational,” making emulation advisable.

<sup>40</sup> It is fortunate that the protagonist aircraft never see each other and never close to visual maneuvering combat, since the weight increase of the Raptor has made the F-22 comparable to the F-15C in maneuvering performance, and a fair fight would ensue—unacceptable at a 5-to-1 cost ratio.



“It failed to meet required mission capable rates primarily due to immature integrated diagnostics, evolving tech order data, and part reliability.”<sup>41</sup>

What is wrong and what is missing from with these claims could fill a large volume. Much of it is exposed in my *History and Military Analysis of the F-22*. This is in parallel with the scripting done and the claims made for the F-15’s effectiveness when it was to replace the F-4 Phantom in the early 1970s. USAF computer simulations generated *the notorious 955-to-1 exchange ratio* with an F-15A equipped with a superb, idealistic, fictional AIM-82 missile that never saw the light of day, versus a Russian Mig-21 equipped with our old Aim-9B. The USN behaved somewhat similarly in justifying the F-14 Tomcat–Phoenix missile system. With one salvo of its six Phoenix — “All six opponents (programmed target drones) are destroyed,” making the crew *instant aces*. One did not have to be too imaginative *then* to support the F-14 and F-15 development programs for they were never in jeopardy.

Notice that the current rules of engagement are not defined. Still it can be clearly inferred that they were essentially repetitions of jousts, as with the knights of olde —protagonists hurtling at each other, with their identities established. Pilots of the F-22 with its low radar signature in its forward quarter combined with its powerful yet stealthy radar, detect their known adversaries (*not equipped with sophisticated radar detectors* or with modern radars) first; they launch their missiles first into a “*free [to] fire zone*,” their computerized missiles seldom miss, and the adversaries are destroyed. *Superiority has become simplicity itself*. In charging down the lists, the knights with the longest lance should win the joust. Hughes radar advocates delight in revealing this simile in their advocacy presentations, but the F-14/Phoenix history did not vindicate them. Were the adversary pilots allowed to create innovative tactics to game the system? Possibly, but not likely. The script was written. Were equal cost fleets and their realistic flight readiness rates represented in the fights? Of course not. If the tests had produced high F-22 losses, would the reports have been different? No. Is the *Whole Truth* available to the public? Absolutely not. The test description and the results have many *impenetrable overlapping* layers of security classification laid on them.<sup>42</sup> What is evident however is that the USAF doesn’t know how to evaluate its aircraft operationally, much as the colorful jousts of olde before royalty and the ladies of the court did not portray the value of *a force* of knights in combat. Forgotten is that with knighthood in full flower, French knights galloping in successive massive waves into British footmen equipped only with lances and the longbow disappeared permanently in two battles at Agincourt and Crecy for the loss of some 40 British bowmen. Horses and knights littered the battlefield. *The enemy responded asymmetrically!* Such is the price of irrelevant training and questionable battle evaluation.

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<sup>41</sup> Note the last sentence. This *failure* was both predictable and predicted. And the statement was candid! Remarkable!

<sup>42</sup> Speaking of withholding information — At Northrop I witnessed an interesting simulation event that relates to these tests. The adversaries were to prevent “blue” strike packages (formations) composed of F-15s (and sometimes very stealthy B-2s) escorted and protected by very stealthy ATFs, from entering their “red” airspace. Success against the intruders was very low at first. But, with time, a clever, thinking adversary (red) pilot *created a system of tactics using their numbers to unmask the stealthy aircraft* permitting successful attacks of the strike forces and the ATFs. To suppress their unanticipated and undesirable mounting successes, more and more cues were removed from the adversary aircraft until the test lost all semblance to reality. Needless to say, the successful adversary tactics *and the unfavorable results went unrecorded and were certainly not reported to their superiors*. The “script” prevailed; the ATF survived. **One clue** — no aircraft is truly invisible, hence the name “Low Observables.” Stealth is relative, not absolute and it varies with the aspects, the sensors, the ground environment, the situation and the tactics. Given numbers, there are ways to uncover them. **Another clue** — “*WishRams*.”

Some decades ago, the USAF conducted a fairly intense, somewhat relevant, airbattle test at Nellis AFB called *Aimval-Aceval*. This was a two part test aimed at — a) Testing the difference between the high performance, sophisticated F-15C versus a low performance, unsophisticated F-5E, and b) Evaluating the effect of short-range missiles in the ensuing close-in, maneuvering airbattle. Preliminary computer simulations indicated that the exchange ratio would favor the F-15 by 70-to-1. Pilots flying some preliminary engagements suggested that the estimated ratio be lowered to 18-to-1. Many engagements with 1-vs-1, 2-on-2, 2-on-4, and 4-on-4 were flown. They would enter from opposite sides of a 30-mile diameter circular arena approaching each other head-on (in the classic joust, of course), and then “have at it” in maneuvering engagements using computerized short-range missiles and camera guns.<sup>43</sup> Despite the fact that this test heavily favored the high performance F-15 with its vastly superior radar and medium range AIM-7F missile, the test results proved quite different from the expectations. The results? The data? With 2 F-15s pitted against 1 F-5, the F-15 was better in the ratio of about 5-to-1. In 1-on-1 jousts, the F-15 was *3 times* as successful as the F-5. As the number of aircraft in the arena became larger and more target rich, with 4 F-15s vs. 4 F-5s, still with even numbers, the success ratio dropped to about 2-to-1. When the protagonists were 4 F-5s vs. 2 F-15s, the success ratio tended to 1-to-1.<sup>44</sup> A startling (unpredicted) result. But, in the end it made sense.

Since the F-22 never closed to visual range before its missiles were fired, it is deducible that the decisions and missile launches *were all made beyond visual range and with positive identification of the “enemy” aircraft*.<sup>45</sup> So their Beyond Visual Range Identification (BVRID) system must have been almost perfect. *This is break-thorough news!* This technology has been under development for 35 years, frequently claimed, but never achieved. So, presumably, *the USAF now has the capability to positively Identify (distinguish) Friend from Foe from Neutral (IFEN)*. Lack of this important capability kept the USAF and the USN from firing missiles at unknown aircraft beyond visual range in Vietnam and subsequent campaigns. Visual identification has been the only reliable means of identification. When this was ignored, fratricide was too frequently the result. It happened in Vietnam, and in the celebrated and unfortunate shoot down of the Iranian airliner by an Aegis missile cruiser in the Persian Gulf. **Crucial question** — Were **neutral**, not-to-be shot-down aircraft (called “ringers”), inserted into the operational test to check the efficacy of the identification system, as they were in Aimval-Aceval? Were decoys simulating fighters available to the adversary aircraft? We will never know for reasons of security classification. *If they weren’t, there is insufficient assurance that the system works. If it doesn’t, it again becomes necessary to make Visual Identification before firing — making the operational test of the F-22 moot — and possibly even invalid.*<sup>46</sup>

**A proper operational test** would employ small but equal cost fleets of F-22s, F-15Cs, F-16s, and

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<sup>43</sup> Only the F-15 carried the “long lance,” the Aim-7F Sparrow missile. Both carried the short range Aim-9 Sidewinder.

<sup>44</sup> The relationship between target richness and the exchange ratio in actual combat surprised many. In the Vietnam War, it was noticed by the cognoscenti that our preponderant numbers actually fed the enemy by providing them more targets. As in Africa’s jungles and savannahs with many animals (prey), there are always the weak and the unaware to make a predator’s conquest easy. Complexity and chaos degrade the effectiveness of any system. In this case it was the complexity and chaos induced by the battle, not the complexity of the aircraft.

<sup>45</sup> Had they closed to visual range, the ensuing combat would have produced results very close to 1-to-1.

<sup>46</sup> IFF, the old *Identification of Friend from Foe*, is not good enough for ID in combat. The Vietnam War revealed that identifying aircraft by tracking them *from the point of origin* led to unacceptable errors. There is cooperation of information among the charging F-22s and if the enemy *flies a structured war*, BVRID is possible. The remaining question is whether the extant system will perform reliably *in the chaos of a real war*.

possibly even possibly F-18Es against a more numerous enemy (Red Team), over a short but significant operational period to provide statistically meaningful *comparative* data.<sup>47</sup> This, with the enemy strategy divined by competent, creative Red Team adversary pilots, not the Blue Team flying our aircraft. Further, the aircraft should be flown at their normal *realistic* readiness rates. This class of testing is unthinkable, of course, for obvious reasons — the F-22 force might lose the air campaign! Further by using many types of aircraft, and by inserting neutrals and decoys into the campaign, *the validity of the ID system would receive a definitive test*. Note that this test brings in *the usual key battle characteristics* — **Ubiquity** and **Presence** as functions of **Time** — *three* factors that are all-important in war, **yet are never the concern of the USAF**.<sup>48</sup> In summary, the validity of the F-22's operational test remains unknown to us, the lay public — *and possibly to the USAF*. But experience warns us to be suspicious of this test, and the reported claims. No insight provided means — no acceptance. One must never accept physical things “*purely on faith*.”

A word about missile evaluation is relevant. The AIM-7 Sparrow missile's history is particularly interesting. The US Navy designed it specifically to destroy aircraft approaching head-on to attack the fleet. With the missile's Doppler radar for homing to its target, there is a large “*successful delivery*” space lobe in the enemy's forward quarter. However, *in total contradiction to its design and its employment concept* — most of its kills achieved by USAF and USN pilots in **ten years** of combat in Vietnam, occurred in the much smaller difficult-to-get-into successful launch domain in the enemy's rear. Only a few were achieved in the large forward (ill named) successful delivery quarter.<sup>49</sup> Good Navy pilots, smart pilots, prefer to remain away from the enemy's lethal forward quarter. Head-to-head weapon exchanges bred parity of results—unacceptable with our expensive aircraft and our highly trained (expensive) pilots. **So, everything was analyzed precisely backwards**. — *Cost and effectiveness, successful employment domains, successful delivery parameters, and most importantly, the results. It is difficult to be precisely wrong*, yet ironically, it happens with startling frequency. And, it is this misinformation that is unwittingly fed into computers simulating missile flights in evaluative exercises. The AIM-7's poor success in Vietnam was the result of utterly inadequate pre-combat testing by the USAF.<sup>50</sup>

The expensive, complex, “versatile” multi-mode Phoenix missile could be fired at very long ranges, at medium ranges (BVR of course), and at short ranges. Simulators and a **single, scripted, carefully**

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<sup>47</sup> The fleets cannot be too small. If a minimum for the F-22 is 10 aircraft, the F-15 and F-18 fleets should number at least 50, and the F-16s depending on the model would be 70 to 90. The Red team fleets need not be and should not be the same aircraft type. F-5s should outnumber the F-16 by at least two-to-one. But that is no problem with all the aircraft available worldwide, Mirages, F-5s, F-104s, F-4 Phantoms etc. Further, the mission exercises must be varied. If some think the test too expensive, they should assess the cost of inadequate testing. The F-14/Phoenix system was not adequately tested, nor was the F-4C Sparrow system which failed so badly in Vietnam. Further, **comparison is the key. Everything must be compared for proper evaluation**, be the objects china, silverware, gourmet meals, helicopters, or weapons.

<sup>48</sup> **Repetitions of single-event-jousts do not characterize campaigns**. Diversity of tactics and the time factor are needed to let the losers, and the winners adjust to improve their performances. These campaign exercises not only allow evaluation of the forces (as opposed to the airplanes) but also provide invaluable training for war. They will be well worth the expense.

<sup>49</sup> To give Navy analysts due credit—the AIM-7 Sparrow was *more efficient* in the frontal quarter meaning the ratio of its kills per missiles fired was higher. But it was *more effective* in the rear quarter because most of the firings and most of the kills occurred there. *Efficiency vs Effectiveness* is the debate. Resolution — *Effectiveness* is the preferred battle parameter.

<sup>50</sup> The available telemetry data were only pre-launch data, not in-flight test data. The test personnel never searched deeply to find the reasons it failed in test. Failure generally meant the F-4 was guilty, not the missile. They wanted the missile to “*succeed*.”— A curious definition of success.

**groomed and monitored** airborne test showed that an F-14 could fire 6 Phoenix simultaneously at six **identified** targets beyond visual range, and destroy all six at once.<sup>51</sup> However, the Phoenix was essentially never used in combat for many reasons. *Only two were fired in anger in 30 plus years, and both missed!* The Phoenix missile was a very expensive, failed development program. This, despite all its advocacy, development, and evaluation.

Lastly, allow me to present the **data of aerial kill mechanisms in the 10-year Vietnam War**. The 20 mm cannon, the low-cost AIM-9 Sidewinder, the AIM-4 IR Falcon, the AIM-7 radar Sparrow (models C through E), and the AIM-54 multimode Phoenix had success rates **that descended** in the order given. The **kill-rate-per-firing decreased exponentially** from 28 percent for the gun to 15 percent for the Sidewinder, to 11 percent for the Falcon, to 8 percent for the Sparrow, and essentially zero for the Phoenix. The cost of expendables-per-kill (a weak, incomplete measure of cost) ranged from a few hundred dollars per kill for the gun and **increased exponentially** to \$15,000 for the Sidewinder, to \$90,000 for the Falcon, to \$500,000 for the Sparrow, to unknown millions for the Phoenix (1970 dollars were about 8 times more valuable than today's dollars). The **overall cost** of destroying enemy aircraft with *radar missiles* including training and the required ground environment, has never been computed. It is astronomical, even frightful. **Their effectiveness and cost-effectiveness were precisely the opposite of the plans and the advocacy, — again.** Finally, after three decades of development at great cost, the improved AIM-7, and the AIM-21 AMRAAM missiles are tolerably effective. Only time and an air war will tell. It is not likely to happen for lack of aerial enemies.

But, despite the F-22's alleged operational success in test, **the conclusion remains unchanged — Whatever the quality of the F-22 is in the air superiority role, with no air superiority problem facing the US today, and real inimical aerial threats won't develop for decades —**

**The Aircraft Is Irrelevant to Modern 4<sup>th</sup> Generation Warfare.**<sup>52</sup>

Our terrorist enemies will never be impressed or affected by it. As a final enlightening item—a general asked the Chief of Staff of the USAF the question — “Do you really believe the claims you are making about the F-22 program?” The Chief's reply was *candid* and *priceless* —

**“I express opinions about the F-22 that I am told to express.” Suspicious confirmed!**

It is now time to summarize the state of the F-22 acquisition and the questionable culture of the DoD weapon acquisition progress.

## VI TRAGEDY OF DoD WEAPONS ACQUISITION— BRIEF SUMMARY

Having reviewed the F-22's engineering development and acquisition program, some cogent observations can be made about the **Raptor** and the **DoD Acquisition System** in general. **One failure** in the ATF program was the set of requirements (desirements) that could not be realized in a given airframe. **The weight was optimistic by a gross error of 26 percent** (the desired 50,000lbs became

<sup>51</sup> Actually, only 5 of the 6 target drones were destroyed, but it was possible to kill the sixth. Something went wrong.

<sup>52</sup> The F-22 is named “raptor”— a bird of prey. With no prey, nature's raptor dies in the wilds. Nature selects it out. The man-made Raptor, on lacking prey, survives on its life-support system —continual mutation by an unenlightened DoD that lacks the courage to do “the right,” with uninterrupted funding by a compliant vote-sensitive Congress.

63,000 lbs). ***Another failure was the disingenuous claim of its cost. It was in error by more than a factor of 5 (going from \$50,000,000 to \$257,000,000 and rising)! Despite a near doubling of the funding, the fleet purchase was reduced from an original plan of 750 to 800 aircraft to 275 aircraft and is now tending to 180 and 150. Worse, these results are not errors; they were planned events to mislead the public. Further, the originally planned force could never have dominated the skies deep in Russia — the initial judgment error of presumption.***<sup>53</sup>

With the F-22's weight increase, came a *non-achievement*: “*Outstanding*” was reduced to ***Ordinary Performance and Maneuverability equivalent to that of the 30 year old F-15C it was meant to replace.*** ***The first pillar justifying the Raptor thus crumbled.*** With its original planned weight, its current fuel quantity would have given the aircraft an excellent 36 percent fuel fraction for a supercruiser. But as the honest former Chief of Staff of the Air Force, General McPeak, stated publicly — “the struggling hope is to achieve [the prosaic] fuel fraction of 29 percent, and lower can happen.” It did. The fuel fraction is now 28 percent — a bit low even for a good subcruising fighter. To cognoscenti this indicates that the aircraft does not have a significant supersonic cruise radius when allowing for the combat fuel and the standard landing reserves.<sup>54</sup> Pillar three, Supercruise, was failed by its developers. Pillar two, Stealth, achieved in some limited sense, is useless against militant Arab insurgents, the only real enemy we have. Advanced Avionics survives— though it too is useless against the insurgents, and besides it must be completely replaced. The F-22 Raptor is far from advertised. Its proposed variations are specious.<sup>55</sup>

The major causes of this typical failed development are—

1. The adherence of the DoD to its distorted pronouncements — like the need for a new air superiority aircraft in a post Cold War world, and the need for its air-to-surface variants — all without valid justification.
2. An incredible, unreasonably long development time caused by lack of understanding and excessive complexity — a gestation time so long that the world situation and our enemies changed.
3. Current world affairs define our present and future enemies. The new enemies make the aircraft irrelevant. The DoD and The Congress cannot forget the old enemies, and cannot recognize the new.
4. Military contractors that promise the USAF anything—***even the physically impossible***—just to stay in business.<sup>56</sup> Equivalently military program personnel were not competent to recognize the impossibilities. And the development system does not give the contractors the freedom to tell ***The Truth*** about their science.
5. Military and contractor test pilots ***are neither critical nor evaluative.*** They are in a friendly cooperative venture to ***advertise the program*** — believing that it guarantees their personal success.<sup>57</sup>

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<sup>53</sup> This fantasy could have been fulfilled only if the Russian planners used “*Western Preferred Russian strategy and tactics.*”

<sup>54</sup> When, as advocates do, claiming supersonic cruise purely because it can fly at 1.6 Mach without afterburning, they exhibit a total lack of insight into supersonic cruise fighter design. The subject is complex; it is partially addressed, and covered in greater detail in op. cit., Riccioni. USAF claims that they regard fuel fraction as unimportant is further proof of lack of insight. The subject requires a separate presentation — available on request.

<sup>55</sup> “*Specious*”—1. *superficially possible, but actually wrong*, 2. *misleadingly attractive in appearance*, Ill, Oxford Dict. Both definitions apply simultaneously.

<sup>56</sup> This is not unique to the F-22. It was most notably evident in the B-1B development program.

<sup>57</sup> In contradistinction to this—When in Flight Test Engineering at Edwards Air Force base as a naïve, idealistic, first lieutenant learning my philosophy from the great Chuck Yeager and his many excellent peers—I evaluated the Lockheed F-94C and reported it “*Unacceptable to the US Air Force as an interceptor.*” On reevaluation, an

6. The flawed integrity of USAF officers on the F-22 and on acquisition matters in general.
7. The lack of insight and *the prostitution* of study groups and the pantheon of pundits.
8. The lack of courage on the part of DoD executives and the military to face reality and cancel a program that has gone bad.<sup>58 59</sup> This, despite funding shortages generated by an expensive war.
9. The failures of DoD officials to admit the real justification for the aircraft is to sustain a business venture, not to improve our nation's military or defensive capability.
10. Congressional failure to provide real oversight, and their *uncritical* approval of every request for funds. The Senate and House Armed Services Committees do not check service veracity, and *frequently lack the expertise to evaluate both Cost and Effectiveness*.
11. Failure of the media to make the obvious distortions evident to the voting public. They fail for lack of insight, conviction, courage, and lack of dedication to public service.<sup>60</sup>

***A grievous result of our DoD system of weapons development*** is their exponential growth in cost with a concomitant exponential decrease in the numbers purchasable. Fighter aircraft, once purchased in thousands per year in the 1950s and 1960s are now acquired in tens per year. Global jet bomber fleets of B-47s and B-52s (our oldest and still our best heavy bomber) acquired by the thousand and many hundreds have fallen to 100 B-1Bs and 21 B-2s. Missiles follow the same pattern of exponential cost and atrophy. ***This is Unilateral Disarmament in the Face of Our Enemies by acquiring the wrong weapons for the relevant wars.***

Another failure is our present use of Stealth as a fashion instead of a battle requirement. Design-to-stealth greatly increases an aircraft's size and cost. Concomitantly, it reduces its maintainability, versatility, and numbers. All counterproductive unless stealth is frightfully necessary.

## VII ROAD TO RESOLUTION

Given the discrepancies listed in VI, resolutions to our malfunctioning Department of Defense Acquisition System are amazingly simple. The needs are—

***A The Integrity to tell The Truth!*** This is essentially lacking today. Especially the officer corps of the military must behave in accordance with its proper honor code.<sup>61</sup>

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independent USAF test group, deemed the F-94C "unacceptable," and the acquisition was cancelled. I knowingly risked my career, but kept my integrity intact. The country prospered.

<sup>58</sup> There are some rare exceptions — When Vice President Cheney was the Secretary of Defense, he had the insight, courage, and conviction to cancel the ill conceived Osprey for its unreasonable expense, and the A-12 for lack of Navy and contractor performance. Equivalently Donald Rumsfeld, the current Secretary of Defense cancelled the Crusader cannon for lack of relevance, despite the (archaic) claims and desires of the Army.

<sup>59</sup> It may be necessary to keep a competent contractor from collapsing because of changing world events. With competent executive imagination, it is always possible to do it constructively by employing public law 85-804.

<sup>60</sup> Here, too, there are grand exceptions — for instance, Pulitzer Prize winners Alan Miller and Kevin Sack, two *Los Angeles Times* reporters, ably, completely, and responsibly described the true nature of the Marine Corps AV-8B force to the public. Public servant reporter Joe Neff ably reported the disaster that the V-22 has in store for the USMC and the nation.

<sup>61</sup> "We will not lie, cheat or steal — Nor tolerate those who do." It is a lovely, simple, effective code.

**B** The Realization that only The Truth will prevent the current chaos and insanity. The current acquisition system fails too frequently and must be changed.

**C** The Courage to face The Truth and then To Act On It.

**D** A hierarchy of command that commits to spending the public's money on real defense problems, real weapons that will cope with our most important threats, weapons that will make our country militarily strong and relatively secure. This requires talent, courage, and a great deal of study and insight, but given the serious nature of our nation's problems, it must be done.

***Our nation must lose its appetite for spin and revert to The Truth.***

***The F-22 Raptor acquisition should be cancelled and its funding properly reallocated.***

Failure to make these changes means ***a significant loss in US national and military power.***

*Only an informed, alerted, alarmed, and active public can **force** these changes.<sup>62</sup>*

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<sup>62</sup> Self-inflicted corrective surgery is possible but it seldom happens.