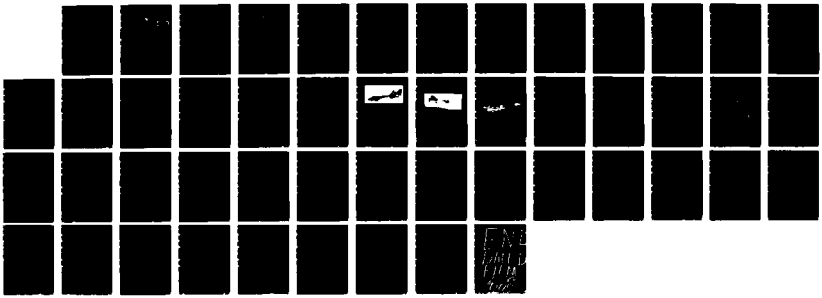
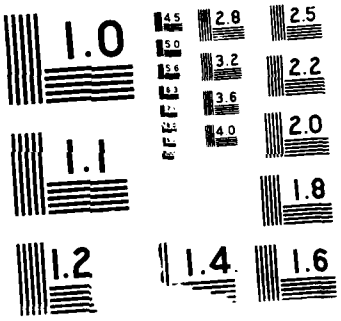
AD-A194 399 F-15/F-16 MIXED AGGRESSOR FORCE FOR THE FUTURE(U) AIR COMMAND AND STAFF COLL MAXWELL AFB AL M M RUMOHR ET AL APR 88 ACSC-88-2270 1/1

UNCLASSIFIED F/G 15/5 NL




1.0
4.5
5.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.2
1.4
1.6

DTIC FILE COPY

(2)

AD-A194 399

DTIC
ELECTE
JUN 0 9 1988
S D
H

AIR COMMAND AND STAFF COLLEGE

STUDENT REPORT

F-15/F-16 MIXED AGGRESSOR FORCE FOR THE FUTURE

MAJOR MARK M. RUMOHR 88-2270
MAJOR GARY C. WEST

"insights into tomorrow"

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

88 6 0 078

DISCLAIMER

The views and conclusions expressed in this document are those of the author. They are not intended and should not be thought to represent official ideas, attitudes, or policies of any agency of the United States Government. The author has not had special access to official information or ideas and has employed only open-source material available to any writer on this subject.

This document is the property of the United States Government. It is available for distribution to the general public. A loan copy of the document may be obtained from the Air University Interlibrary Loan Service (AUL/LDEX, Maxwell AFB, Alabama, 36112-5564) or the Defense Technical Information Center. Request must include the author's name and complete title of the study.

This document may be reproduced for use in other research reports or educational pursuits contingent upon the following stipulations:

- Reproduction rights do not extend to any copyrighted material that may be contained in the research report.

- All reproduced copies must contain the following credit line: "Reprinted by permission of the Air Command and Staff College."

- All reproduced copies must contain the name(s) of the report's author(s).

- If format modification is necessary to better serve the user's needs, adjustments may be made to this report--this authorization does not extend to copyrighted information or material. The following statement must accompany the modified document: "Adapted from Air Command and Staff College Research Report _____(number)_____ entitled _____(title)_____ by _____(author)."

- This notice must be included with any reproduced or adapted portions of this document.

REPORT NUMBER 88-2270

TITLE F-15/F-16 MIXED AGGRESSOR FORCE FOR THE FUTURE

AUTHOR(S) MAJOR MARK M. RUMOHR, USAF
MAJOR GARY C. WEST, USAF

FACULTY ADVISOR MAJOR RONALD R. DUFRESNE, ACSC/3823 STUS-32

SPONSOR COL DOUGLAS MELSON, 57 FWW/AT

Submitted to the faculty in partial fulfillment of requirements for graduation.

AIR COMMAND AND STAFF COLLEGE
AIR UNIVERSITY
MAXWELL AFB, AL 36112-5542

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

A194 399

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT STATEMENT "A" Approved for public release; Distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 88-2270	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION ACSC/EDC 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Maxwell AFB, AL 36112-5542	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO. / TASK NO / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
F-15/F-16 MIXED AGGRESSOR FORCE FOR THE FUTURE (U)

12. PERSONAL AUTHOR(S)
Rumohr, Mark M., Major, USAF; West, Gary C., Major, USAF

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
	FROM _____ TO _____	1988 April	40

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Headquarters Tactical Air Command (TAC) is considering a replacement aircraft for the aging F-5E Aggressor aircraft. This study proposes an F-15/F-16 mixed force as the best replacement choice. Historical justification for the Aggressor force is reviewed. Evaluation of Soviet threat comparisons, operational and cost benefits of the mixed force, and proposed changes to Aggressor training syllabi are analyzed. The study concludes the F-15/F-16 mixed Aggressor force offers the TAF maximum benefits for realistic threat emulation, operational flying hours savings, and cost benefits.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL ACSC/EDC Maxwell AFB, AL 36112-5542	22b. TELEPHONE (Include Area Code) (205) 293-2867 22c. OFFICE SYMBOL

DD Form 1473, JUN 86 Previous editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

PREFACE

In keeping with Soviet air force modernization, Tactical Air Command (TAC) is currently planning to upgrade the F-5E Aggressor force with a newer, more comparable, threat emulator aircraft. Current TAC proposals support the selection of the F-16 as the Aggressor's follow-on aircraft. While this aircraft is a good candidate, it is not a dissimilar aircraft to a growing F-16 community. The authors reccommend selecting both the F-15 and F-16 as Aggressor follow-on aircraft. This report supports this recommendation by focusing on the need for dissimilar Aggressor training, producing F-15/F-16 threat comparison, providing operational benefits, Adversary Tactic Instrucor Course suggestions, and finally, furnishing cost benefits.

The authors treat the issue from a TAC Aggressor perspective. Although the proposal would apply world-wide, US Air Forces Europe (USAFE) and Pacific Air Force (PACAF) Aggressor specifics were considered beyond the scope of this study and not mentioned.

The authors want to acknowledge a few individuals for their contribution to this study. First, they thank their project advisor Major Ron "Dufer" Dufresne for his laborious editorial and directive support. Second, they would like to recognize the following people for their time and information; Lt Col "Bubba" Gentrup of TAC/DR, Major Stan "Wheat" Whitfield of TAC/DOO, Major Joe "Hose" Hodges of Adversary Tactics, and Captain Bob "Lurch" Schneider of the 65th Aggressor Squadron.

COPY INSPECTED 1

Accession For
NTIS GRA&I ☑
DTIC TAB ☐
Unannounced ☐
Justification
By
Distribution/
Availability Codes
Avail and/or
Dist Special
A-1

ABOUT THE AUTHOR

MAJOR MARK M. RUMOHR

Major Rumohr received his Bachelor of Arts degree in Political Science in 1976 and his Master of Arts degree in Political Science/International Relations in 1977 from the University of Arkansas. He was commissioned through the Air Force Reserve Officer Training program in May 1976.

He graduated from Undergraduate Pilot Training (UPT) at Vance AFB, Oklahoma, in April 1978. His first assignment was to the 25th Tactical Fighter Squadron (TFS) at Kadena AB, Japan, as a Mission Ready F-4 pilot. While assigned to the 25 TFS, he served as a Laser Designator Aircraft Commander and the Squadron Training Officer.

He was transferred to Clark AB, Republic of the Philippines, and assigned to the 90 TFS. During his tour he served as a squadron scheduler and as a 3 TFW Standardization and Evaluation Flight Examiner. On his following assignment, he was an instructor pilot and the Chief of Scheduling for the 20 TFTS, the German F-4 training squadron, at George AFB, California.

In May 1986, he graduated from the F-5 Instructor Training Course at Williams AFB. His follow on assignment was as Chief, Technical Assistance Field Team (TAFT) at Meknes, Morrocco, serving as an instructor and advisor to the Royal Moroccan Air Forces' F-5 Squadron.

Major Rumohr is a Senior Pilot with over 1700 flying hours. He completed both Squadron Officer School and Air Command and Staff College through correspondence. He is currently attending the Air Command and Staff College at Maxwell AFB.

ABOUT THE AUTHOR

MAJOR GARY C. WEST

Major West received his Bachelor of Arts degree in Music/ Radio and Television Production from Colorado State University and was commissioned through the Air Force Reserve Officer Training program in May 1978.

He graduated from Undergraduate Pilot Training (UPT) at Vance AFB, Oklahoma, in March 1980. His first assignment was to the 58th Tactical Fighter Squadron (TFS) at Eglin AFB, Florida, as a Mission Ready F-15 pilot. While assigned to the 58 TFS, he served as a squadron Standardization and Evaluation (Stan/Eval) Officer and as the squadron Tactics Officer in the 58 TFS Weapons Office. In May 1983, he was selected to become an Aggressor for the 65th Aggressor Squadron (AS), Nellis AFB, Nevada.

While at Nellis, Major West served as an F-5 Aggressor Pilot and was the squadron's Chief of Training from September 1983 to October 1984. He then upgraded as an Adversary Tactics Instructor Course (ATIC) Instructor Pilot. He also became the ATIC Element Air Combat (EAC) Phase Director and platform academic instructor. He then became the 65 AS's Chief of Programming from June 1986 to July 1987.

Major West authored an article entitled "Aggressively Speaking", which appeared in the Summer 1987 issue of the USAF Fighter Weapons Review.

Major West is a Senior Pilot with over 1500 flying hours. He attended Squadron Officer School in 1983 and is currently attending Air Command and Staff College.

TABLE OF CONTENTS

Preface iii
About the Authors iv
Table of Contents vii
List of Illustrations viii
Executive Summary ix

CHAPTER ONE--NEED FOR DISSIMILAR AGGRESSORS
- Historical Background 1
- Aggressor Program Growth 4
- The Continuing Need for Dissimilar Aggressors 5

CHAPTER TWO--F-15/F-16 THREAT COMPARISON
- Soviet Fighter Threat 7
  - MIG-31 Foxhound 8
  - MIG-29 Fulcrum 9
  - SU-27 Flanker 10
- TAC Aggressor Follow On Requirements 11
- F-15/F-16 Follow on Aggressor 12

CHAPTER THREE--OPERATIONAL BENEFITS
- Continued Dissimilar Training 15
- Improved Training Quality 16
  - More Effective Aggressor Pilots 16
  - Composite Threat Training 17
- Enhanced F-15/F-16 Combat Readiness 18

CHAPTER FOUR--SUGGESTED F-15/F-16 ATIC SYLLABUS
- ATIC Streamline 21
- F-15/F-16 Long ATIC 23
- FWIC/ATIC Academic Integration 24

CHAPTER FIVE--COST BENEFITS
- Findings 27
- Conclusions 33

BIBLIOGRAPHY 35

LIST OF ILLUSTRATIONS

TABLES

TABLE 2-1 US Fighter Requirement Comparison..... 12
TABLE 4-1 American Transition Phase..... 22
TABLE 4-2 Single Air Combat Phase..... 23
TABLE 4-3 F-15 FWIC/ATIC Academic Integration..... 24
TABLE 4-4 F-16 FWIC/ATIC Academic Integration..... 25
TABLE 5-1 Long and Short Course Comparison..... 29
TABLE 5-2 Hours and Cost Comparison..... 30
TABLE 5-3 Retraining Cost Comparison..... 31
TABLE 5-4 Training/Retraining Cost per Class Comparison..... 31
TABLE 5-5 Annual Flying Program Cost by Option..... 32

FIGURES

FIGURE 2-1 MiG-31 Foxhound..... 8
FIGURE 2-2 MiG-29 Fulcrum..... 9
FIGURE 2-3 Su-27 Flanker..... 10
FIGURE 2-4 Fighter Planform Comparison..... 14

EXECUTIVE SUMMARY

Part of our College mission is distribution of the students' problem solving products to DOD sponsors and other interested agencies to enhance insight into contemporary, defense related issues. While the College has accepted this product as meeting academic requirements for graduation, the views and opinions expressed or implied are solely those of the author and should not be construed as carrying official sanction.

"insights into tomorrow"

REPORT NUMBER 88-2270

AUTHOR(S) MAJOR(S) MARK M. RUMOHR and GARY C. WEST, USAF

TITLE F-15/F-16 MIXED AGGRESSOR FORCE FOR THE FUTURE

I. Purpose: To investigate the concept of a F-15/F-16 mixed force for the United States Air Force Aggressors as a replacement aircraft for the F-5E.

II. Problem: Headquarters Tactical Air Command (TAC) is considering a replacement aircraft for the aging F-5E Aggressor aircraft. The F-5E does not adequately emulate new Soviet aircraft becoming operational in the 1980s. The replacement aircraft needs to provide the quality threat emulation that has become the trademark of the Aggressors for the last 15 years. The urgency of the issue is due to extensive depot maintenance which will be required on the aging F-5E fleet by 1993. It is the hypothesis of this analysis that an F-15/F-16 mixed force is the best choice for the replacement of the F-5E.

III. Discussion of Analysis: This analysis has been narrowed by TAC's decisions concerning possible candidate aircraft. No new aircraft will be purchased to fill this role. Prohibitive startup cost and small unit support costs dictate the replacement aircraft will come from aircraft in the current inventory. Although Navy

aircraft, such as the F-14 or F-18, could fill the requirements established by TAC/DOO, the high costs associated with the program are considered unacceptable. The F-16 and F-15 emerge as the best choices for threat emulation when comparing the current USAF inventory to the new Soviet threat, such as the Foxhound, Flanker, and Fulcrum. Aircraft visual characteristics, capabilities, and similiarities make the F-16 and F-15 realistic threat emulators.

The analysis focuses on the question of the optimum composition of a replacement Aggressor force. TAC/DOO is considering the F-16A as the replacement aircraft. The proposed F-15/F-16 mixed force is compared to this option. The mixed force emphasizes dissimilar training. Conversely, the F-16 only option cannot provide dissimlar Aggressor support for the growing F-16 community. The additional operational benefits of improved training quality and composite threat training reinforce the F-15/F-16 mixed force advantages. Differences in Aggressor upgrade training syllabi for each option are compared in light of flying hours and dollar cost savings. Flying hour savings in the F-15/F-16 mixed force result in a significant number of hours available for the operational mission that are not available in the F-16 only option. The savings in the Aggressor training costs reduces the flying hours cost of the F-15/F-16 mixed force. As a result, there is no significant difference in the cost of either proposed Aggressor force despite the higher cost per flying hour of the F-15 aircraft.

IV. Conclusions: The F-15/F-16 mixed force has the diversity necessary to accomplish the realistic threat emulation for the entire tactical air force (TAF) that the F-16 only option cannot provide. The savings in the training program nullifies an argument discarding the F-15 as an Aggressor option due to its excessive flying hour cost. Additionally, hours moved from training to operations in the mixed concept's Annual Flying Hours Program maximizes the effectiveness of the Aggressor program.

V. Recommendations: The United States Air Force and Tactical Air Command should transfer aircraft to establish an F-15/F-16 mixed Aggressor force as a replacement for the F-5E. Squadron aircraft compositions should be similiar to the compositions recommended in this analysis so as to optimize the TAF's utilization of the Aggressors.

Chapter One

NEED FOR DISSIMILAR AGGRESSORS

> Challenging...and realistic training facilitate an effective transition from peace to war...To ensure the readiness of our forces, commanders must develop and implement training programs that build required warfighting skills and that simulate, as closely as possible, the combat environment in which we expect to fight (37:4-7).

This quote emphasizes the necessity of demanding realistic training in peacetime air forces. The Air Force axiom: "Train like you expect to fight" (27:13) simply restates the AFM 1-1 statement. Yet, readiness for conflict is often illusory. In air-to-air combat, "Fewer than 15% of all pilots had a better than even chance of surviving their first combat" (28:2). The USAF experience in Vietnam proved that if air forces are not trained to meet the threat, their success is in jeopardy.

The focus of this analysis is on Dissimilar Air Combat Training (DACT), and specifically the need for a continued USAF Aggressor DACT program. This chapter will, first, review the rationale behind the current dissimilar Aggressor program, and, second, discuss whether evolving events still justify this program. Finally, technological advances will be analyzed to determine if the concept of the Aggressors will be valid into the twenty-first century.

HISTORICAL BACKGROUND

Historically, US air combat pilots have achieved large margins of victory. The World War II margin was a 7:1 kill ratio (25:1) and Korea resulted in a spectacular kill ratio of 14:1 (28:11). However, the Vietnam War produced a dismal 2.2:1 ratio for the USAF, although the US had the technological and numerical advantages. Colonel Robert D. Russ wrote in 1974, "Victories usually go to the best weapon system--an amalgamation of aircraft performance, aerial weapons, and aircrew skill" (20:66). Unfortunately, the biggest deficiency was in the area of aircrew skill.

The Navy, disillusioned with a kill ratio in Vietnam of 2.42:1 during the years 1965-68, initiated a study of the Navy's air combat performance authored by Captain Frank Ault. "The Ault

Report" indicted aircrew training as the major cause for the poor showing. The report recommended "increased air combat maneuvering training for all fleet fighter units, and the development of a specialized group to study and develop air combat tactical concepts" (27:14). This resulted in the creation of the Navy Fighter Weapons School called "Top Gun." The purpose of the school was to train experienced pilots in air combat maneuvering (ACM) and return them to the fleet to instruct (27:14).

The results of "Top Gun" were dramatic. After the commencement of the program in 1970, the majority of the Navy's kills in 1970-73 were attributed to "Top Gun" graduates. The unsatisfactory 2.42:1 kill ratio of 1965-68 improved to 12.5:1 in 1970-73. The naval aviators went from one kill every five engagements to more than one kill per engagement during 1970-73. However, the USAF witnessed a decline of their kill ratio from 2.2:1 to 1.92:1 for the same period (27:15).

In 1972, the Air Force made its own study of the air war in Vietnam, called Red Baron II, and made some of the same conclusions that Frank Ault did three years earlier. In a briefing to the Tactical Air Power Subcommittee of the Senate Armed Services Committee in March 1975, Lt Col Jerry Nabors related some of the more salient findings of this interim report.

> The most common problem found [was]..."insufficient training and experience in air-to-air combat." The air-to-air training that had been conducted was conducted against similar aircraft using USAF tactics...similar aircraft training...was unsatisfactory when engaging better turning MIG aircraft...crucial errors were made in visual range estimations which resulted in certain necessary aerial maneuvers being employed at the wrong point in space or not at all (27:16).

As indicated, the most significant lesson learned from the air war over North Vietnam was the aircrews were improperly trained to engage dissimilar aircraft.

In light of more than 20 years of aerial successes in WWII and Korea, the Air Force should have been prepared for the DACT environment. However, a change in training philosophy occurred between the Korean conflict and Vietnam based on doctrine. This doctrinal shift had occurred during the interim years due to a growth in weapons technology and nuclear deterrent strategy. The supersonic penetrator became the prominent aircraft design for employing new technologies. Speed, rather than maneuverability, became the cornerstone of air combat.

An influential technological development was the air-to-air missile. Navy Lt Randy Cunningham, Vietnam ace, described the resultant doctrinal shift in his book, Fox Two:

> In the late 1950s...the concept evolved in western air forces that missiles would replace guns in aerial combat....Aircraft would be armed with long-ranged missiles and sophisticated radar...that would eliminate the need for air combat maneuvering (27:35).

Unfortunately, this concept was never validated during the war. During the first part of the war, gun attacks from better turning MIG-17s and MIG-21s were commonplace. As the conflict evolved and the Air Force equipped its F-4s with guns and slats for better maneuverability, the gun became a potent weapon (28:13). 'During the 1972 campaign, 50 percent of the F-4 gun attacks were successful" (28:13). Radar and heat missile shots were much less effective because of a combination of factors: rules of engagement(ROE), missile reliability, employment doctrine, and aircrew proficiency.

USAF results failed to match expectations. In contrast, the Navy had nearly achieved the same kill ratios during the 1970-73 campaigns as were accomplished in Korea. The USAF could not dispute the successes achieved by the "Top Gun" program. As a result, the USAF's 64th Fighter Weapons Squadron was formed in October 1972. Its purpose "was to add realism to Air Combat Training (ACBT) by beginning a Tactical Air Command (TAC) Dissimilar Air Combat Training (DACBT) program" (39:1).

This program rapidly expanded into the Aggressor mission which included squadrons stationed in the Pacific and European theaters as well as TAC. As the value of the Aggressors was recognized the emphasis for more realistic dissimilar training was solidified. In 1975, the current air-to-air regulation TACR 51-2, Dissimilar Aircraft Air Combat Training, stated,

> The fundamental objective of the dissimilar aircraft ACT (Air Combat Training) program is to prepare aircrews to enter the aerial combat arena and attain the highest possible success...This is best achieved by exposing aircrews to various simulated threat aircraft employing current enemy tactics (38:1).

AGGRESSOR PROGRAM GROWTH

The growth of DACT and requirements for the Aggressor mission diluted the quality of dissimilar training as interunit DACT increased to supplement Aggressor training. Whereas the initial Aggressor mission was designed "to provide basic DACT training" for TAF aircrews, including a "visit [to] every TAC base three times a year,"(25:3) momentum turned the mission in other directions, too. The Aggressors' ability to accurately emulate the enemy threat made their assets a highly sought after part of any exercise or

evaluation. Their presence in large joint/combined exercises like Red Flag and Maple Flag has grown to 17% of their total commitment in FY87 (30:--,31:--,32:--,33:--). During the mid-seventies, a large part of the Nellis Aggressors was dedicated to supporting the AIMVAL/ACEVAL evaluation. In addition, upgrade training supporting the four Aggressor squadrons has taken 36.5% of the total annual sorties flown by the Nellis squadrons since 1976 (30:--,31:--,32:--,33:--).

Despite these growing demands for Aggressor sorties, goals were established for each TAF unit by TACM 51-50, Tactical Fighter/Reconnaissance Aircrew Training, that, "50% of ACBT requirements should be accomplished against dissimilar aircraft" (27:37). At the 1984 TAC Aggressors symposium the 57 FWW representative conceded,

> The requirements for DACBT, Red flag, Green Flag, Maple Flag, Fighter Weapons Instructor Course, and PFT [left little] to fly the more basic 1v1 and 2v1 type training...priority should be given to tactics training found in larger scenario training instead of instruction in visual maneuvering air combat (18:21).

This shortfall results in interunit DACT being flown to fill the need for DACT the Aggressors are unable to support due to their other commitments. For example, in 1985 the 1 TFW (F-15) and the 363 TFW (F-16) flew only 16% and 7%, respectively, of their sorties as DACT. Only 4% of the 1 TFW sorties and less than 1% of the 363 TFW sorties were flown against the Aggressors (27:38-39).

While interunit DACT partially fills the need for dissimilar training, it is not a substitute for Aggressor training. There are counter productive results to this type of training. In interunit dissimilar training (i.e., Air Force F-15 vs. Navy F-14), each element in the engagement typically attempts to maximize their own tactics against similar US tactics. Rarely are realistic Soviet tactics or weapons parameters simulated on either side of the engagement. US tactics are pitted against US tactics validating operational concepts successful against friendly assets, but not necessarily valid against enemy aircraft or tactics. In many cases, specific tactics for exploiting the adversary US aircraft's weaknesses are designed with no correlation to Soviet capabilities or weaknesses (27:32,40). A professional Aggressor force still provides the accurate threat emulation required by the Ault and Red Baron reports.

THE CONTINUING NEED FOR DISSIMILAR AGGRESSORS

The Aggressor force has become an integral part of the Air Force's realistic training since its institution in 1972. Have any technological or doctrinal changes in air combat since that time

decreased the need for an Aggressor force? Maj Gen Blesse, double ace in Korea, predicted an era when "95% of our air-to-air fighting will be done at long range" (28:26). This era of beyond visual range (BVR) weapons when "pilot skill and ferocity" (28:26) would not be required could decrease the value of the dissimilar Aggressor training.

Conflicts since Vietnam do not support Maj Gen Blesse's predictions. Prior to the 1967 Arab-Israeli War "IAF [Israeli Air Force] ACBT concentrated on visual maneuvering air combat and the employment of the cannon" (27:36). As a result, all IAF air-to-air kills were gun kills during maneuvering engagements. In the 1973 Yom Kippur war, only 7 of 335 kills were beyond visual range (BVR) AIM-7 shots. The remainder were visual, maneuvering kills achieved with an AIM-9, or Shafir infrared heat missile, or cannon (27:36). In the 1982 Falklands War, Argentinian lack of effective pilot training contributed to the British Harriers success against them. (9:67) In a more recent example, the composite force integration of Israeli F-15/F-16 gained them a decisive victory over numerically superior, yet simpler Syrian aircraft in the Bekaa Valley in 1982. Success can be "attributable to the superiority of their training, not necessarily to the aircraft they flew" (11:78). Analysts conclude the Aim-7 was sparingly used BVR and "the AIM-9L accounted for most of the kills over the Bekaa" (24:37).

These examples reiterate two lessons: air combat will progress to the visual arena and training is essential. In the future, there are several reasons why the fighter pilot may be forced into the visual maneuvering air combat arena.

In a future lookdown, shootdown BVR air battle, why would this be true? First, although the credibility of the BVR systems may no longer be a technological reliability issue, there still are reasons for a pilot's reluctance to commit his weapons. The pilot must be confident the weapon he fires will hit only that hostile target. Identification Friend or Foe (IFF) is an integral part of the BVR capability. The possibility of fratricide makes faith in an IFF system an important aspect. "The first four defending fighters can have a clear shot at the enemy but the next four defenders to come upon the scene need to know which of the aircraft out in front are friendly and which enemy" (22:76). Thus, indecision and degradation of situational awareness may delay the commitment of a BVR weapon.

The amount of traffic in the air combat arena will contribute to this situation. "DOD planners are talking about 6000 to 8000 tracks in one day through a band only 100 miles wide compared with 40 to 50 enemy and 80 to 100 friendly tracks at any one time over North Vietnam" (28:27). Even with complete confidence enemy tracks

can be sorted and BVR weapons committed, the possibility of better than 4 to 1 odds means that statistically some targeted tracks may get through to the merge.

Second, if the enemy could fire the first BVR shot, the friendly pilot's missile defense with the radar turned away will degrade his situational awareness as the enemy closes. Third, in this crowded arena, degraded Command, Control, and Communications, possible "late detection, degraded fire control systems [or IFF system], possible VID requirements...can all contribute to poor SA [situational awareness] and allow one or more of the bandits to reach the merge alive" (14:3). Ultimately, once the bandit is inside the maneuvering arena, the enemy's maneuverability will require solid BFM skills to be employed.

Despite all these difficulties, hopefully, enough of these BVR weapons will be successfully committed to narrow the odds at the merge. But, current training experience indicates that pilots aren't always successful committing the BVR weapon. Recent Aggressor deployments continue to indicate "weapons employment was marginal due to poor targeting yielding few front aspect kills...and several F-5s entering the merge phase alive and unobserved" (45:3). These training problems, the multiplicity of confusion factors mentioned above, and other distractions such as low altitude combat results in a complex stage requiring the fighter pilot to be prepared for the visual maneuvering fight.

All of this supports the continued requirement for the dissimilar Aggressor mission. The complexity of the situation described above needs to be experienced in training against the most realistic threat emulator available. As each new generation of fighter pilot arrives, the same old lessons have to be relearned. Comments such as "BFM and mutual support was average overall...problems with misjudging the range of attacking F-5s allowed unreacted shots" (47:3) are always the result of poor DACBT proficiency. All the basic skills need to be "second nature" (26:52). The Weapons System Evaluation Program (WSEP) has advocated that advanced systems are "no substitute for basic air to air skills. Intercept and BFM proficiency, along with weapon system knowledge, remain keys to success in today's complex air-to-air environment" (18:30).

As stated in air combat regulation, TACR 55-79, TAC needs to continue providing "the opportunity for aircrews to gain proficiency in DBFM, DACM and DACT against...a realistic surrogate threat aircraft" (27:42). This means dissimilar Aggressor training for air-to-ground and air-to-air units in missions from 1v1 to large threat scenarios like Red Flag are necessary to prepare the fighter pilot for possible future combat. The way in which this task is accomplished will also be critical. The following chapters will outline how a F-15/F-16 mixed Aggressor force can best accomplish this task.

Chapter Two

F-15/F-16 THREAT COMPARISON

Since 1972 the Aggressors' mission has been to provide the TAF realistic dissimilar Soviet tactical training. The workhorse for this training has been the F-5E aircraft. This aircraft was originally selected because of its close performance and size comparison to the Soviet primary fighter threat: the MiG-19, MiG-21, and the MiG-23. However, because of the F-5E's age and recent Soviet deployment of the new sophisticated MiG-29 and Su-27 fighters, the F-5E is unable to provide an accurate emulation of the current threat. Air Force Logistics Command (AFLC) estimates the F-5E will require major structural replacements if it is to safely continue the Aggressor mission into the 1990s (35:TAB 1). TAC is convinced of the importance of the Aggressor concept and doesn't feel the costly modifications, required to extend the life of the F-5, will meet the TAF's training need for the 1990s. Consequently, TAC believes a replacement Aggressor aircraft is vital for the 1990s and beyond (35:TAB 1).

In looking at possible Aggressor follow-on aircraft, the authors believe an F-15 and F-16 Aggressor mix is the best answer. To support this thesis, it is necessary to first look at Soviet fighter threat in the nineties, then examine TAC's requirements for an Aggressor follow-on aircraft, and finally see how the F-15 and F-16 meets these requirements.

SOVIET FIGHTER THREAT

"If you know the enemy and know yourself, you need not fear the result of a hundred battles..." (29:9).

Sun Tzu

The Soviets have made large strides in closing the technology gap. This qualitative gap has been, until recently, the US's primary advantage countering the Soviet's quantitative fighter lead. The Soviet effort to improve their fighter technology becomes most evident when examining the capabilities of the Soviet's most recent fighter developments, the MiG-31 (Foxhound), MiG-29 (Fulcrum), and Su-27 (Flanker).

MIG-31 FOXHOUND

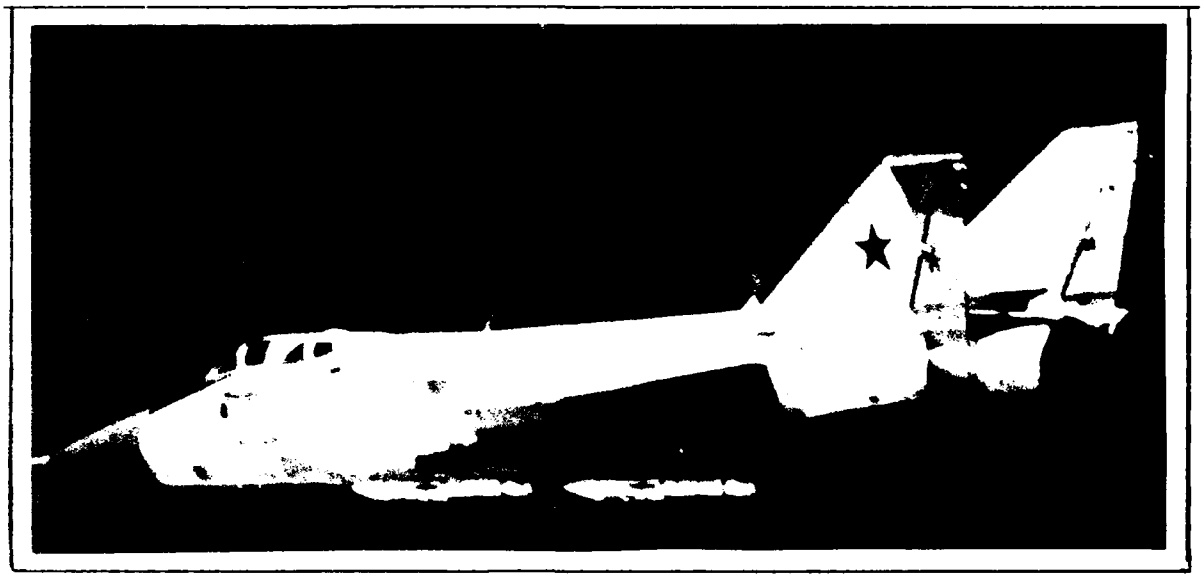


Figure 2-1: MIG-31 Foxhound

"With the development of the MIG-31 Foxhound in the late 1970s, the Soviets had definitely arrived as builders of high quality, high-technology fighters" (17:42). The MIG-31, the Soviet's most sophisticated air defense aircraft, is an F-15 size, twin-tailed, twin-engine interceptor, with a combat range of 1,100 nautical miles (17:42). It is equipped with a large Pulse-Doppler (PD) radar with a detection capability of 190 miles and a target track range of 167 miles (23:89). This radar is said to possess the technology of the F-18's AN/APG-65 digital radar giving the Soviets their first true look-down platform (23:89). Integrated with this radar are four AA-9 (Amos) long range air-to-air radar missiles which together give the Foxhound a multiple-target engagement capability. It is postulated that wing pylons may be fitted to increase the AA-9 weapon load to eight (23:89; 17:42). The Foxhound is also capable of carrying eight AA-8 (Aphid) infrared (IR) air-to-air missiles. Additional advanced avionics include an electronically passive infrared search and track system (IRSTS), active defensive countermeasure equipment, and radar warning receivers. Although not considered highly maneuverable, the MIG-31's long range weapon system is viewed to be a real threat to any western fighter.

With over 150 Foxhounds operational, US interdictors could expect to confront this homeland defender in combat. Other US fighters could possibly face the platform in a defense of high value targets such as AWACS. The operational technology of the MIG-31 provides a base for the Soviet's newest fighters, the MIG-29 and Su-27.

MIG-29 FULCRUM

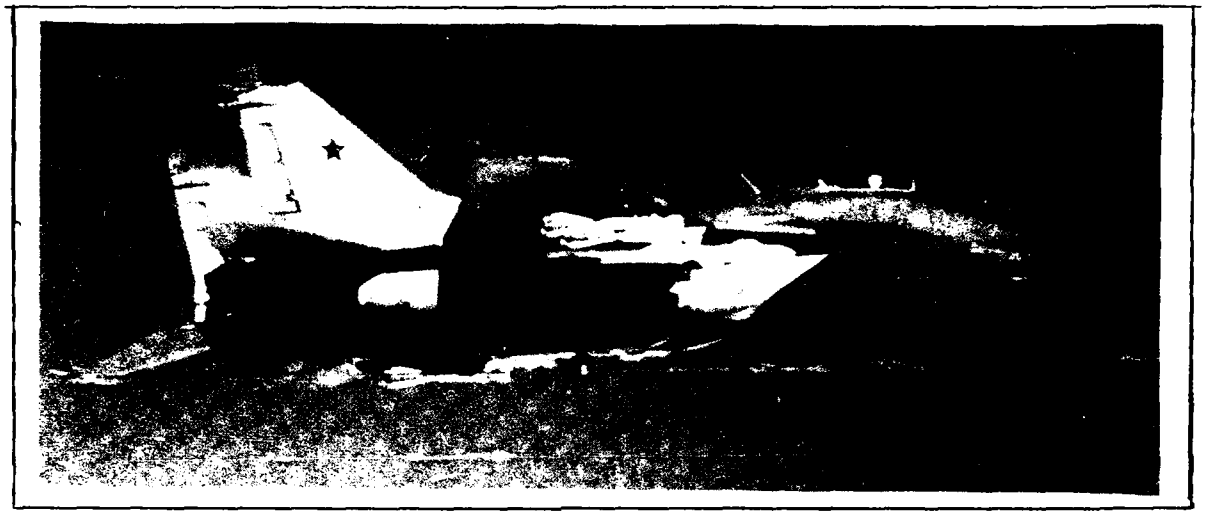


Figure 2-2: MIG-29 Fulcrum

The Soviet's answer to the US qualitative fighter edge is demonstrated by the development and deployment of the highly maneuverable, twin tailed, supersonic MIG-29. With over 300 Fulcrums operational, the Soviets are expected to replace less capable fighters with the MIG-29 (46:60). This twin-tailed, F-18 sized, aircraft has a combat radius of 715 miles and a top speed of 2.2 mach (23:89). It is equipped with an IRSTS giving a passive employment capability in a heavy ECM arena. The MIG-29's onboard Pulse-Doppler radar and six AA-10 (Alamo) medium range air-to-air missiles give it a true look-down, shoot-down capability (23:89).

With large breakthroughs in turbofan technology, the Soviets have equipped the Fulcrum with two R33-D turbofans giving the MIG-29 an estimated 1.23:1 thrust-to-weight ratio (15:25). This engine power and advanced airframe design make the Fulcrum a highly maneuverable platform to employ AA-11 (Archer) short range IR missiles and 30MM gatling gun in a fluid dog-fight arena.

Due to the aircraft's recent introduction, many details are either not known or classified. This aircraft is expected to have, at least, the same level technology found in the older MiG-31. US pilots can expect to confront this aircraft in a counter-air role deploying from several forward locations. Two Soviet regiments in East Germany have already converted to MiG-29s and a regiment in Hungary is undergoing Fulcrum conversion at this time (46:67). The Soviets are expected to equip their allies with the Fulcrum. The first Fulcrum recipients are expected to be Syria and India (23:88).

SU-27 FLANKER

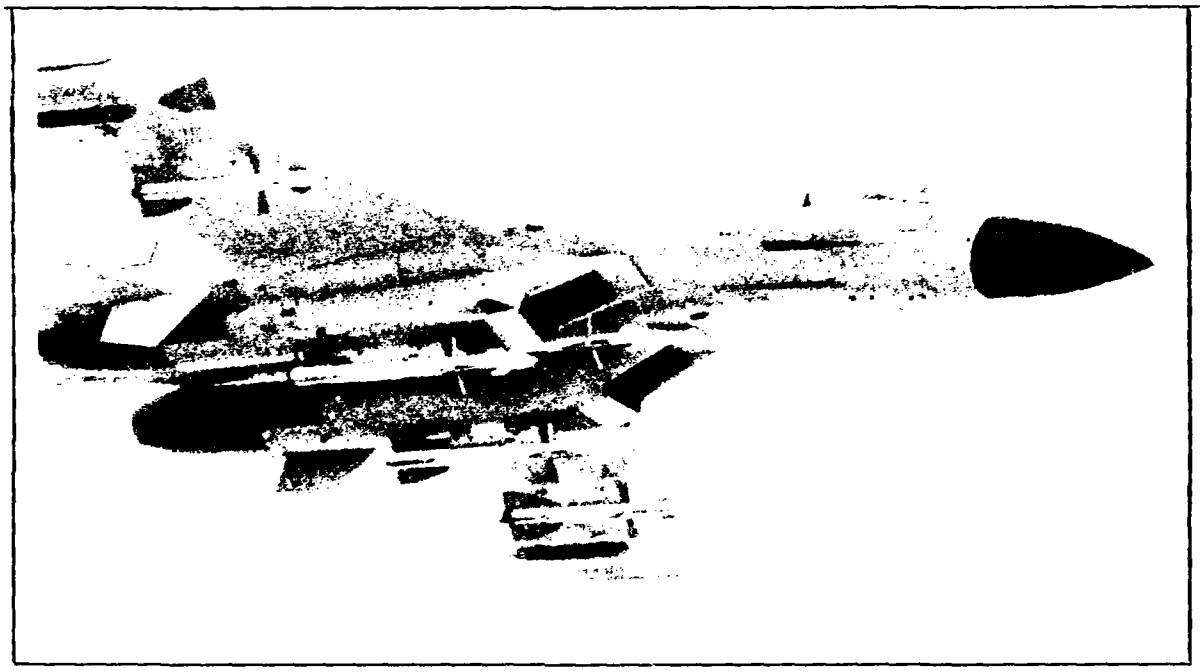


Figure 2-3: Su-27 Flanker

In what appears to be a parallel development with the Fulcrum, is a larger twin-tailed fighter built by Sukhoi, dubbed by NATO as Flanker. Possessing similar technology as the Fulcrum, the Su-27 has a slightly different role and capability. With a primary mission of deep fighter escort, the Flanker was designed for longer range (46:78). This fighter is presumably powered by two R-31 turbofans giving the large Flanker a top end speed of Mach 2 and an economical combat range of 930 miles (23:89).

The Su-27 is thought to be equipped with either the same, or at least similar, radar as the Fulcrum, giving it the same look-down, shoot-down capability. Similarly, the Flanker is armed with six AA-10 missiles for beyond-visual-range (BVR) employment as well as the new, all aspect, AA-11 short range IR missile. With the primary role of deep escort and secondary role of attack, US forces can expect to face this F-15 size threat behind friendly lines.

Sources have also observed this aircraft at Saki Naval Air Base, apparently testing for operations on the new 65,000 metric ton class Soviet aircraft carrier. Equipped with the Flanker, this nuclear carrier could deliver this airborne threat to US forces world-wide by the early 1990s (46:20).

TAC AGGRESSOR FOLLOW-ON REQUIREMENTS

"...the threat from Soviet forces, conventional and strategic, from the Soviet drive for domination,...remains great. This is reality. Closing our eyes will not make reality disappear" (46:preface).

Ronald Reagan

In light of this reality, TAC is convinced of the value of the Aggressor concept and has outlined the following requirements for the F-5 replacement (35:TAB 1). The TAC/DO position paper states the aircraft should enable Aggressor pilots to simulate any Soviet formation and tactic, as well as, Soviet avionics and weapons capability. This aircraft should be similar in size and performance to Soviet aircraft and should be able to provide enough sorties to fulfill the Aggressor mission. Finally, in an effort to continue to provide the most effective training, this aircraft should be dissimilar (34:--).

TAC's analysis of these objectives, in light of the Soviet threat, produced the following bottom line aircraft requirements. The aircraft must:

1. be able to attain 1.2 mach with a G capability at or exceeding 7.33.
2. have a look-down radar search and track capability in excess of 40 NM.
3. be capable of simulating all aspect radar and heat seeking missiles.
4. be approximately the same size as fourth generation Soviet aircraft.
5. be available in sufficient numbers to provide an adequate number of sorties.
6. be a dissimilar aircraft (34:--).

F-15/F16 FOLLOW-ON AGGRESSOR

In an effort to meet TAC's requirements, the authors looked at several US aircraft to determine which could best match the capabilities of the Soviet fighter and provide a dissimilar threat. Five Air Force and two Navy aircraft were examined. Table 2-1 shows how each aircraft compares to TAC's prerequisites. Every aircraft, except the A-10, is capable of achieving 1.2 mach, but the need to exceed 7.33Gs eliminates the F-4 and F-111. Additionally, none of these aircraft are equipped with pulse-Doppler air intercept (AI) radars. In examining the dissimilar requirement the most obvious choice is either the F-14 or F-18. However, the start-up training, logistics, and acquisition costs of new aircraft in the Air Force inventory make these aircraft unrealistic choices. This leaves the F-15 and F-16 as the most likely follow-on choice.

A/C	1.2 IMN	7.33 G'S	PD RADAR	ALL ASPECT MISSILE	DISSIMILAR
F-5	YES	YES	NO	YES [1]	YES
F-4	YES	NO	NO	YES	YES [3]
F-111	YES	NO	NO	NO	YES [3]
A-10	NO	NO	NO	YES [2]	YES [3]
F-16	YES	YES	YES	YES [1]	YES [3]
F-15	YES	YES	YES	YES	YES [3]
F-14	YES	YES	YES	YES	YES
F-18	YES	YES	YES	YES	YES

NOTES: [1] IR Capable/Radar Missile Simulated
[2] IR Capable/ No Radar Missile Simulation
[3] Dissimilar to all other USAF A/C except self

Table 2-1: US Fighter Requirement Comparison

The F-15 and F-16 are the two best candidates for the Aggressors. They both can simulate any known Soviet formation or tactic and operate easily in the 1.2 mach region. Likewise, their avionics allow them to simulate Soviet fighter detection capability. They each possess a Pulse-Doppler radar capable of

detecting and tracking fighter-sized targets in the look-down arena. In addition, the F-15 and F-16 can simulate the wide variety of current Soviet weapons. Both have all aspect IR missile capability and the F-15 is the only one, of the two, currently possessing a radar missile. Although, the F-16 can provide accurate radar weapon simulation with its advanced fire control system.

As far as appearance, both aircraft have some similarities with the newer Soviet fighters. The F-16 is a bit smaller in size, than the Fulcrum, but has the same blended wing/fuselage body of the Flanker and Fulcrum. As Figure 2-4 shows, the F-15 compares closely, in size and shape, with each twin-tailed Soviet fighter. Either aircraft is a logical choice, given the threat, and TAC Aggressor requirements. That is unless the dissimilar requirement is ignored.

The selection of only the F-15, creates artificial training constraints during Aggressor deployments to F-15 units. The selection of only the F-16 corrects the similar training problem for the F-15 community but presents the same problem to the ever growing F-16 community. By selecting both aircraft the Aggressors are able to accurately emulate current Soviet fighters, meet all the specifications outlined by TAC, and through efficient scheduling, provide dissimilar training to every fighter unit in TAC.

The selection of both aircraft provides several operational, force structure, and cost benefits giving credibility to choosing both aircraft over selecting one. These benefits are the subject of the next few chapters.

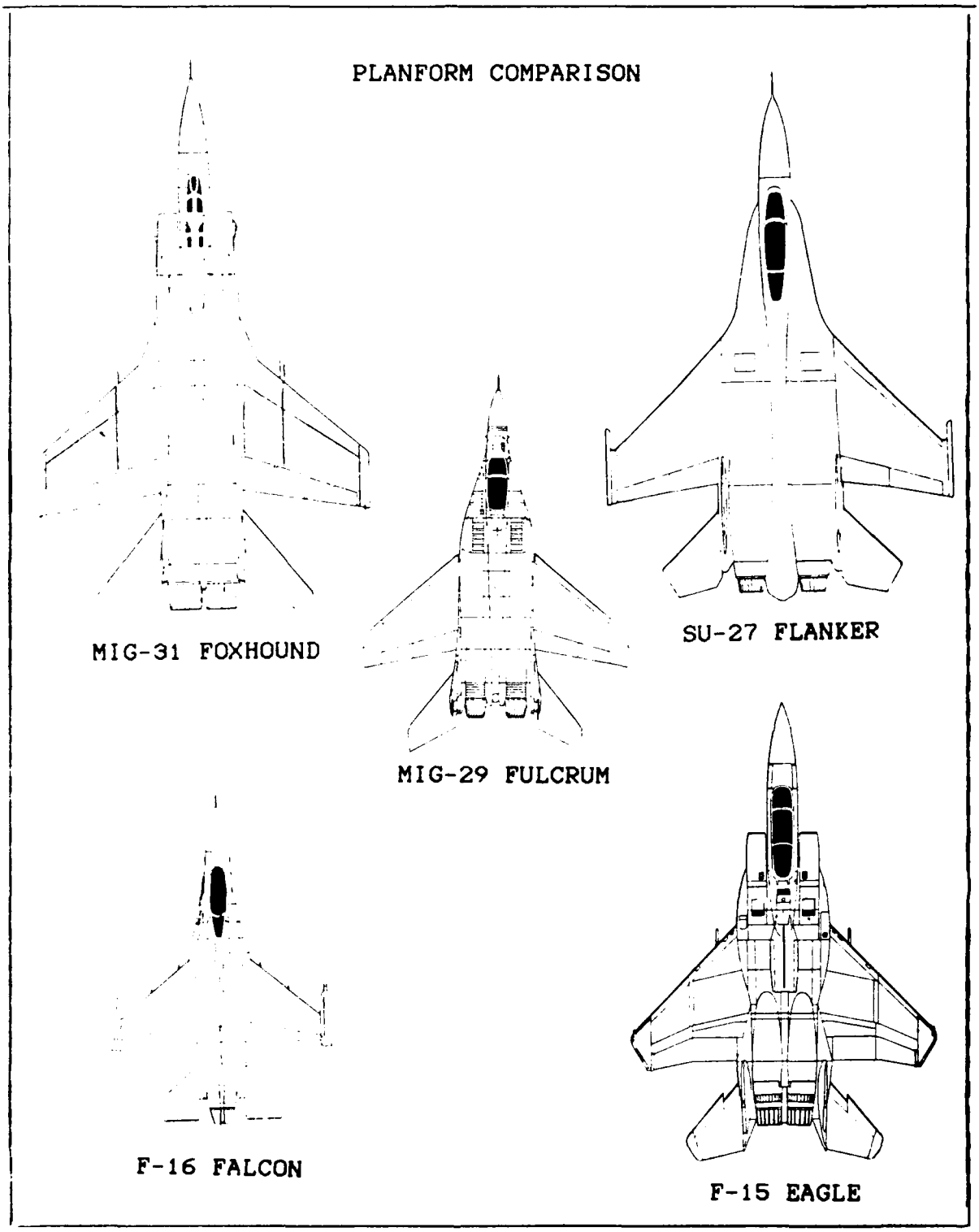


Figure 2-4: Fighter Planform Comparison

Chapter Three

OPERATIONAL BENEFITS

This chapter addresses several benefits gained from using both the F-15 and F-16 as Aggressor follow-on aircraft. They include the ability to continue providing dissimilar training, improving Aggressor training quality, and enhancing F-15/F-16 combat readiness.

CONTINUED DISSIMILAR TRAINING

> AGGRESSOR MISSION: "To provide dissimilar threat air combat tactics to TAC, USAFR and ANG aircrews..." (40:1).

By selecting both the F-15 and F-16, the Aggressors can continue to provide the TAF dissimilar training. This is made possible by scheduling F-16 Aggressors to support F-15 units and F-15 Aggressors to support F-16 units. Other units such as F-4s, F-111s, and A-10s can be supported by either threat aircraft giving the TAF 100% dissimilar Aggressor training.

Using a dissimilar adversary is important because it contributes realism to training by presenting pilots a different performance challenge than what their accustomed to. In addition, it eliminates the artificiality associated with sorting out who is whom in a similar visual fight.

Advocates of F-16 only Aggressors lose the benefit of dissimilar Aggressor training for each operational F-16 unit. Using 1987 TAC Aggressor deployment figures, this equates to 36% of annual Aggressor deployment training (30:--, 31:--, 32:--, 33:--). This percentage is particularly significant considering more F-4 units are programmed to convert to the F-16 resulting in fewer units receiving dissimilar Aggressor training. This figure is also alarming because for some of these air-to-ground units, Aggressor training constitutes only 1% of their annual training (27:38-39).

However, using both F-15 and F-16, the Aggressors can fulfill their original charter of providing every TAF fighter unit dissimilar training.

IMPROVED TRAINING QUALITY

> To ensure the readiness or our forces, commanders must develop and implement training programs that build required warfighting skills and that simulate, as closely as possible, the combat environment in which we expect to fight (37:4-7).

MORE EFFECTIVE AGGRESSOR PILOTS

An F-15/F-16 mixed Aggressor force will improve the quality of training by presenting the TAF a more effective Aggressor instructor pilot. This increased effectiveness is a direct result of increased pilot proficiency. For example, current Aggressors come primarily from the F-15 and F-16 communities giving the Aggressors a balance of air-to-air and air-to-ground expertise. These pilots typically assigned to the Aggressors with a minimum of 500 F-15 or F-16 hours. However, because these pilots must transition to a different aircraft, the F-5, the advantage of their previous aircraft proficiency is lost. As a result, new Aggressors must develop new aircraft switchology habits as well as adjust to new aircraft performance characteristics. Upon completion of the Adversary Tactics Instructor Course (ATIC) each Aggressor pilot begins providing TAF DACT instruction with only 30-40 F-5 hours, resulting in reduced instructor effectiveness. The average Aggressor takes approximately one year to gain total proficiency over the F-5, delaying new Aggressors from reaching their full instructor potential.

An F-16 only Aggressor force yields the same reduced level of instructor effectiveness from each previously qualified F-15 pilot. This assumes the Aggressors will maintain a balance of F-15 and F-16 pilots. The time to achieve total F-16 proficiency will most likely take longer than the F-5 because of the more complex F-16 weapons system.

Using both the F-15 and F-16, the Aggressors can make direct use of previous aircraft proficiency and produce more proficient instructors. These pilots, possessing a minimum of 530 hours of Aggressor aircraft experience, will be able to employ their aircraft with out hesitation and confidently max perform their aircraft. Thus, they will likely be a more potent and capable adversary which equates to more effective training.

COMPOSITE THREAT TRAINING

> Soviet strategy espouses an offensive, simultaneous massive air offensive,...The "first wave" will consist primarily of fighters (MiG-21s; MiG-29s; MiG-31s; Su-27s) and fighter bombers (MiG-23s; Su-22s; MiG-27s). A "second wave" will follow shortly within the hour...a "third wave" will follow--probably within a couple hours of the first...This "wave attack" is characteristic of Soviet operations used extensively in World II. Its intent is to overwhelm an enemy allowing concentration of forces and allowing attack of rear support echelons (27:3,4).

An F-15/F-16 mixed Aggressor force can also improve the quality of training by offering selected air defense tasked units composite threat training. This area of training is of great importance given the threat, but is currently lacking in the F-5 Aggressor force.

Some units have attempted to create this scenario, using the current F-5 Aggressor threat, with unrealistic and costly results (51:--). For example, some have attempted to simulate striker and fighter packages by assigning F-5s specific striker altitude blocks. However, this makes striker identification very easy and unrealistic. Others have attempted to correct this artificiality by scheduling one of their own pilots to fly with the Aggressors in a benign striker role. Although this approach is more realistic, it costs the host unit additional sorties and does not provide training for the simulated striker pilot. Additionally, these striker augmentees are normally unfamiliar with specific Aggressor tactics execution and consequently are difficult to incorporate in a realistic Soviet strike tactic (51:--).

By deploying, for example, four F-16 Aggressors and two F-15 Aggressors to an F-15 unit the Aggressors can provide an integrated Soviet strike package. This will not only provide the realism of a multi-aircraft threat but will not place the burden of training on the host unit. Any similarities associated with the F-15 Aggressor strike aircraft and host F-15s can be reduced with Aggressor paint schemes.

An additional benefit of a mixed deployment is the potential use of specific weapon system instruction provided by the similar Aggressor. Historically, Aggressors have been able to give detailed employment instruction based on the Aggressors previous experience in the host's jet. This included instruction in areas like radar employment techniques and specific

stick and rudder techniques (51:--). However, this type of detailed instruction gradually disappeared because it was felt that Aggressors were too far removed from their previous jet to instruct weapon system employment. Consequently, Fighter Weapons Instructor Course (FWIC) IPs augment Aggressor deployments as the credible instructor voice for the Aggressor and give "hands-on" detailed instruction. However, by deploying a mix of F-15s/F-16s, Aggressors can provide credible detailed academic and flight instruction, reducing the need for FWIC IP augmentation.

ENHANCED F-15/F-16 COMBAT READINESS

The Air Force places high priority on combat readiness. One of the vital ingredients to combat readiness is pilot proficiency (45:6-1). In light of projected budget cuts and the current low pilot retention figures, proficiency may be more difficult to maintain in the future. An F-15/F-16 mixed Aggressor force enhances combat readiness because F-15/F-16 Aggressor pilots increase their primary weapon system proficiency while accomplishing the Aggressor mission thus, increasing the overall TAF F-15/F-16 experience level. This not only gives the TAF an extra experience reserve in the event of war, but also adds proficieny to F-15/F-16 units gaining former Aggressors.

In an F-16 only Aggressor force, previously qualified F-15 pilots will spend their three Aggressor years in an aircraft that is not their primary weapon system. As a result, they will return to operational flying with the same F-15 experience level they left with, now three years removed. Consequently, these pilots will have to spend time re-acquainting themselves with switchology and performance characteristics of the F-15. The time spent regaining skills impacts the gaining unit's combat readiness.

Not only can a mixed Aggressor force enhance the TAF by providing extra pilots in the case of war, but they can provide additional combat aircraft as well. This is particularly important in light of the predicted Defense budget cut. This budget cut is likely to force TAF reductions in force structure, to include the deactivation of some operational fighter squadrons. However, by transferring some F-15s and F-16s to Aggressor squadrons, the TAF can make balanced theater force reductions without losing as much combat potential. For example; in USAFE, some F-16s could be transferred from a deactivating F-16 unit to the Alconbury Aggressors, giving them an upgraded aircraft while enhancing their England defense commitment in the event of war. The F-15 Aggressor force can be attained by having part of a Bitburg F-15 squadron pick up a portion the Aggressor Mission. Selected Bitburg pilots could attend ATIC enabling them to

provide dissimilar Aggressor training to USAFE F-16 units while retaining their combat tasking.

The same idea can be used in PACAF. If enough F-15s/F-16s are not available to equip the Clark AFB Aggressors, PACAF could task part of a Kadena F-15 squadron and a Misawa F-16 squadron with the Aggressor mission. This would give PACAF a dissimilar Aggressor force while maintaining a strong combat force structure.

Although absorbing Aggressor missions by operational units is not the best option, it does provide a way to achieve the recommended Aggressor mix without losing as much combat readiness. This is useful in light of potential force structure reductions.

As the Air Force faces future challenges, every attempt must be made to accurately train our pilots to fight and win wars. The operational benefits of dissimilar training, improved training quality, and F-15/F-16 combat readiness enhancement provided by an F-15/F-16 mixed Aggressor force will help the Air Force meet those challenges.

Chapter Four

SUGGESTED F-15/F-16 ATIC SYLLABUS

This chapter outlines recommendations for developing an F-15/16 ATIC. It offers suggestions to reduce ATIC sorties and provides possible Fighter Weapons Instructor Course (FWIC)/ATIC academic integration options.

ATIC STREAMLINE

Equipped with the F-15/F-16, the Aggressors will be able to reduce the ATIC by eliminating sorties previously dedicated to aircraft transition and basic handling.

The following is a comparison of the current F-5 ATIC to the recommended F-15/F-16 ATIC. The recommended course is derived from analysis of the similar phases of the F-15/F-16 Fighter Weapons Instructor Course (FWIC).

Because F-15/F-16 pilots are already checked out in their aircraft the American Transition (ATR) Phase should be reduced to one ride (see Table 4-1). This ride is an advanced handling ride designed to allow students to explore performance capabilities of the aircraft while familiarizing pilots with the Nellis flying area.

AMERICAN TRANSITION (ATR)					
F-5		F-15		F-16	
SORTIES/HOURS		SORTIES/HOURS		SORTIES/HOURS	
ATR-1	1.1	N/A	N/A	N/A	N/A
ATR-2	1.1	N/A	N/A	N/A	N/A
ATR-3	1.1	N/A	N/A	N/A	N/A
ATR-4	1.0	N/A	N/A	N/A	N/A
ATR-5	1.0	N/A	N/A	N/A	N/A
ATR-6	1.0	AHC-1	1.1	AHC-1	1.1
6	6.3	1	1.1	1	1.1

Table 4-1: ATR Phase

Because much of the F-5 Single Air Combat (SAC) Phase is devoted to increasing proficiency in the F-5 as well as perfecting Basic Fighter Maneuvers (BFM), the authors have used the FWIC approach and reduced the phase to five sorties (see table 4-2). The F-15/F-16 FWIC provides two instructor led and two student led offensive and defensive rides as well as one student led high aspect ride (43:5-3 - 5-11, 44:5-4 - 5-9). The assumption is made that pilots must demonstrate proficiency on all F-15/F-16 SAC sorties before progressing to the next sortie, thereby eliminating a phase checkride.

The Specialized Aggressor Training (SAT) Phase is reduced by one sortie. In the F-5 course each student has a dissimilar BFM sortie against an F-15 and F-16. In the new course there is only one dissimilar adversary of the two, thus eliminating one sortie. The balance of SAT is renumbered but not changed. SAT-2, 3, and 4 is flown against the 4477th TES and SAT-5 is flown in conjunction with EAC-7 (41:5-8).

Because the Element Air Combat (EAC) Phase includes sorties dedicated to supporting student Ground Control Intercept (GCI) training, the number and content of this phase was not changed. Additionally, because of low altitude flight safety considerations, the Step Down Train- ing (SDT) Phase was not shortened. The Element Combat Phase (ECT) was also not changed to provide enough sorties to teach Soviet tactics to the student pilots and controllers.

SINGLE AIR COMBAT (SAC)					
F-5		F-15		F-16	
SORTIES	/HOURS	SORTIES	/HOURS	SORTIES	/HOURS
SAC-1	0.8	N/A	XXX	N/A	XXX
SAC-2	0.8	SAC-1	1.1	SAC-1	1.1
SAC-3	0.8	SAC-2	1.1	SAC-2	1.1
SAC-4	0.8	SAC-3	1.1	SAC-3	1.1
SAC-5	0.8	SAC-4	1.1	SAC-4	1.1
SAC-6	0.8	N/A	XXX	N/A	XXX
SAC-7	0.8	SAC-5	1.1	SAC-5	1.1
SAC-8	0.8	N/A	XXX	N/A	XXX
SAC-9	0.8	N/A	XXX	N/A	XXX
9	7.2	5	5.5	5	5.5

Table 4-2: SAC Phase

The ATIC streamline reflects a reduction of 10 student sorties and 9 direct support sorties. It also reduces the ATIC flying training days from 62 to 47. The sorties saved could be use to provide direct support to the final DACT and Mission Employment Phase of the FWIC.

F-15/F-16 LONG ATIC

Because the possibility exists that some Aggressor pilots may come from aircraft other than the F-15 or F-16, the following long course is suggested.

A Transition Phase (ATR) must be included to teach previously unqualified pilots how to fly the new aircraft. A six sortie phase, similar in content with the existing F-5 transition phase, is recommended. TR-6 should be a Stan/Eval checkride, qualifying the pilot in the aircraft.

Since the SAC phase provides a critical performance base for the rest of the course, the authors recommend the SAC phase remain the same as the current F-5 course. This includes a SAC checkride given by squadron supervisors.

The remainder of the course can match the short course from the SAT phase to the ECT phase. This assumes long course students begin training earlier than short course students.

FWIC/ATIC ACADEMIC INTEGRATION

Because the FWIC and ATIC will use the same kind of aircraft, it is possible to combine certain basic academic classes eliminating duplication and fostering standardization.

Tables 4-3 and 4-4 list courses currently used in the F-15 and F-16 FWIC, respectively, that could be integrated with an F-15/F-16 ATIC.

F-15	
WE-1	School Orientation/In-Processing
WE-3	4477th Mission Profile Academics
IP-1	Brief and Debrief Techniques
IP-2	Inflight Techniques
IP-3	Preparing the Presentation/Evaluating Comprehension
IP-4	Communication and Delivery Techniques/Training Aids
AHP-1	Basic Aerodynamics
AHP-2	Turn Performance
AHP-3	Energy Maneuverability (EM)
AHP-4	F-15 Advanced Handling Characteristics/BFM
AHP-5	BFM Instructional Techniques/G-Induced Loss of Consciousness (GLOC)
AHP-6	AHP Exam
AV-1	F-15 Avionics Orientation
AAMP-2	GCI
ED-1	Soviet Aircraft and Armament
ED-2	Exam
ED-3	Principles of Air Defense Systems
ED-4	Soviet Antiaircraft Artillery (AAA)/SAMs
ED-5	Free World SAMs/AAA
ED-6	Air Defense/AAA/ Exam
ED-7	Soviet Radio Electronic Capabilities
ED-8	Soviet Strategic SAMs
ED-9	Soviet Tactical SAMs
ED-10	Soviet Naval Defenses
ED-11	Integrated Air Defense System (IADS) Countertactics
ED-13	Soviet REC/SAM/Naval Def Exam
PA-2	ECM/IRCM

Table 4-3: F-15 FWIC/ATIC Academic Integration

F-16	
CAWE 601	Orientation/In Processing
CAWE 603	Coronet Springs Academics
CAIP 601	Preparing the Presentation/Evaluating Comprehension
AVAS 105	Pulse Doppler Principles
AVAS 106	F-16 Air-to-Air Radar
AAAP 601	Energy Maneuverability (EM)
AAAP 101	F-16 BFM
AAWP 601	Infrared (IR) Missile Theory/AIM-9P
AAWP 602	AIM 9L/M
SAMP 101	F-16 Low Altitude Flying
TSED 601	Soviet Aircraft and Armament
TSED 602	EXAM
TSED 606	Integrated Air Defense Systems
TSED 603	Soviet AAA/Man Portable SAMs
TSED 604	Non-Soviet Defenses
TSED 605	Non-Soviet Exam
TSED 607	Soviet Radio Electronic Combat
TSED 608	IADS/REC Exam
TSED 609	Soviet Strategic SAMs
TSED 610	Soviet Tactical SAMs
TSED 611	Soviet Naval Defenses
TSED 612	IADS Countertactics
TSED 613	Soviet SAM/Naval Def Exam
TSEC 601	Basic Radar Fundamentals

Table 4-4: F-16 FWIC/ATIC Academic Integration

Integration of the two schools, where possible, can have a positive effect of increasing the Aggressors credibility because of the closer association between the two schools. It will also reduce unnecessary duplication of instruction effort and associated support.

Furthermore, because the recommended ATIC is shorter, additional sorties are available to directly support the FWIC final DACT/ Mission Employment phase. This benefits the Fighter Weapons School (FWS) by giving their students advanced Soviet dissimilar training from high-technology threat aircraft. And because the two schools are collocated, money will be saved by reducing the need for expensive off-station syllabus support. Additional cost benefits are addressed in chapter five.

Chapter Five

COST BENEFITS

For the Aggressor program, low cost has been one of the major successes of the F-5E. In this era of escalating costs, cost effectiveness is a priority consideration. The following discussion illustrates how the F-15/F-16 mixed Aggressor force can help reduce costs and achieve the best DACT training available.

Although this mixed force accrues cost benefits throughout the TAF as mentioned in previous chapters, the focus of this chapter is on the savings which can be developed in the Aggressor program itself. Aggressor upgrade training accounts for over 36% of the entire Aggressor flying hour program at Nellis (30:--,31:--, 32:--,33:--). Changes in the upgrade class composition and training syllabi can have a large impact on cost and sortie savings.

The following analysis will examine two possible Aggressor force mixes: an F-16 only and an F-15/F-16 mixed Aggressor force. The basis for the comparison will be computed total flying hour costs for a proposed annual flying program. Some assumptions are made as a basis for the following analysis.

1. The analysis uses the FY87 Aggressor annual flying hours program as its basis. The data used are a) total sorties flown, b) the ratio of Programmed Flying Training (PFT) sorties to total sorties, c) and the number of deployment sorties flown with F-16 units vs. non-F-16 units.

2. The flying hour cost figures are current average cost per hour which include average hourly fuel consumption, depot level maintenance costs, base level maintenance costs, and replenishment spares (50:--). The cost figure for an F-15A is $3664/hour. The cost figure for an F-16A is $2682/hour. (50:--). The A model figures are used because the F-16A is one of the currently proposed aircraft for this program (48:--).

3. The costs for the ATIC syllabi will be based on the long and short course proposals for a modified upgrade course as mentioned in Chapter 4. A 1.1 hour average sortie duration (ASD) is used for both the F-15 and F-16 syllabi, based on the current F-16 requalification syllabi (42:1-4).

4. Forty-five aircraft at a 24.0 utilization rate (UTE) will be the basis for this annual flying hour program.. This

is a TAC/DOO defined figure proposed to fill future Aggressor requirements (34:2).

5. The FY87 Nellis Aggressor flying hours program included 11,232 sorties (30:--,31:--,32:--,33:--). This equates to a 20.8 UTE rate for 45 aircraft. Using a 1.1 ASD, the total flying hours would be programmed at 12,355.2 hours.

6. The determining factor on the composition of a mixed Aggressor force will be the ratio of units receiving dissimilar sorties. Comparing the number of F-16 units vs. the number of non-F-16 units allocated deployment sorties, 1,861 of the 5,194 sorties were allocated to F-16 units (30:--,31:--,32:--,33:--). Thus, 35.82% of the deployed sorties (not including sorties required for deployment to or from the serviced unit) were in support of F-16 units.

7. Since the least expensive per hour aircraft being evaluated in this analysis is the F-16, it will be programmed to meet the support requirements for all non-F-16 units (i.e., F-4 and F-15). All non-specific taskings (i.e., Red Flag) are filled with 35.82% F-15 sorties.

This percentage of F-16 units requiring dissimilar support will dictate the number of F-15 aircraft required for this F-15/F-16 mixed force concept. With a total force of 45 aircraft, (16) F-15 and (29) F-16 will be required for the mixed force. A comparison of an F-16 only force and a mixed force with this composition would show that every hour of the approximately 4,500 hours flown by a F-15 in this model would cost $982/hour more than if a F-16 were flying that mission. This would be a $4.4 million cost increase over the F-16 only option.

However, variations in the upgrade training portion of the annual flying program will change that cost differential significantly. The thrust of this comparison emphasizes the increased costs in training pilots without currency in the unit's aircraft. The upgrade class comparisons will be based on proposed and current class compositions.

The FY77-FY87 annual upgrades contained a fairly constant number of 36 students. This study will consider 3 different annual class compositions. Only F-15 and F-16 students will be considered in these class compositions. For simplicity, students unqualified in either aircraft (i.e., F-4 or A-10 qualified students) will not be included in this analysis. They would add long course training/retraining costs to either option and are statistically insignificant to a comparison. The annual class compositions which will be considered are:

1) 18 F-15 qualified and 18 F-16 qualified students,

2) a larger F-15 qualified class which is similar to recent class compositions (22 F-15 qualified and 14 F-16 qualified students),

3) and a class with a percentage similar to the proposed aircraft mix (14 F-15 qualified and 22 F-16 qualified students).

4) Only the 14 F-15/22 F-16 annual class composition will be analyzed for the mixed force option.

In Table 1, the required syllabus sorties for each type of student are represented. This table shows the difference in sorties and hours required for the short and long courses. Ten percent attrition is factored for non-effective sorties.

PROPOSED ADVERSARY TACTCS INSTRUCTOR COURSE (ATIC) SYLLABUS
(DERIVED FROM CURRENT F-5 SYLLABUS)

Syllabus type	F-15 or F-16 previously qualified	F-15 or F-16 non-qualified
AHC	1*	6
SAC	5	9
EAC	8	8
SDT	3	3
ECT	9	9
SAT	5	5
SUB TOTAL	31	40
DIRECT SUPPORT	26	35
TOTAL SORTIES	57	75
HOURS	60.9**	84.9**
TOTAL SORTIES + 10%	62.7	82.5
TOTAL HOURS	66.99**	93.39**

*Qualified pilots don't require transition sorties
**Hourly totals are computed using a 1.1 ASD.

Table 5-1 Long and Short Course Comparison

Hourly requirements for an upgrade class of 36 students will vary depending on the number of students required to take the long course. The long course requires 18 additional sorties (including direct support sorties) equaling 24 additional hours of flying

time. Table 5-2 indicates the sortie, hour, and cost composition of the class mixes flying F-16 only or F-15/F-16 mixed aircraft.

ANNUAL AGGRESSOR PROGRAMMED FLYING TRAINING COSTS*

F-16 ONLY OPTION

STUDENT MIX	SORTIES	HOURS	COST	
(18)F-15	1485	1681.02	$4,508,495	
(18)F-16	1128.6	1205.82	$3,234,009	
TOTAL	2613.6	2886.84		$7,742,504
(14)F-15	1155	1307.46	$3,506,607	
(22)F-16	1379.4	1473.78	$3,952,678	
TOTAL	2534.4	2781.24		$7,459,285
(22)F-15	1815	2054.58	$5,510,383	
(14)F-16	877.8	937.86	$2,515,340	
TOTAL	2692.8	2992.8		$8,025,724
F-15/F-16 MIXED OPTION				
(14)F-15	877.8	937.86	$3,436,319	
(22)F-16	1379.4	1473.78	$3,952,678	
TOTAL	2257.2	2411.64		$7,388,977

*This is flying hours cost only.

Table 5-2 Hours and Cost Comparison

An analysis of the presented cost figures demonstrates that even though F-15 flying time per hour is more expensive than F-16 flying time, the mixed option is less expensive than the F-16 only options. The cost driving factor is the long course checkout in the F-16 only programs resulting in higher sortie and flying cost requirements. In the examples, the F-15/F-16 mix program has no long course students, since all incoming students have previous experience in the aircraft in which they are training.

An additional training cost, which makes the F-15/F-16 mix even more cost effective is the retraining costs required for those pilots returning to their primary weapon system after their Aggressor tour. In our analysis, the F-16 only options are the only programs that incur retraining costs. In the mixed program,

all Aggressor pilots are flying and gaining experience in their primary weapon system. Retraining will not be required when they are reassigned to operational units. For the purpose of quantifying this analysis, it is assumed only 75% of the F-15 pilots finishing their Aggressor tour require retraining.

RETRAINING COSTS FOR F15 PILOTS IN F-16 ONLY OPTION

PFT mix	75% retrained	COST PER PILOT*	TOTAL
18(F-15)/18(F-16)	13	$370,517	$4,816,721
14(F-15)/22(F-16)	10	$370,517	$3,705,170
22(F-15)/14(F-16)	16	$370,517	$5,928,272

*Based on Track II training in an F-15 requalification course (49:--)

Table 5-3 Retraining Cost Comparison

Table 5-3 illustrates that a large cost is accrued from the frequent retraining necessitated by the F-16 only option. Also, consider the "down time" for these pilots during requalification training that they are not a productive part of the mission ready force. Adding the total costs for training/retraining pilots entering this program results in significant cost differences as follows:

TOTAL TRAINING COSTS

F-16 only Aggressor force		F-15/F-16 mixed Aggressor force	
18/18 class	$12,559,225		
14/22 class	$11,164,455	14/22 class	$7,388,997
22/14 class	$13,953,996		

Table 5-4 Training/Retraining Costs for Class Comparisons

This clearly indicates that a mixed force has less expensive training costs. Transferring pilots into the Aggressor units that are current instructors in the appropriate aircraft is the cost savings. Producing the appropriate proportion of pilots to match the aircraft mix is the most cost efficient (i.e., mixed force, 14 F-15/22 F-16 class).

Although training costs are a significant portion of the annual flying program, the remaining cost of operating the Aggressor program for TAC is still going to feel the effect of the F-15/F-16 cost differential in flying time. Table 5-5 illustrates the hours for the operational mission remaining after PFT and its cost.

TOTAL ANNUAL OPERATIONAL FLYING HOURS COST

AIRCRAFT & STUDENT MIX	TIME REMAINING AFTER PFT*	COST**	TOTAL COST***
F-16 only 18(F-15)/18(F-16)	9468.36	$25,394,142	$37,953,367
F-16 only 14(F-15)/22(F-16)	9573.96	$25,677,360	$36,841,816
F-16 only 22(F-15)/14(F-16)	9362.76	$25,110,922	$39,064,918
F-15/F-16 mix 14(F-15)/22(F-16)	9943.56	$30,166,299	$37,555,296

*Annual PFT hours subtracted from the annual flying hours program of 12,355.2

**Operational costs for the F-16 only options are remaining hours X $2,682/hr. Operational costs for the mixed option is based on 35.82% of the remaining hours X $3,664/hr and the remainder X $2,682/hr.

***Training/retraining costs are added to the operational costs column.

Table 5-5 Annual Flying Program Costs by Option

The table demonstrates that the two lowest cost programs are the programs with the 14(F-15)/22(F-16) annual student mix. The F-15/F-16 mix comes within $713,480 of the best F-16 only program and is cheaper than other examples by as much as $1.5 million.

Compared to the original deficit comparison of $4.4 million, it shows that the training/retraining costs significantly narrowed the difference in the total cost of the program. The most significant statistic on Table 5-5 is the difference in hours remaining for the operational mission after PFT hours are subtracted. This efficient mixed force training program allocates nearly 5% more sorties to the operational mission which are not required in training. As much as 580 hours, and at a minimum 370 hours, are saved in the F-15/F-16 mixed option. In view of the ever increasing demand for Aggressor sorties, this statistic is the true savings. As many as 10-12 deployments to air-to-ground units could be implemented through the hours savings.

CONCLUSIONS

Realistic training is the bottom line. It is the reason the Aggressor program was initiated. It is the reason behind the ever expanding demand for the Aggressors throughout the TAF. It is also the reason the Air Force continually needs to search for a better way to emulate the threat.

The proposed F-15/F-16 Aggressor force in this analysis has a myriad of benefits for the TAF, which were discussed. The leap in capabilities represented by the F-15/F-16 mixed force greatly enhances realistic training beyond its present state. The savings in sorties and dollars further enhances the argument for the F-15/F-16 mixed force. The unused sorties diverted from the PFT to the operational mission expand the Aggressors ability to provide the TAF necessary training without increasing costs. The examples in the previous chapter demonstrate cost reduction advantages to the mixed Aggressor force.

The aging of the F-5E fleet demands that a replacement Aggressor be chosen soon. Operational and cost advantages, as well efficient use of scarce flying hours, support the argument for using a mixed force capability through the turn of the century. Even considering the alternatives, the mixed force is still the answer to realistic threat emulation for the next decade and beyond.

BIBLIOGRAPHY

A. REFERENCES CITED

Books

1. Bonds, Ray, et al. The Great Book of Modern Warplanes. New York: Portland House, 1987.

2. Taylor, J. W. R. (ed.). Jane's All the World's Aircraft, 1986-1987. New York: Jane's Publishing Inc., 1986.

Articles and Periodicals

3. "Air Warfare in the 1990's." International Defense Review, August 1986, pp.1055-1056.

4. Alberts, Donald J., Maj, USAF, and Mock, Leroy, Capt, USAF. "Increased Air-to-Air Specialization Training." Air University Review, November-December 1978, pp. 2-14.

5. "Anything Else is Rubbish." USAF Fighter Weapons Review Summer 1975, pp. 10-12.

6. Baker, John R., Lt Col, USAF. "Tactics and the Fog of War." USAF Fighter Weapons Review, Summer 1986, pp. 14-17.

7. Cobleigh, Ed, Capt, USAF. "Top Gun Navy Style." USAF Fighter Weapons Review, Winter 1972, pp. 5-7.

8. Ell, Ted, Capt, USAF. "Staying Alive in the Visual Fight." USAF Fighter Weapons Review, Spring 1986, pp. 2-4.

9. Freeze, James E., Maj Gen, USAF (Ret). "The Falklands and Lebanon Reinforce EW Lessons." Military Electronics/Countermeasures, August 1982, p. 67.

10. Hamilton, Andrew, Capt, Naval Reserve (Ret). "TopGun-The Navy's 'Mig-Killing' School." US Naval Institue Proceedings, January 1976, pp. 95-97.

11. Heston, Robert A., Maj, USAF. "Specialized Air-to-Air Combat Training." Air University Review, September-October 1977, pp.77-84.

12. Kelly, James P., Lt Col, USAF. "Composite Force: Reflections on Red Flag." USAF Fighter Weapons Review, Summer 1985, pp. 2-4.

13. Kross, Walt, Lt Col, USAF. "ACEVAL/AIMVAL: Abusing Atari in the Desert." Armed Forces Journal International, January 1982, pp. 52-56.

14. Mascot, Thomas K., Capt, USAF, and Beesley, Mark G., Capt USAF. "The Bandit's Alive at the Merge." USAF Fighter Weapons Review, Winter 1985, pp. 2-7.

15. "MiG-29 Fighter Design for High Performance, Rough Fields." Aviation Week and Space Technology, 14 July 1986, pp. 24-25.

16. Mordoff, Keith F., "Air Force Aggressor Squadrons Move to Improve Combat Training." Aviation Week and Space Technology, 19 August 1985, pp. 93-96.

17. North, David M., "Soviet Advances Spurring Western Aircraft Upgrades." Aviation Week and Space Technology, 21 July 1986, pp.42-45.

18. Phelps, John N., Maj, USAF. "WSEP Lessons Learned." USAF Fighter Weapons Review, Summer 1986, pp. 27-30.

19. Ross, Don, Maj, USAF, and New, Larry, Capt, USAF. "Getting the Most From Your Aggressors." USAF Fighter Weapons Review, Summer 1986, pp. 20-23.

20. Russ, Robert D., Col, USAF. "Air-to-Air Training under the DOC System." Air University Review, January-February 1977, pp. 65-74.

21. Russ, Robert D., Maj Gen, USAF. "Tactical Fighter Development: We Have Debated Long Enough." Air Force Magazine, April 1981, pp. 31-35.

22. Schefer, Leo, J. "Tomorrow's Dogfight." Asian Defense Journal, April 1983, pp. 72-76.

23. "Soviet Aerospace Almanac 1987." Air Force Magazine, March 1987, pp. 71-102.

24. Swanson, Gregg, Lt Col, USAF. "From Nevada to Bekaa: Air Combat in Theory and Practice." Armed Forces Journal International, January 1983, pp. 33-37.

Unpublished Materials

25. Browning, Ralph T., Maj, USAF. "Aggressor Training: Where Has It Gone? How to Get It Back." Graduate Thesis, *Armed Forces Staff College, Norfolk, VA, 6 May 1977.*

26. McAllister, Bradford J., Maj, USAF. "Air-to-Air Continuation Training in the Tactical Air Command." Research Report submitted to Air Command and Staff College, Air University, Maxwell AFB, AL, April 1985.

27. Taylor, Roger E., Maj, USAF. "Aggressors: Future Proposal." Graduate Thesis, Air Command and Staff College, Air University, Maxwell AFB, AL, 1986.

28. Wood, Barry K. "Will Aggressor Squadrons Be Needed in the Future?" Submitted to US Army Command and General Staff College, Fort Leavenworth, KS, 1979.

Official Documents

29. Air University: ACSC Associate Programs. "Thinking About War: A Survey of Military Theory." Readings Book. Maxwell AFB, AL. No Date.

30. Tactical Air Command: TAC/DOOO. "Aggressor FQ 1/87 Sortie Allocation." message, 4 September 1986.

31. Tactical Air Command: TAC/DOOO. "Aggressor FQ 2/87 Sortie Allocation." message, 5 November 1986.

32. Tactical Air Command: TAC/DOOO. "Aggressor FQ 3/87 Sortie Allocation." message, 5 December 1986.

33. Tactical Air Command: TAC/DOOO. "Aggressor FQ 4/87 Sortie Allocation." message, 4 April 1987.

34. Tactical Air Command: TAC/DO. "Follow-on Aggressor- What is Needed." Position Paper, 1987.

35. Tactical Air Command: TAC/DRFA. "F-5 Aggressor Radar/Aggressor Conversion." staff summary sheet. Langley AFB, VA, September 1987.

36. Tactical Air Command: 57 FWW/ATR. "Increasing F-5's at Nellis." talking paper. Nellis AFB, NV, No Date.

37. US Department of the Air Force: Air Force Chief of Staff. "Basic Aerospace Doctrine the United States Air Force." AFM 1-1. Washington, DC, 16 March 1984.

38. US Department of the Air Force: HQ Tactical Air Command (DOO). Dissimilar Aircraft Air Combat Training, TAC Regulation 51-2. Langley AFB, VA, September 1975.

39. US Department of the Air Force: HQ Tactical Air Command. 57 Fighter Weapons Wing. TAC Regulation 23-77. Langley AFB, VA, 8 December 1986.

40. US Department of the Air Force: HQ Tactical Air Command. 57 Fighter Weapons Wing/ Adversary Tactics. TAC Regulation 23-78. Langely AFB, Va, 5 December 1983.

41. US Department of the Air Force: HQ Tactical Air Command (TAC/DOT). USAF Adversary Tactics Instructor Course F-5E, TAC Syllabus Course F50000AIAN. Langley AFB, VA, May 1986.

42. US Department of the Air Force: HQ Tacical Air Command. "USAF Transition/Requalification Training Course, F-16." Langley AFB, VA, January 1984.

43. US Department of the Air Force: HQ Tactical Air Command (TAC/DOT). USAF Fighter Weapons Instructor Course F-15, TAC Syllabus Course F15001DPON. Langley AFB, VA, April 1986.

44. US Department of the Air Force: HQ Tactical Air Command (TAC/DOT). USAF Fighter Weapons Instructor Course F-16, TAC Syllabus Course F16001DPON. Langley AFB, VA, March 1987.

45. US Department of the Air Force: Office of the Vice Chief of Staff. Air Force Issues Book, Pentagon, Washington, DC, Spring 1987.

46. US Government: Office of the Secretary of Defense. Soviet Military Power. Washington, DC: US Government Printing Office, 1987.

Other Sources

47. Baker, John G., Maj, USAF. "Aggressor Trip Report: 1TFW Langley AFB, 9-20 Feb 87." Submitted to 57FWW/AT, Nellis AFB, NV, February 1987.

48. Gentrup, Mike, Lt Col, USAF. Director, Office of Fighter Acquisition Requirements (TAC/DPFA). Langley AFB, VA. Telecon, 24 September 1987.

49. Hannagan, Mike. Cost Analyst, Directorate of Cost, Cost Analysis Division. (TAC/ACCC). Langley AFB, VA. Telecon, 22 October 1987.

50. Richard, Tony. Management Assistant, Office of TAC Flying Hours (TAC/DOXB). Langley AFB, VA. Telecon, 6 October 1987.

51. West, Gary C., Maj, USAF. Former Aggressor Instructor Pilot. Personnal experience as an Aggressor from 1983 to 1987.

B. RELATE SOURCES

Articles and Periodicals

"Defense Publication Depicts New Soviet Military Aircraft." Aviation Week and Space Technology, 7 April 1986, p. 121.

Dobbin, Ben. "Soviet Air Force Narrows Gap; Pilots Display Signs of Elitism." The Montgomery Advertizer, 11 December, 1987, p. 3C.

Greeley, Brenda M., Jr. "Budget Splashing Would Kill A-6F, Small ICBM, and Aquila." Aviation Week and Space Technology, 21 December 1987, p. 31.

"Norwegian Air Force Intercept Soviet MiG-31 Foxhound." Aviation Week and Space Technology, 17 February 1986.

"Soviet Display MiG-29 During Exchange Visit With Finland." Aviation Week and Space Technology, 7 July 1986, p. 28.

"Soviet MiG-29 Demonstrate Takeoff and Landing Characteristics." Aviation Week and Space Technology 28 July 1986, p. 91.

"Soviet MiG-29 Fighters Demonstrate Handling Capabilities in Finland." Aviation Week and Space Technology, 4 August 1986, pp. 118-119.

Taylor, John W. R., "Jane's Aerospace Survey 1987." Air Force Magazine, January 1987, pp.54-65.

Ulsamer, Edgar. "Shaping the Force." Air Force Magazine, January 1987, pp. 94-98.

Official Documents

Tactical Air Command: 57 FWW/DOOS. "Aggressor and FWS Support Requirements, May-Aug 87." staff summary sheet. Nellis AFB, NV. 13 February 1987.

Unpublished Materials

Craig, David, E., Major, USAF. "Pilot Error: Cause or Effect?" Thesis submitted to Air Command and Staff College, Air University, Maxwell AFB, AL, June 1967.

Anderson, Charles T., Lt Col, USAF, "The Tactical Fighter Pilot: Improving Combat Effectiveness." Reaserch report submitted to Air War College, Air University, Maxwell AFB, AL, April 1972.

Other Sources

Brown, Larry J., Maj, USAF. "Aggressor Trip Report: 388TFW, Hill AFB, UT, 3-7 Aug 87." Submitted to 57TWW/AT, Nellis AFB, NV, 10 August 1987.

Kanno, Stanley S., Maj, USAF. "Aggressor Trip Report: Seymour Johnson AFB, NC, 27 May-5 Jun 87." Submitted to 57FWW/AT, Nellis AFB, NV. 8 June 1987.

END
DATED
FILM
8-88
DTIC