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Realistic Training: The Key to Success in Aerial Combat

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Final report 8 June 1979

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A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

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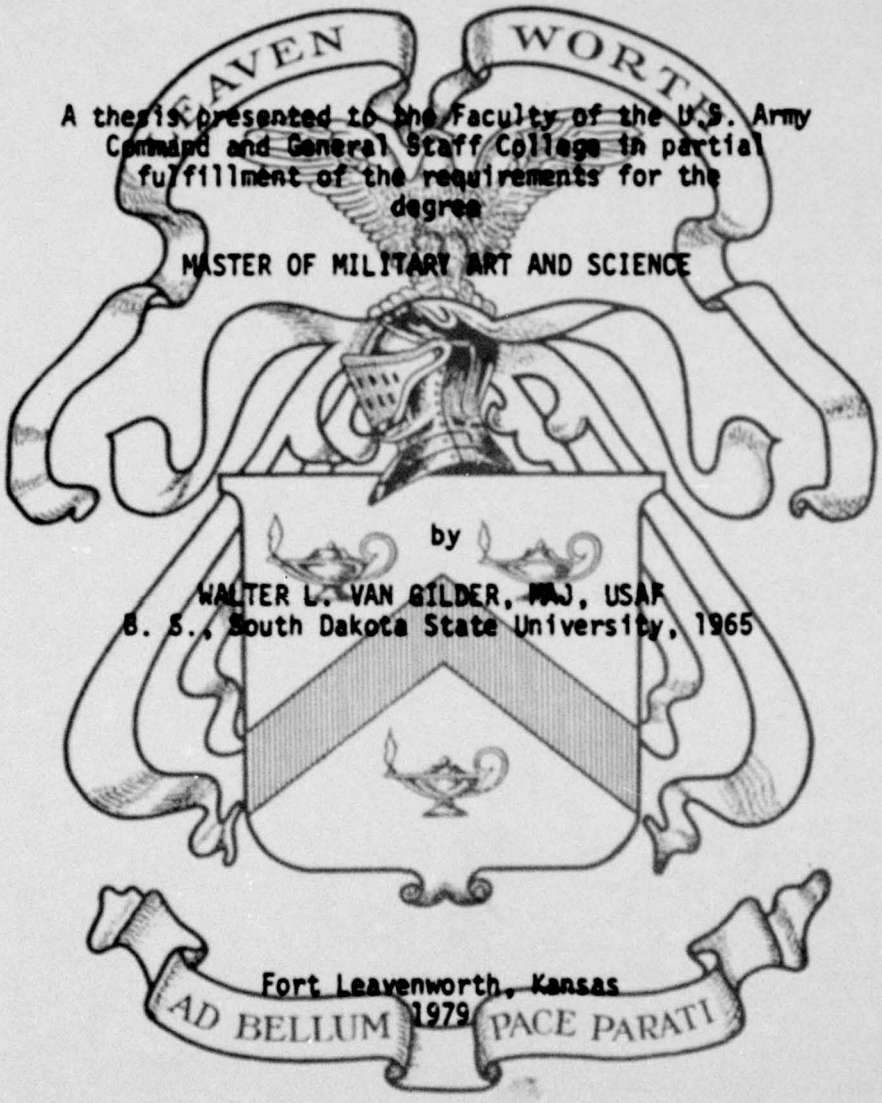

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CHAPTER I

INTRODUCTION

> The mission of tactical air power is to deter the enemy from attacking, and should deterence fail, to conduct war at the level of intensity and effectiveness needed to win. This mission demands the right forces effectively employed. But effective methods of modern warfare are not known instinctively; they must be learned. We learn them by training the way we fight.[1]

United States Air Force doctrine states the need for air forces organized, trained and equipped to prosecute war successfully. Three of the major operational missions are assigned specifically to our tactical fighter forces: counter-air, air interdiction, and close air support.[2] These missions are further divided into subelements all of which are necessary to successfully conduct air operations. However this paper will deal only with counter-air operations.

> Counter-air operations are conducted to gain and maintain air superiority by destruction or neutralization of an enemy's offensive and defensive air capability. The counter-air mission involves both offensive and defensive air action.
>
> (1) Offensive counter-air operations are normally conducted throughout enemy territory to seek out and destroy aircraft in the air or on the ground, missile and anti-aircraft sites, airbases, air control systems, fuel stores, and other elements that constitute or support the enemy air order of battle.
>
> (2) Defensive counter-air operations are generally reactive to enemy initiatives. Air defense operations involve destroying

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[1]Department of the Air Force, Tactical Air Operations, TACM 2-1 (15 April 1978), p. 1-1. (hereinafter cited as DAF, TACM 2-1).

[2]Department of the Air Force, United States Air Force Basic Doctrine, AFM 1-1 (DRAFT) (20 May 1977), p. 3-2.

> enemy air vehicles attempting to penetrate friendly airspace. While air defense is vital to the overall counter-air program and to the security of friendly forces and installations, the most rapid and conclusive results are obtained through offensive action.[3]

Defeating an enemy air effort becomes the top priority mission of our tactical air forces when confronted with an offensive air threat by the enemy.[4] In addition to being high priority, attaining and maintaining air superiority is perhaps the most demanding and difficult of the entire battle.[5]

> Air superiority, through dominance in the air battle, permits the conduct of land, sea and air operations when and where desired, without prohibitive interference from an opposing force. Only through a well developed and flexible plan coupled with thorough execution can we realize the objective of counter-air operations -- air supremacy, the ultimate degree of air superiority which renders opposing air forces incapable of effective interference.[6]

Historically command of the air has been a dominant feature in every war since the advent of the airplane. Successful counter-air operations will also be a necessity in the foreseeable future if we are to be victorious in a conventional war against the Soviets or Soviet trained and equipped forces. This requirement presents the United States Air Force with a considerable problem in light of the present situation.

The present build up of Soviet fighter forces is widening the

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[3]U.S. Army Command and General Staff College, U.S. Air Force Basic Data, RB 110-1 (July 1977), pp. 1-4, 1-5.

[4]DAF, TACM 2-1, pp. 1-2.

[5]Ibid., pp. 4-29.

[6]Ibid.

gap over the already numerically inferior USAF tactical fighter fleet. The Soviets and Warsaw Pact are training for offensive operations and continue to design, produce and field new, technologically advanced fighter weapons systems.[7] This numerical superiority and recent Soviet offensive orientation, coupled with our current fiscal constraints, austere flying hours, and fewer and less experienced fighter pilots will require placing more emphasis on the quality of training our air superiority forces receive. If the determining factor in a quantity versus quality struggle is the side which has air superiority, then the proficiency of our fighter aircrews will be vitally important to fulfill that commitment. Therefore, our air-to-air training programs must be comprehensive, versatile and truly combat oriented if we are called upon to utilize our air superiority forces in a future operation against the enemy and win. The programs must anticipate the complex tactics and employment techniques required in future conflicts and keep up with the pace of advanced technology in modern weapons systems.

History has shown that there is little time in the heat of battle to learn or analyze situations which could have been practiced in training. This is particularly important today with the anticipation of a relatively short, high intensity conflict. Considering all these factors, the question remains, is our present aerial combat training program in Tactical Air Command (TAC) oriented in the proper

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[7]Robert P. Berman, Soviet Air Power in Transition, (Washington: The Brookings Institution, August 1977), pp. 32-33.

direction and sufficiently realistic to gain and maintain victory over an enemy in the modern threat environment. Are we achieving maximum combat capability and exploiting the full potential of our present weapons and weapons systems through the current training techniques and programs?

Objectives of the Study

The objectives of this study are to review historical methods of training for aerial combat, investigate present programs, arrive at conclusions concerning the validity of these programs and recommend modifications to increase the combat readiness of our air-to-air fighter forces.

Limitations

The content of this study is limited to only the air-to-air combat portion of achieving air superiority. It is recognized that the preferred method, when possible, is to destroy the enemy's aircraft before they get airborne. This objective is becoming more difficult however, in light of the threat's hardened and dispersed aircraft shelters and significant SAM/AAA coverage.

Only continuation training in stateside operational TAC fighter squadrons is discussed. This training encompasses the major area where combat capability is determined. The selection and training of fighter pilots prior to reaching the operational units also has a dramatic impact in this area, but it is a study in itself and will not be specifically addressed.

Numerous classified studies exist concerning this subject, but their use has not been included in this paper.

Air superiority is discussed in a limited, conventional war rather than in a nuclear environment.

Methodology

In order to establish a background on jet air-to-air training and application, this study begins with an historical review of the USAF involvement in the Korean and North Vietnam air wars. Then some current USAF air-to-air programs and training exercises will be discussed. The final chapter will present conclusions and offer recommendations to improve the combat readiness of our air superiority forces.

CHAPTER II

AIR WAR OVER KOREA

> The air battles of World War II demonstrated the amazing versatility of American tactical airpower. By controlling the skies over the battlefield, fighters protected the movement of Allied ground troops.[1]

The lessons on use of tactical airpower during World War II were recognized by many of our military leaders. General Arnold stated that in addition to vigilance that the nation would need air superiority, both offensive and defensive, before any land or sea action could be successful.[2] However, the major emphasis after World War II was placed on strategic air capability and aerial defense of the CONUS, with little attention devoted to aerial combat training and tactics development. A Korean double ace Colonel Ralph S. Parr has stated:

> "Aside from an annual attempt to qualify in air-to-air gunnery, any combat training in tactics was frowned upon for reasons of flying safety and nobody being willing to bite the bullet and give a requirement for it in peacetime. In short, it was catch as catch can and hope you weren't put on the carpet."[3]

Air-To-Air Employment

When North Korea attacked South Korea on 25 June 1950 the

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[1] Alfred Goldberg, Ed., A History of the United States Air Force 1907-1957, (Princeton, New Jersey: D. Van Nostrand Company, Inc., 1957) p. 139.

[2] Ibid., p. 97.

[3] Colonel (Ret.) Ralph S. Parr, survey response, (19 March 1979).

United States did not possess a credible air superiority force. We were faced with the task of rebuilding and retraining our fighting unit to contest the aerial domain over Korea. Fortunately, the weakness of the threat and time allowed the United States Air Force to develop this capability. By the end of the conflict the United States had a highly trained and effective aerial combat fighter force. This is attested to by the favorable kill ratio of approximately 10:1 achieved by the United States F-86 pilots.[4]

At the time of the attack, the United States Air Force fighter aircraft in the theater were the P-51, F-80, F-82 and F-84. Some of these aircraft were put into action on 26 June to establish air superiority over the ports and airfields in South Korea. This air cover aided the evacuation of American civilians, protecting them from air attack. On 27 June F-82 fighters from the 8th Fighter-Bomber Wing engaged and destroyed three Soviet built YAK fighters enroute to attack Kimpo airfield where the evacuees were boarding transports. This was the first aerial encounter of the war, and its successful execution allowed 851 refugees to reach safety.[5]

General Douglas Mac Arthur's first objective in Korea was to establish air superiority over the entire penninsula. The North Korean Air Force was small and obsolete at the beginning of the war and was attrited rapidly. An estimated 110 enemy aircraft were destroyed by

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[4]Pierre Grasset, "Dogfighting Makes a Comeback." Interavia, No. 29 (December 1974): p. 1189.

[5]Goldberg, p. 243.

10 August, leaving them with about twenty-two aircraft. Therefore, General MacArthur's first objective had been achieved in the first month without great difficulty.[6] Air superiority was maintained by the United Nations Command forces for the remainder of the conflict, but not without significant challenges from the enemy. The introduction of the MIG-15 was the first major challenge.

> Less than three years after the first flight (October 1, 1947) of the XP-86, which later became the F-86, the Korean War broke out on June 25, 1950. On November 1 that year, the first MIG-15s appeared. The shock-effect on the Chiefs of Staff and in the Government was deeply felt in the United States of America.[7]

When the Chinese communists entered the conflict with their Russian built MIG-15s, the USAF did not have an aircraft in the theater of comparable quality to contest air superiority. The F-86 program was accelerated and the Sabre along with the 4th Fighter Interceptor Wing was rushed to the war zone. On 17 December 1950 the F-86 pilots flew their first operational missions and claimed four kills. The skies over Korea had been owned by the MIG-15 for 47 days.[8,9]

The limited war aims of the United Nations constrained the United States forces. Enemy air forces were granted the area north of the Yalu River as an air and surface sanctuary. Because of this

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[6] Ibid., p. 243.

[7] Grasset, p. 1188.

[8] Ibid.

[9] Goldberg, p. 249.

sanctuary, the USAF was forced to conduct its counter-air battle through air-to-air combat. The MIG-15s normally outnumbered the Sabres and had offensive advantage. Guns and close-in dogfighting dominated these battles much as they had in WW II.[10]

The MIG was generally considered to be superior in overall performance, yet the kill ratio does not reflect that superiority. Appendix A contains an excellent discussion of the comparison of these two aircraft, as well as many other enlightening points concerning the air war over Korea as presented in the FEAF (Far East Air Force) Report on the Korean War.[11]

Another excellent historical document containing aerial combat tactics and formations employed during the Korean Era is the classic, "No Guts No Glory." The author then Major Frederick C. (Boots) Blesse said:

> . . . a strong program of teaching air-to-air tactics is a necessity if our Air Force is to remain the most aggressive air arm in the world.
>
> One of the minor contributions which instruction of this type makes to the pilot is the ability to fly on another man's wing through any kind of maneuver his leader attempts. The greatest reward and the basis for all that is to follow, however, is the self-confidence the pilot feels in himself. As this confidence grows, so does his enthusiasm. Enthusiasm increases interest, which in turn pays dividends in overall accomplishment. All of these qualities together add up to the one thing a training program must produce if the graduate pilots are to be successful in combat - aggressiveness. It is this pilot aggressiveness which we seek. Without it, all training is useless, for the individual pilot must have the desire to put into effect that which he has been taught. Amazing results have been achieved in combat through aggressiveness alone, but it has been proven

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[10] Ibid., pp. 247-254.

[11] This document has been included due to its relative obscurity and detailed descriptions.

> time and again that all the training in the world is insufficient when the individual does not have it in his heart to engage the enemy or destroy the target. Certainly then, the goal which we seek, or should be seeking, in the training of any pilot is to produce a pilot who is aggressive and well trained.[12]

The Sabre pilots were credited with destroying 792 MIG-15s while only losing 78 aircraft.[13] Much of this success has been attributed to the combat experience, aggressiveness and training of the F-86 pilots. An article in The Hawk by Colonel Harvey L. Kimsey highlights some interesting statistics: Of the 38 USAF pilots who reached ace status in Korea, 34 had participated in WW II and had an average of two kills there. Together they averaged 2000 hours of fighter time and accounted for more than 310 of the MIG kills in Korea.[14]

A questionnaire was sent to seventeen fighter pilots who served on active duty during the Korean war to determine their impressions of important aspects of aerial combat training during the Korean era. Some of these individuals are included in the above mentioned group.[15] The responses to the questions vary based upon where and

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[12]Frederick C. Blesse, "No Guts No Glory," (Reprint) USAF Fighter Weapons Review, Spring 1973, preface.

[13]Grasset, p. 1189.

[14]Colonel Harvey L. Kimsey, "The Requirement For a Tactical Air Superiority Fighter in the United States Air Force Now and in the 70's" The Hawk, Number 31, February 1970, pp. 51-59.

[15]See Appendix B for the individuals surveyed, those who responded, and the complete questionnaire.

when the individual received his air-to-air training, his unit's mission and the individual's position and perspective.

Questions posed and selected responses follow:

1. Overall-what is your impression of the relevance of the Air Combat Training (ACT) you received prior to the War? Was adequate time devoted to realistic training or was it merely square filling?

a. Our ACT training was excellent if you went thru the upgrading at Nellis of which I did - F-84 and then F-86.[16]

b. Statistics from every major war clearly indicate that combat air losses are always higher during an aircrew's first period of actual combat hours/missions/days/weeks. Recent studies on combat air losses refer to the first ten missions as being the most critical. The 4th Fighter Wing was the first air-to-air combat organization in Korea. Its entire cadre was made up of highly experienced fighter pilots. As a result there was no immediate requirement to establish a fighter training program to train pilots for combat air operations in Korea. I would agree that it should have been started at once but the need was not apparent to our leaders at that time. There was no "square filling" in those days. Every fighter pilot was anxious to go to Korea and spent every minute in the air practicing for it. At that time the only missions considered to be "square filling" and a waste of time were navigation, formation and instrument flying. Most of the time we practiced air to air and logged it as navigation, etc.[17]

c. Prior to the Korean War the demobilization hit rock bottom in 1947 and for two painful years the main task was to keep airplanes just <u>flying</u>; shooting was a luxury almost!![18]

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[16]Major General (Ret.) Albert W. Schinz, survey response, (29 March 1979).

[17]Lieutenant General, (Ret.) Winton W. Marshall, survey response, (26 March 1979).

[18]Major General, (Ret.) Foster Lee Smith, survey response, (25 March 1979).

d. My impressions of the relevance of the air combat training I received prior to the Korean conflict was that the training was excellent. The training was realistic and not square filling.[19]

2. What types of air-to-air dedicated sorties were flown per six months training cycle - Basic Fighter Maneuvers (BFM), Aerial Combat Maneuvers (ACM), Aerial Combat Tactics (ACT), etc.?

a. These engagements combined all of your modern terminology. The penalty for not knowing the extreme ranges of your aircraft's capabilities, combined with your own skill/courage/talent/aggressiveness, was a wrecked airplane and sometimes a dead pilot.[20]

b. Mostly flight against flight - same type aircraft. Of course this usually breaks down into an old fashioned dogfight.[21]

c. Pre-Korean War combat in training tactics/maneuvers were mostly 'rat racing', a great sport . . . Actually it was great training for operations against the highly maneuverable MIG-15.[22]

3. Were upgraders in the air-to-air phase given adequate sorties to become combat ready - or simply upgraded when they received the minimum number of sorties/hours?

a. Upgraders (and we had a number in the squadron by the summer of 1950) were given adequate sorties. But I emphasize - nothing was set by HQ as a minimum requirement. As a matter of fact, I firmly believe we were expected to turn out accomplished fighter pilots while HQ looked the other way. If the C.O. did the job - Good - If someone got hurt, or you lost a few aircraft - Bad - and you were fired. That made it easy on the HQ guys. No one then had to bite the bullet. (Sound familiar?)[23]

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[19]Colonel (Ret.) Ralph D. Gibson, survey response, (28 March 1979).

[20]B/General (Ret.) Robin Olds, survey response, (27 March 1979).

[21]Colonel (Ret.) Vermont Garrison, survey response, 20 March 1979).

[22]Marshall, previously cited.

[23]Olds, previously cited.

b. While there were minimum flying hours/sortie requirements for upgrading, no pilot was certified for upgrading until he had satisfactorily demonstrated his capabilities in the particular phase to a supervising pilot, usually his flight leader. In those days it was easy to transfer a weak pilot to non-tactical administrative duty.[24]

c. Newly assigned air crews were given adequate sorties to become combat ready. To be upgraded a crew member was required to become combat ready. To be upgraded a crew member was required to qualify on a banner target. Crew members were not upgraded based on a minimum number of sorties.[25]

4. Did air-to-ground sorties take precedence - in other words, did Air Force doctrine at the time put air superiority low on the priority list?

a. Air to ground was favored with air to air gaining strength by 1952.[26]

b. Air Force doctrine put air superiority high on the priority list (*but not air-air as best method to gain it.*) Because AG (air-ground) took precedence doesn't mean doctrine put air superiority low; in fact good AG on an enemy air base is far better air superiority doctrine and tactics than is air-air combat.[27]

c. It seemed to me that air-to-air and air-to-ground received about equal priority in most units. Again, it seemed to me, much depended on the Wing, Group, and Squadron Commander. During a period in 1951-1952 I commanded an F-86 training squadron at Nellis AFB called the "Applied Tactics Squadron." - We emphasized air-to-air mostly - sort of a final polishing squadron before being assigned mostly to units in Korea.[28]

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[24]Marshall, previously cited.

[25]Gibson, previously cited.

[26]Parr, previously cited.

[27]Smith, previously cited.

[28]Garrison, previously cited.

d. Not specifically prior to Korea. Air Force didn't seem to have a doctrine that reached the squadrons. We knew what had to be done - and we did what we could with the facilities (ranges) available . . . at home plate, darned near all sorties wound up rat racing - which was good since all the troops ultimately wound up in the 86 outfits in Korea.[29]

5. Were safety considerations/regulations overly restrictive - a driving factor in your training scenarios?

a. Safety regulations restrictive: In 1949 and 1950 one pilot error accident could get the pilot permanently grounded and the commander fired. Not everywhere mind you but it was generally considered as such and I've seen it happen.[30]

b. Since HQ looked the other way and considered air-to-air excellence to be achieved by some process of magic - no, safety was not overly restrictive - mainly because we did not pay much attention to the many rules that did exist.[31]

6. Were the continuation training air-to-air sorties realistic - were there composite strike/air superiority packages with simulated ground and air threats; or were they merely 1V1's, 1V2's, 2V2's, etc? If so, what was the largest scenario; 8V8?

a. There were no composite strike/air superiority training operations nor "Red Flag" type ground environment systems. We did practice large scale air to air combat maneuvers: flight against flight, squadron against squadron, with 20 to 30 fighter aircraft mixing it up.[32]

b. No, they were not realistic at first; there was a strong attempt to give graduating pilots a short "what to do" on a one to one encounter.[33]

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[29]Olds, previously cited.

[30]Parr, previously cited.

[31]Olds, previously cited.

[32]Marshall, previously cited.

[33]Parr, previously cited.

c. Continuation training air-to-air sorties were realistic. We flew composite strike/air superiority packages with simulated ground-to-air threats. We flew 1V1's, 1V2's and 2V2's. The largest scenario was 16V16 (P-51).[34]

7. Did you practice Dissimilar Air Combat Tactics (DACT); if so, against what types of aircraft? How frequently?

a. Dissimilar air combat tactics as they are structured today were not practiced officially. Unofficially we seldom took off on a training mission without searching the skies for fighters from other areas and organizations, particularly the Navy, with no pre-planning or coordination between the participants. I have flown numerous missions involving F-86 vs F-84, F-86/84 vs Navy, F-84 vs F-80 and F-86 vs F-51.[35]

b. No! safety the villain again.[36]

c. Yes - any stranger who came into sight.[37]

8. Were low-altitude (below 5000' AGL) air-to-air practice engagements allowed?

a. No, usually broke off at 10K (10,000 feet).[38]

b. Our combat air to air training requirements were broken down into high, medium and low altitude. High being 35,000 feet and higher, and low below 15,000 feet. In actual practice our combat maneuvers started at 25,000 feet and usually broke-off at 500 feet over unpopulated areas.[39]

c. Not authorized![40]

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[34]Gibson, previously cited.

[35]Marshall, previously cited.

[36]Parr, previously cited.

[37]Olds, previously cited.

[38]Smith, previously cited.

[39]Marshall previously cited.

[40]Parr, previously cited.

d. No - but every rat-race ended up on the deck anyhow.[41]

e. Air-to-air practice engagements were allowed. All engagements had to be discontinued at 1,500 AGL.[42]

9. What impact did the Fighter Weapons School (FWS) at Nellis have on tactics and training - did the word get out to the wings?

a. Nellis FWS was the only input we had on air to air. It didn't get out to the users for them to try until Viet Nam was raising its head.[43]

b. Initially there were no fighter tactics courses at Nellis specifically designed for Korean air combat operations. The 4th Fighter Wing arrived in Korea, intact with highly experienced fighter aircrews. It would take eight to ten months for them to complete their 100 missions. Many of the first returning 4th Fighter Wing aircrews were assigned to Nellis and were instrumental in establishing the excellent combat air training program based on lessons learned in Korea. Yes, the word was getting out. There was an abundance of information flowing to the CONUS fighter wings from the Korean theater and Nellis. Combat films were available to all units. Returning aircrews were the best source for getting the word out.[44]

10. To what do you attribute the USAF's outstanding success during aerial combat in Korea? Was it the man or the machines which made the difference?

a. The man using the known strengths of the machines against enemies not as well trained.[45]

b. To reiterate, I would credit the excellent intelligence support we received in studies and pre-mission briefings and by

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[41]Olds, previously cited.

[42]Gibson, previously cited.

[43]Parr, previously cited.

[44]Marshall, previously cited.

[45]Smith, previously cited.

radio while in enemy territory. The engine, flight control system, gunsight and strength of its airframe made the F-86 unmatched in air fighting capability at 25,000 feet and below which when coupled with our highly experienced and trained aircrews gave the United States an unbeatable combination for aerial combat. Our advantage in experience and training was further increased by the Communist's system of continually rotating new fighter units in and out of the Korean theater, presumely to provide their Communist fighter forces with maximum combat exposure against the U. S. Air Force. As a result a majority of our fighter crews were highly experienced in fighting the MIG-15 while we were of the opinion from observing their tactics and mistakes, that a majority of their pilots were low in experience against the F-86. We continuously worked at improving on our tactics, and so did they but we did it better.[46]

c. Our 14 to 1 ratio I regret to say is not too accurate. Statistics can be interpreted to tell damn near anything - We definitely were quite successful however and the biggest reason was the high experience level (old heads) we began to get in the F86 units by the end of the war. It was not the machines.[47]

d. Men and machines both. But men above all.[48]

e. Good aggressive leadership on our side - convincing youngsters they could beat the other side. Mostly the man made the difference. The machines were too close in performance to have been the deciding factor.[49]

f. I attribute the outstanding success of the aerial combat operation in Korea to the excellent fighter training program I had prior to Korea. I believe it was the combination of man and machine that made the difference in Korea. The leadership of my superiors was outstanding, with few exceptions. My first combat mission in an F-86 was a dive bombing mission North of Seoul, and I was the only non WW II combat pilot on the mission. This planning and foresight was carried out throughout the time that I flew combat. Old hands were always available to lead the less experienced crew member. When I flew my first combat mission, I had more than 3,000 fighter hours but only 102 hours in the

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[46]Marshall, previously cited.

[47]Parr, previously cited.

[48]Olds, previously cited.

[49]Garrison, previously cited.

F-86. I was prepared and the results are history![50]

g. In a telephone conversation with Colonel (Ret.) Harold E. Fischer on 3 April 1979 he was asked a somewhat related question bearing on the problem of preparedness - Colonel Fischer replied: that it (air-to-air training) didn't help or hinder because I never had any. I flew a tour in F-80's first and went back to FEAF HQ's in Japan as a personnel officer. I was soon reassigned to Korea to fly F-86's. I was trained by a Canadian - they had their own rules, broke ours all to hell. My instructor was Wing Commander Douglas Lindsay, a Canadian Ace who's objective was to shoot down aircraft. He never worried about fuel remaining when a kill was evident. On one mission he got a MIG with 9 rounds - Fischer was his wingman. I often had less fuel than he had when we returned to base. On my 4th mission we returned to base and I flamed out on the runway. After that I never worried about fuel. All-in-all, I don't feel I would have been as effective, had I been trained by Americans.[51]

h. Brigadier General (Ret.) Harrison R. Thyng, Commander, 4th Tactical Fighter Wing in 1952 commented on combat crews in his After-Action-Report upon departure from the fighting zone: The 4th was manned 88% of its officer personnel. Only about 10% at any one time, were combat veterans of the previous war or who had any combat experience. About 60% were 2nd Lieutenants right out of flying school at Nellis. I would like to comment on the record of these youngsters. They are young, they are good, they are able, they show the effect of marvelous state side training.[52]

11. What changes took place in TAC air-to-air programs after the war ended - were the lessons learned applied and expanded on?

a. The Korean air battles resulted in reactivation of specialized air superiority tactical fighter forces. Previously, fighters were designed primarily as a fighter-bomber. Air fighting was secondary and only a means for self protection. The F-84 is a case in point. The straight wing F-84 had good turning capability but its mission was a fighter bomber with long range penetration capability. Based on the lessons learned in Korea

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[50]Gibson, previously cited.

[51]Colonel (Ret.) Harold E. Fischer, telephone conversation, 2 April 1979.

[52]B/General (Ret.) Harrison Thyng, After Action Report - 4th Fighter Wing in Korea, 16 October 1952.

the Tactical Air Command launched on a new effort to give recognition to the requirement for an air superiority fighter, air to air tactics, new training procedures, new emphasis on training facilities. As a result of TAC's efforts we now have the F-15 and the F-16 and the "Red Baron" air combat training program. As fighter pilots we are pleased with the large quantities of air superiority fighters being procured by both the Air Force and Navy. But keep in mind that we have never been able to fulfill all fighter bomber requests by our combat ground forces due to lack of sufficient fighter bomber aircraft, ordinance and all-weather air to ground capability in World War II, the Korean War and the recent war in Southeast Asia.[53]

b. TAC slowly initiated air to air programs after Korea-repeat slowly. It wasn't till after Viet Nam (1973-4) that TAC developed the realistic training it needed. Frankly, the leadership until that time was not strong enough to demand it and get it. Personal opinion!

One last comment. Oddly enough it wasn't really until after the Pentagon discovered (on 1 April 51) that B29's were really vulnerable to fighter attack that the air superiority role "really" got looked at. Only after 3 wars does it look like we are finally trying to learn from our previous mistakes in regards to fighter aviation.[54]

c. Training after the war took advantage of lessons learned until safety consideration influenced training. As an overall analysis, I would have to say that the air-to-air training programs stayed strong. With the advent of nuclear weapons training, the training problem became more difficult and the resulting specialization made it more difficult.[55]

d. Ah, I am glad you asked! After Korea, air-to-air became an absolute NO-NO. It was not scheduled. Rat racing, dog fighting was absolutely unauthorized. People were court-martialed-C.O.'s were fired. Nuclear strike was the word - idiot loops and lay downs-toss bombing and long range, low level navigation. . . . Went to Pentagon PCS - fought for a decent fighter and appropriate training - was told by 2 star boss: 'Olds, you're living in the past - you're a romantic - you think like a

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[53]Marshall, previously cited.

[54]Parr, previously cited.

[55]Gibson, previously cited.

dinosaur. Get it through your head. The USAF is not going to be engaged in air to air combat ever again - or in conventional war - Get back to your desk and shut-up.' Time: June 1962.
Time: June 1967 - I'm up to my ass in MIG 17's and MIG-21's - wishing that 2 star were in my back seat.
OK, that is it. Not a pretty story - but accurate.[56]

Overall, the responses to the questionnaire would seem to indicate that the effectiveness of the U. S. fighter forces in Korea can be credited to several factors. Major among these contributions, however, are a capable air-to-air aircraft combined with mission specialized units, experienced pilots to provide the leadership, and the eventual establishment of an effective aerial combat training course at Nellis AFB which produced aggressive, young fighter pilots.

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[56] Olds, previously cited.

CHAPTER III

AIR WAR OVER NORTH VIETNAM

> Obviously, not all pilots committed to battle will have had previous combat experience. Training then becomes an important element in air superiority. Between 1954 and 1962 the USAF training curriculum for fighter pilots included little, if any, air-to-air combat. This omission was partly a result of doctrine, which then regarded tactical primarily as a means for delivering nuclear ordnance. It was partly a reflection of concern for flying safety. In any event, as late as October 1963 it was reported that only four of 30 pilots in one fighter squadron had ever shot aerial gunnery.[1]

The above remarks by General Holloway highlight the secondary status given to the training of our tactical fighter forces after the Korean conflict. Any benefits derived from the lessons learned about the struggle for air superiority and the requirement to retain a highly trained air superiority cadre appear to have been neglected.

During the period before the United States involvement in Vietnam emphasis was placed on multimission tactical aircraft in addition to the overriding importance placed on our strategic strike force. General William W. Momyer noted:

> With the end of the Korean War, defense planners reevaluated our strategy for employing airpower. Perhaps the paramount question of the time was whether we should prepare to fight limited as well as general wars. After the agony and expense of Korea, an understandably popular position was that we would never fight, nor should we prepare to fight, another war like Korea. Adding to the popularity of this position was the fact that it could be

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[1] General B. K. Holloway, "Air Superiority in Tactical Air Warfare," Air University Review, March-April 1968, p. 9.

> used to justify a reduction in defense forces and expenditures. If a limited war should break out, proponents said, nuclear weapons could end it quickly. But the way to prevent such wars would be to maintain military and political pressure against potential instigators. If the outside support for a limited conflict were neutralized, the conflict itself would soon die for lack of weapons and other resources. Most airmen consented to the idea that nuclear weapons should be the basis of our defense strategies, but the Army and Navy maintained that limited conflict was most likely and that limited wars would, at least initially, be fought with conventional weapons.[2]

This situation led to a serious shortfall in the training toward attainment of a viable air superiority force. Our aircraft, tactics, and training were directed for use in an air-ground environment. As a result our air-to-air forces relied primarily on the various formations and tactics employed in Korea.

In the early 1960's our tactical fighter fleet was composed of aircraft that corresponded to our tactical doctrine of nuclear strike capability. Very few aircraft had been developed for the counter-air mission. The F-102 and F-106 had been built and introduced into the inventory, but they were developed to fill a defensive type counter-air role. The majority of our fleet development was around a fighter-bomber force. The F-100 and F-105 were the two main air-to-ground delivery systems and had only limited air-to-air capability. Consequently, when the United States Air Force was committed to the air battle in Southeast Asia, it had only a very meager inventory capable of conducting prolonged counter-air operations. At the same time the United States Navy was operating the F-4 aircraft for primary fleet defense.

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[2]William W. Momyer, Air Power in Three Wars (WWII, Korea, Vietnam), 1 January 1978, p. 6.

Limited numbers of these aircraft were also possessed by the Air Force with a programmed offensive air-to-air mission.

Air-To-Air Employment

United States fighter pilots faced Russian built aircraft just as they had in Korea. In addition to the MIG-15 which we had faced in Korea, the small and highly maneuverable MIG-17, 19, and 21 had been produced prior to the start of the Vietnam war. The air defense system over North Vietnam in August 1964, at the time of the Gulf of Tonkin retailatory strikes, totaled "approximately 1,426 anti-aircraft artillery weapons, 22 early warning radars, and 4 fire control radars."[3]

Initially United States political decisions in this "limited" conflict placed surface-to-air missile sites and air fields off limits to our fighter bombers. Enemy fighters were allowed to operate from a sanctuary, much as they had in Korea. These restrictions placed a tremendous burden on the ability of our air force to successfully fulfill its counter-air mission.

The air war over North Vietnam was composed of three major campaigns, Rolling Thunder, Linebacker I, and Linebacker II. Rolling Thunder took place from 2 March 1965 to 31 March 1968.[4] On 4 April 1965 a flight of GCI (Ground Controlled Intercept) vectored MIG-17's

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[3]Robert F. Futrell and others, Aces & Aerial Victories, The United States Air Force in Southeast Asia 1965-1973, (Washington: Government Printing Office, 1976) p. 4.

[4]U.S.G. Sharp and W.C. Westmoreland, Report on the War in Vietnam (Washington: Government Printing Office, 1969), pp. 12-16.

engaged a flight of bomb laden F-105's attacking targets near Thanh Hoa, North Vietnam. The MIGs shot down two of the orbiting fighter-bombers and then fled.[5] These were the first air-to-air losses of the war. Due to the escalating nature of the air war, and our deficient air-to-air capability, the decision was then made to send the F-4 into the conflict. The first USAF kills were achieved on 10 July 1965 by a flight of F-4C's when two MIG-17's were shot down with sidewinder missiles.[6]

As the aerial engagements became more frequent and the number of aircraft increased, further deficiencies in our aircraft and weapons became apparent. The rules of engagement at the time stated that to preclude shooting down friendly forces a positive visual identification (electronic means did not exist early in the war) of the aircraft being fired upon was required. This action led to aerial engagements similar to the dogfights of World War II and Korea. The smaller and more maneuverable MIGs had a decided advantage, especially since the F-4 was not equipped with a cannon during these initial stages of the war.

During the Rolling Thunder campaign (1965-1968), the USAF and USN achieved approximately the same kill ratio over the North Vietnamese Air Force, about 2.3 : 1.[7] The USAF answer to this poor showing

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[5]Futrell and others, p. 4.

[6]Ibid., pp. 4-5.

[7]Peter deLeon, The Peacetime Evaluation of the Pilot Skill Factor in Air-To-Air Combat, United States Air Force Project Rand R-2070 - PR, Santa Monica, Calif: The Rand Corp. Jan. 77, p. 10.

was to send aerial combat briefing teams and evaluators to the theater. These teams confirmed what had previously been suspected - our aircrews had been poorly trained for aerial combat:

> . . . The results of these briefings and a series of demonstration flights proved that our combat crews were not totally familiar in air combat tactics and were not proficient in maximum performance maneuvering of their respective weapons systems. Similar deficiencies exist in other areas of combat tactics such as proper capping procedures, escort procedures and aerial engagement procedures at low altitude. Many of these areas had not been explored and, consequently not developed. The entire air combat tactics area was sadly neglected.[8]

Minimum changes were made in the Replacement Training Unit (RTU) programs to compensate for these noted deficiencies. The training programs that existed were event oriented and did not take into account the importance of developing tactical skills through combat oriented scenarios. Rather, they were mechanical and inflexible and did not produce aircrews capable of accomplishing the entire mission. Safety rather than realistic, productive training was the overriding concern in most RTU's. Certain more aggressive commanders, however, took it upon themselves (much as had been done in units prior to Korea), to initiate a limited amount of DACT for their aircrews. This was the exception rather than the rule, the majority of the RTU commanders were content to abide by the rules and regulations and not jeopardize their position. It should be noted that even though CONUS training was less than desired, equipment improvements were being made to hopefully improve air-to-air results. In addition, in - theater

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[8] Report on Project Featherduster (Nellis AFB, Nevada, USAF Tactical Fighter Weapons Center, 1966), p. 2.

flexibility fortunately was available which allowed units to build a limited amount of expertise in their aircrews by only scheduling them for less demanding missions during their initial months in country (the combat zone).

The Navy on the other hand, after an extensive investigation, started an advanced aerial combat training program in the Top Gun Squadron located at Miramar Naval Air Station centering around dissimilar air combat training.[9] Aerial combat engagements were conducted against the A-4 aircraft which closely simulates the MIG-17. This training was given to the most experienced and capable Navy fighter pilots.[10]

Only limited air activity occurred from the time President Johnson declared the bombing halt above the 20th parallel on 1 April 1968, which ended the Rolling Thunder operation, until 8 May 1972 when President Nixon initiated Operation Linebacker I. This operation lasted until 23 October 1972.[11]

Although the North Vietnamese possessed only a rudimentary air defense system at the outset of the conflict, they developed a significant capability during the years of Rolling Thunder. In addition, the four year bombing halt between Rolling Thunder and Linebacker I allowed the North Vietnamese to build a more potent air defense network. A closely integrated GCI controlled MIG, AAA and Sam threat

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[9]Ibid., p. 11.

[10]Ibid., p. 11.

[11]Futrell and others, p. 89.

faced the United States aircrews at the beginning of the Linebacker Operation.

Tactics development during the Linebacker Operations took a major step forward. The traditional fighting wing concept was replaced by fluid formations which allowed all flight members to bring firepower to bear on the enemy. These advances can be accounted for by the eventual increased emphasis within the Air Force on combat training primarily as a result of the unfavorable kill ratio (2.3 :1) during 1965-1968. The following quotation from Aces & Aerial Victories adds new dimensions to the awakening of the USAF air warfare doctrine:

> Operation Linebacker commenced on 9 May, and American forces did well in air-to-air engagements. During May and June the ratio of kills was better than one to one in favor of the American forces. *Fighter aircrews of the 432d Tactical Reconnaissance Wing*, based at Udorn, scored the majority of kills. The wing was the primary counter-air unit in Southeast Asia during 1972. The addition of this role to its mission made it the only composite strike-interdiction, counter-air, and reconnaissance wing in the conflict and, more notable, its role made possible the majority of MIG kills. The 432d Wing's counter-air mission was diversified, including ingress MIGCAP, egress CAP, and barrier CAP (different types of combat air patrol).[12]

A total of 69 MIGs were destroyed by our fighters during the short Linebacker I Operation between 9 May and 23 October 1972, compared to 112 during the entire Rolling Thunder Operation from 1965-1968.[13]

A two month bombing halt was then established, and air op-

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[12]Ibid., p. 91.

[13]"Airpower Provides Viet Leverage," Aviation Week & Space Technology, 30 October 1972, p. 12.

erations did not commence again until 18 December 1972 when Linebacker II started. This operation lasted only 12 days, but it was intense; an operation to defeat the war making capability of the enemy.[14]

Poor weather, night bombing raids, and attacks on North Vietnamese airfields by F-111 aircraft precluded any major threat from the MIGs. Of the 32 aircraft launched by the North Vietnamese during this operation, eight were shot down by American fighters.[15] Linebacker II was the final chapter of the air war over North Vietnam, as shortly thereafter the United States began its withdrawal.

The USAF kill ratio during the combined Linebacker Operations remained relatively unchanged over that achieved during Rolling Thunder. The Navy from 1971 to the termination of the conflict, on the other hand, achieved a kill ratio of 12.5 : 1.[16] The Navy's average kill per aerial combat engagement increased to 1.04 during the same period.[17]

Lieutenant Randy Cunningham, the leading Navy ace in Vietnam, related to reasons for his success when he said:

When I met my first MIG I had over 150 ACM training flights.

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[14]U. S., Congress, House, Committee on Appropriations, Subcommittee on Department of Defense, Briefings on Bombings of North Vietnam, Hearings, Committee Print, 93d Cong., 1st sess., March 1973 pp. 4, 11, & 38.

[15]Ibid.

[16]deLeon, p. 11.

[17]Ibid., p. 11.

> During my MIG engagements I used tactics I had practiced against adversary aircraft. Pappy Boyington once said; 'The air battle is not necessarily won at the time of the battle.' The winner may have been decided by the amount of time, energy, thought, and training an individual has previously accomplished in an effort to increase his ability as a fighter pilot.[18]

The following table displays vividly the increased kill ratio achieved by the Navy which seems to reinforce the value of realistic training:[19]

Periods	MIGs Killed	U.S. Losses	USAF Ratio	USN Ratio
1965-1968	110	48	2.25	2.42
1970-1973	72	28	1.88	12.50

This dramatic improvement can be directly attributed to the Navy's incorporation of the DACT program during the war. In Peter deLeon's words, "Improved air combat skills, largely honed by the new training emphasis, thus seem to be the only new variable that could have resulted in the Navy's singular success."[20]

Summary

The air war over North Vietnam resurfaced the requirement for a strong air-to-air combat capability in conventional warfare. Equipment improvements were made throughout the war to increase the effectiveness, but training and especially realistic training to increase the proficiency of the aircrews did not keep pace. The only USAF pilot to

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[18] George Haering, An Introduction to Air Combat Maneuvering (ACM), Joint Technical Coordinating Group for Munitions Effectiveness (Air Operational Group), 61 JTCG/ME-76-4 (Washington, D.C.: U.S. Government Printing Office, 21 March 1976), pp. 2-4.

[19] "You Fight Like you Train and TOPGUN Crews Train Hard," Armed Forces Journal International, May 1974, p. 26.

[20] deLeon, p. 12.

achieve ace status in Vietnam, Captain Richard S. Ritchie, when addressing air superiority training made the following statement:

> . . . the pilot most likely to succeed is the one most highly trained. Stated another way, A superior pilot in an inferior aircraft will defeat an inferior pilot in a superior aircraft. I feel that our F-4 aircrews assigned to Southeast Asia were not properly trained to engage MIGS in Route Package Six, and combat is certainly not the place to train. We must prepare our aircrews for worldwide air combat before the war begins. From my experience during Linebacker, I am convinced that proper aircrew preparation requires a complete renovation of all our training programs from UPT to continuation training. . . .[21]

[21]Captain Richard S. Ritchie, "Air Superiority," Letter written to General William W. Momyer, Commander, Tactical Air Command (30 October 1972), p. 1.

CHAPTER IV

CURRENT AIR-TO-AIR TRAINING PROGRAMS AND EXERCISES

> The numbers and types of aircraft are the basic strength of the tactical air forces, but the aircraft are only as effective as the aircrews. The tactical fighter aircrew is the key element in the effectiveness of the tactical air forces. As such, his training must be conducted on a continuing realistic basis in order to maintain the highest degree of operational readiness for the tactical air forces.[1]

Initiatives taken as a result of the lessons learned by the USAF in the Southeast Asian conflict, with added impetus from the Yom Kippur War and the growing Soviet threat have significantly increased the quality of training that our air-to-air crews presently receive. Combat oriented training exercises and programs coupled with recent emphasis on mission specialized aircraft and units are dramatically increasing our readiness posture. General Robert J. Dixon former commander of TAC noted: "Our professional business in Tactical Air Command is readiness - readiness to deploy and readiness to fight."[2] This chapter first defines the threat, then analyzes some of the current training methods to determine if they are accomplishing the vital requirement of maximum readiness through realistic training.

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[1]General G. P. Disoway, "Tactical Airpower: Past, Present, and Future," Air Force Information Policy Letter Supplement for Commanders (Washington: Department of the Air Force, Hq USAF, June 1963), No. 120, p. 11.

[2]DAF, TACM 2-1, Foreward.

The Threat

The current air threat is now assessed in order to put the air superiority training problem facing the United States Air Force in perspective. The Soviet Union supplies numerous countries throughout the world with fighter aircraft and munitions. These countries can also be expected to abide by Soviet doctrine and employ their tactics. Therefore, in the foreseeable future, the USAF can expect to face either the Soviets or Soviet equipped and trained forces in any limited, conventional conflict.

> Since the early 1960's the USSR has traditionally emphasized air defense in its tactical air forces and now has a clear advantage over the U.S. and its allies in this area. But the Soviet Union recently switched to the attack role, resulting in a new generation of dual-capable aircraft and other weapons systems.[3]

Recent Soviet tactical strategy espouses an offensive, simultaneous combined arms effort. This is a change over the previous policy which was primarily defense oriented. In the past, counter-air operations over Soviet ground forces were the major role of their tactical air forces. Today, however, Soviet tactical aviation has emerged as a highly potent offensive threat, possessing the mission and aircraft capable of conducting far ranging operations.

> Soviet doctrine demands that the struggle for air supremacy be conducted on a wide front and a great depth, with all branches of the armed forces contributing to its achievement. Although the Soviet Ground Forces (including operations by airborne troops) and the Navy have particular roles to play in the air supremacy

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[3]"Eastern Bloc Augments Attack Force," Aviation Week & Space Technology, (6 February 1978), p. 57.

> battle, the dominant part is assigned to the Soviet Air Force, in the first instance, Frontal Aviation.[4]

Frontovaya aviatsiya (FA) has seen many fundamental changes during the last decade. FA in addition to its previous role of local air superiority over Soviet ground forces now poses: "a truly major offensive threat to NATO ground forces and their infrastructure throughout the European theater."[5]

Modernization of FA continues at a rapid pace as is evidenced by the following:

> Around 15 percent of Frontal Aviation's inventory is being replaced each year by six types of aircraft: the multipurpose MIG-21 Fishbed J, K, and L; the MIG-23 Flogger B air-combat fighter; the MIG-27 Flogger D, SU-17 Fitter C, and SU-19 Fencer ground-attack aircraft; and the MIG-25 Foxbat B reconnaissance aircraft. About 38 percent of Frontal Aviation's aircraft are models of the MIG-21 used for fighter, ground-attack, and reconnaissance requirements; 36 percent the SU-17, SU-19, MIG-23, MIG-25, and MIG-27; and 26 percent such older types as the MIG-17, SU-7, YAK-27, YAK-28, and IL-28. Frontal Aviation appears to be larger now than it has been since the 1950's; over the next five years it is likely to remain fairly stable at 4,600 airplanes.[6]

The new Soviet aircraft being deployed have increased ranges, more payload capability and improved electronic counter measures equipment, ordnance, avionics and penetration capabilities. "As a consequence, they now have a significant capability -- previously lacking --

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[4]Lynn M. Hansen, "The Resurgence of Soviet Frontal Aviation," Strategic Review, (Fall 1978), p. 76.

[5]Colin Gray, "Soviet Tactical Airpower," Air Force Magazine, March 1977, p. 31.

[6]Robert P. Berman, Soviet Air Power in Transition, (Washington: The Brookings Institution, August 1977), pp. 32-33.

to conduct deep air-superiority . . . missions . . ."[7]

Perhaps the most serious air-to-air threat is the MIG-23 Flogger B. It, along with the latest models of the venerable MIG-21 series, will be the primary Soviet aircraft charged with the aerial combat mission. The Flogger B can carry two AA-8 (Aphid) and two AA-7 (Apex) missiles. The Aphid has a range of approximately 2.2 kilometers and the Apex approximately 8.3 kilometers.[8] Even more significantly, however,

> The Flogger-B is particularly important in the air combat mode because it is the first Soviet aircraft with a demonstrated ability to track and engage targets flying below its own altitude. While it represents a rudimentary system far short of a full capability to detect, track and shoot down attacking aircraft at lower altitudes, it does betoken a continued Soviet commitment to Frontal Aviation's air combat role."[9]

Continuation Training

Historically, aircrew participation in a wartime aerial combat environment has demonstrated that experience/exposure increases not only their effectiveness, but also their chances for survival. With this in mind, it becomes apparent that our peacetime training should duplicate wartime conditions to the maximum extent possible.[10] Several limitations which exist today inhibiting training are: a constrained budget; safety directives; inadequate range facilities; high-

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[7]Harold Brown, Department of Defense Annual Report FY 79, (Washington: U.S. Government Printing Office, 2 February 1978), p. 76.

[8]Hansen, p. 74.

[9]Ibid., p. 76.

[10]DAF, TACM 2-1, p. 10-2.

er headquarters directed missions; pilot retention; and an eroding aircrew experience base. Despite these problems an attempt must be made to develop the full combat potential of our air-to-air fighting force with the resources provided. It is recognized that in order to achieve this objective a time consuming, step by step effort is necessary. An effective air-to-air program requires a "building block" approach starting with Basic Fighter Maneuvers (BFM) and progression to the most demanding "few verses many" tactical scenarios. In addition, continuity and repetition are essential ingredients if an aircrew is to maintain a high degree of proficiency in this complex skill.

Minimum operational unit training standards and programs required to maintain and develop the capability to defeat our projected threat are primarily established in TAC Manual 51-50 Vol I.

Among the general responsibilities set forth in this manual are:

> 1. Commanders at each level will comply with the policies in this manual, insure that safety is not compromised, and monitor the aircrew training to insure timely progression through appropriate training.
>
> 2. Supervisors will identify areas where additional training is needed and direct training accordingly.[11]

The training program set forth in this manual is designed around a Graduated Combat Capability (GCC) concept. This concept is a giant step forward from our previous event dominated program which

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[11]TAC Manual 51-50, Tactical Fighter/Reconnaissance Aircrew Training, (Langley AFB, Virginia: Headquarters, Tactical Air Command, Vol. I, 1 October 1978), p. 1-1. (hereinafter cited as TACM 51-50., Vol. I.).

did not develop the required expertise to accomplish the entire mission. TACM 51-50 identifies the need for the aircrew "to be provided the necessary sorties to train for each assigned level of readiness/mission . . . and that the degree of difficulty and training complexity for each task/mission varies."[12] It further states that in order to reach each of these levels, a set amount of aerial training has to be provided.[13] The manual concedes, however, that because of limited resources units "may not be fully trained to the weapons system's maximum potential. To accomplish full capability, additional resources will be necessary."[14]

The GCC concept gives MAJCOM commanders the means to structure unit training programs to meet wartime commitments within allocated funds. Each fighter squadron is tasked for employment and given those training requirements needed to achieve identified combat capabilities which support the assigned tasking.[15]

Three levels of capability are defined within the GCC concept to prioritize training requirements, and to quantify training accomplishments by the unit.[16] For each given requirement

> . . . a specific number of sorties are required to be flown. The more sorties that are available for a particular unit the more capabilities that unit can possess . . . When tasking the units, the combat capabilities are assigned in order of priority.

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[12]TACM 51-50, Vol. I, p. 1-1.

[13]Ibid.

[14]Ibid., p. 1-2.

[15]Ibid., p. 4-3.

[16]Ibid., p. 1-2.

> This provides an automatic management feature to the system which prevents dilution of higher priority training. Thus, as sorties are reduced for whatever reason, the unit drops from its training program the capability it can no longer support (the least priority).[17]

Each unit is required to develop and update innovative mission scenarios for training purposes which correspond to their assigned tasks.[18] In addition: "Tactical Training should emphasize the employment of basic skills in realistic training scenarios/profiles developed . . ."[19]

To further stress the importance placed on training in a realistic environment TACM 51-50 Vol. I. states

> . . . as a goal, aircrews should be scheduled to participate in Red Flag training each six month training cycle. When Red Flag participation is not possible Composite Force Training should be scheduled using facilities available to the unit. Emphasis will be placed on aircrews performing their wartime tasks . . . taking the threat and scenarios into account.[20]

As outlined, this new approach recognizes the requirement to develop combat skills through realistic unit training programs. The measure of effectiveness, however, lies in the individual unit's implementation of this directive. Are the squadrons capitalizing on this new approach to insure that maximum utility and realism are gained from each training sortie? As a measure

. . . realistic training must provide a suitable environment

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[17]David L. Carleton, "Assuring Combat Pilot Effectiveness" (unpublished report to the 1978 Air Warfare Symposium, Air University, Maxwell AFB, Alabama, February 1978), pp. 11-12.

[18]TACM 51-50, Vol. I, p. 6-1.

[19]Ibid., pp. 6-12.

[20]Ibid., p. 6-25.

> for a participant who is mentally prepared to accept events as both training and combat. If the emotional, the human element, of actual combat is allowed to enter the training arena, then the training accomplished will more effectively prepare the participant for combat.[21]

With these facts in mind, it would appear that individual unit commanders, supervisors and instructor pilots are, within assets available, charged with the responsibility to devise methods to optimize the amount of realistic training and combat capability that our aircrews receive on each training sortie.

> . . . Sorties are prescribed for each GCC level by MAJCOM training personnel who decide how many sorties are required to achieve a given level of combat capability. Herein lies the dilemma. Allocating sorties to produce some desired or usable level of combat capability presumes that operational units employ some known process to achieve this capability. This means that units must possess personnel with knowledge of the tactics and techniques required to achieve combat capability; that these people are being employed to that end; and that each sortie within an allocated block contributes progressively to the ultimate goal. Expanding this point further, a complete training program must contain both the tools and methods of training to fulfill the expectations of combat capability. The erosion of sorties and experience in operational units has limited the potential for units and individuals to train themselves to any predictable end.[22]

The author has had the privilege of observing many TAC fighter squadron operations in recent years through experience gained as an Aggressor pilot and adversary participant in Red Flag exercises.

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[21]Leif R. Dunn, "Can Air Combat Training Be Realistic" (Speech before 1978 Air University Airpower Symposium, Air War College, 13-15 February 1978), p. 4.

[22]John P. Jumper, "Tactics, Training and Evaluation: Toward Combat Capability" (Report No. 1210-78, Air Command and Staff College, May 1978), pp. 31-32.

Based on these experiences it is felt that current continuation training methods require yet further modification to produce a more highly competent air-to-air pilot. Some training related observations follow.

1. Some unit supervisors are unwilling to depart from long established procedures and allow tactics experimentation and development. Therefore many units become regimented and inflexible in their daily operations which reduces the potential for maximum realism and increased proficiency.

2. A need exists to train and retain highly competent air combat tactics instructors at squadron level. In many instances individuals were sent from the squadron to the Fighter Weapons School at Nellis, but on return were assigned at wing level instead of being returned to their squadron.

3. "One versus many" and "few versus many" scenarios are not practiced to any significant extent.

4. Unprogrammed, "wild card", aircraft are not allowed to enter the aerial engagement arena on training sorties to simulate additional enemy aircraft entering the fight.

5. Kill removal procedures are very rarely established or exercised effectively during tactical scenarios to simulate force attrition.

6. A close working relationship does not exist between the air crews and the GCI controllers, often due to no personal contact. None of the units observed are organized with an integrated GCI

flight. Flight briefings and debriefings of GCI, if they occurred, often took place over the telephone.

7. Those units with access to Air Combat Maneuvering Instrumentation (ACMI) range facilities did not fully exploit the capabilities of the system. Although at times, the fault, was either system or aircraft simulation related deficiencies, at other times it was simply lack of unit ingenuity and initiative that degraded full exploitation.

Although not inclusive, and in some cases beyond the control of the units involved, these examples are representative of deficient areas noted. Unless these areas have been corrected recently it would appear that our aircrews are not receiving the quality continuation training which allows them to fully capitalize on the unique capabilities of current weapons systems. Therefore the goal of "training like we plan to fight" has not yet been achieved.

Aggressors

Tactical Air Command formed the first Aggressor squadron in October 1972 at Nellis AFB, Nevada. This unit was equipped with the standard, white T-38 aircraft. Since that time an additional aggressor squadron has been added to Nellis, as well as one located in Europe at Alconbury, England and another in the Pacific at Clark Air Base in the Philippines. All the aggressor squadrons are now equipped with camouflaged F-5E aircraft which closely simulate the Russian built MIG-21 in size and performance. The function of the

Aggressors is to provide our tactical fighter force an "enemy" to engage in dissimilar air combat training (DACT). In addition, the Aggressor personnel provide academic packages of instruction covering various aspects of the enemy, including his training, tactics, formations and equipment.

The Aggressor squadrons were initiated as a result of USAF's less than satisfactory performance in air-to-air combat against the MIGs in North Vietnam. In that conflict our pilots had been poorly trained for the type of air-to-air combat that was encountered. Lieutenant Colonel Jerry Nabors aptly described the situation:

> The most common problem found could be summed up in the words '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. Yet most of the maneuvers and tactics employed in attacking or defending in aerial engagements depend upon performance characteristics of your aircraft versus your adversary's aircraft, correct estimation of his range, and knowledge of his tactics. It was determined that similar aircraft training - for example - F-4 versus F-4 - was unsatisfactory when engaging better turning MIG aircraft. Visual lookout procedures and training were adequate to acquire an aircraft of similar size to yours, but grossly inadequate to detect the smaller MIGs. As a result, many kills were obtained by the enemy totally undetected until it was too late to react.
>
> Even when detected, 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. Also, enemy tactics had never been flown in training scenarios. An urgent need existed for an air-to-air training program using aircraft with comparable characteristics of the potential enemy aircraft and flown by pilots who had extensively studied the enemy fighter pilot and were skilled in his tactics and fighting philosophy.[23]

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[23] U.S. Congress, Committee on Armed Services, Subcommittee on Tactical Air Power, TAC Air Programs for Fiscal Year 1976 (11 March 1975), pp. 2-3.

In addition to providing DACT and academics to TAC operational and training units, the Aggressors provide adversary support for the fighter weapons instructor courses at Nellis, participate as enemy air threats during Red Flag and similar exercises as well as participate in unit Operational Readiness Inspections (ORIs) and other directed tests and evaluations.

The normal routine when visiting an operational unit is for a detachment of aggressor pilots, their GCI controllers and related support package to deploy to the unit for one or two weeks. Fighter Weapons School (FWS) instructors from Nellis who fly the same type of aircraft as the visited unit normally accompany the Aggressors to provide expertise in U.S. tactics through ground and airborne instruction. The types of missions and scenarios vary based upon the unit's mission, desires, imagination and capabilities. Some units start with the basic 1V1 offensive and defensive "set piece" attacks and then build to the more demanding and complicated tactical scenarios where the aggressors fly known formations and tactics in free play engagements.

Strict rules of engagement (ROE) are prebriefed and followed during all engagements. For instance, 5,000 feet above ground level when flying over land and 10,000 feet when over water are the minimum altitude restrictions. Another example is that a minimum separation distance of 1,000 feet must be maintained between engaged aircraft. Both of these restrictions, as well as all of the ROE, are imposed for safety of flight reasons and in some cases restrict the pilot

since he would not be so constrained in actual combat.

One of the most important learning tools of these engagements is the extensive flight debriefing. Tape recordings of the radio commentary as well as verbal comments made by the Aggressor pilots during the actual engagements in conjunction with gun camera film from all aircraft are reviewed to determine and reinforce lessons learned.

Without a doubt, the addition of the Aggressor program to TAC has added immeasureably to the realism in our air-to-air training and significantly contributes to the overall combat readiness and effectiveness of our tactical air forces. Two major deficiencies, however, standout which detract from this overall effectiveness. The first is an operational unit's lack of preparedness to fully benefit from the spectrum of scenarios offered by the Aggressors. This is primarily due to the lack of prior effective local training which fails to produce the necessary capability to successfully utilize the much in demand Aggressor assets.

The second deficiency concerns the inability of the F-5E to adequately simulate the performance capabilities of the Soviet MIG-23 Flogger. This simulation often takes place however, "even though this Soviet fighter has a larger radar cross section and a greater performance advantage."[24] Without an effective simulator for the more advanced MIG aircraft, our aircrews are led into a false sense of

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[24]"Aggressor Units Hone TAC Pilot Tactics," Aviation Week & Space Technology, 6 February 1978, p. 153.

security and practice tactics and maneuvers against the F-5Es which would probably not be effective against higher performing MIG aircraft. More aptly stated: "By training against the most accurate possible representation of an adversary, the most valuable training is accomplished."[25]

Red Flag

To test the validity of previous training, our tactical air crews are exposed to advanced combat scenarios in the continuous Red Flag exercise series. Red Flag was initiated in November 1975 in response to a requirement to give our aircrews "peacetime" combat experience. This experience will hopefully increase their survival beyond the first ten critical sorties flown during wartime. As of August 1978 less than twenty-five percent of the aircrews in TAC had combat time.[26]

Tactical fighter units[27] and support elements deploy to Nellis Air Force Base, Nevada where the exercises are conducted on the large tactical range complex located North of Nellis. Blue Force pilots face both a simulated Soviet integrated air defense ground threat and an airborne threat, the aggressor pilots. Various force mixes and sizes consisting of SAM/AAA suppression, electronic war-

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[25]Dunn, p. 4.

[26]John Joss, "Red Flag" Realism on the Range," Air Force Magazine, August 1978, p. 40.

[27]All of the major air commands, sister services and some allied air forces have previously and continue to participate in Red Flag.

fare, ground attack, communications jamming, and air superiority aircraft are used in an attempt to defeat the threat and strike targets.

Flight crews are encouraged to not only use established tactics, but to develop and employ new tactics. The entire exercise is monitored by a White Force that collects and analyzes data. This data is presented at the daily mass mission debriefing, that is attended by both the Blue and Red Forces which further adds to the lessons learned.

Overall, Red Flag presents an excellent opportunity for realistic training, however, certain areas require improvement to more closely simulate real world situations and derive maximum benefits. Considering the present Soviet offensive philosophy and numerical advantage plus our national policy of allowing the enemy the initiative, the scenarios at Red Flag appear to be programmed for the wrong kind of war. Most scenarios center around an offensive composite strike force penetrating deep into enemy territory rather than a primarily defensive counter-air effort against wave attacks as might be anticipated in Europe or elsewhere. This is not to say that the Blue Forces should not practice offensive operations, because that would be a fatal mistake, but that a larger percentage of the scenarios should be defensively oriented. In addition, very rarely does the Aggressor threat outnumber the Blue Forces. The GCI facilities and control do not realistically simulate that which could be expected in a real conflict, especially as employed by the Soviets or Soviet trained forces. This deficiency is not a GCI controller problem

(most are highly qualified, especially the Aggressor controllers) but primarily the poor location of the GCI sites and aging equipment.

Safety during Red Flag is stressed to the utmost because of the size and complexity of the exercise. Red Flag rules of engagement are more realistic than for normal DACT, however, altitude block requirements exist for the Aggressors and effective and realistic kill removal procedures are not included as part of the ROE. It is recognized that elimination of altitude blocks and incorporation of permanent kill removal would invite a certain amount of risk and perhaps some degradation in training time for those attrited. Nonetheless, Red Flag is designed to be the "graduate" school for tactics training, development, and evaluation and therefore should simulate actual combat to the maximum. With proper previous training an aircrew should intimately know his personal limitations and capabilities as well as that of his aircraft. More aptly stated: "Safety will logically follow from skill and situational awareness - not from artificial restrictions."[28]

Without a firm basic skill developed through unit continuation training programs aircrews are very likely to be overtaxed in the Red Flag environment; therefore, any chance to exploit the opportunities offered by the advanced Red Flag scenarios to develop a true combat capability are probably wasted.

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[28]Captain Clyde B. Phillips, "The Bottom Line," USAF Fighter Weapons Review (Winter 1977), p. 21.

Red Flag is basically a good weather operation over desert terrain. This type of fighting environment may be applicable for anticipated fighter force employment in certain trouble spots, but does not resemble those predominate weather conditions and terrain features which exist in the NATO scenario.[29]

Red Flag does provide the most realistic training environment to date, and the potential does exist for units to develop a highly polished combat capability assuming they are properly trained and have done their "homework" prior to arrival at Nellis. Since most operational TAC units average only one Red Flag visit per year,[30] the "bottom line" must be concerned with answers to the following questions: Are the lessons from Red Flag participation incorporated into and expanded upon to the maximum extent possible in unit continuation training programs? Are multi-bogey engagements and communications jamming practiced in a simulated ground threat environment and is kill removal practiced by mission ready crews? If the answers to these questions are not yes, they should be. We must maintain a constant state of readiness for "if a fight comes, we will go with what we have and worry about tomorrow later.[31]

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[29]General T. R. Milton, USAF (Ret.), "Reflections From A Red Flag," Air Force Magazine, Vol. 62, (January 1979), p. 54.

[30]"Red Flag Stresses Realism in Training," Aviation Week & Space Technology, 6 February 1978, p. 186.

[31]Milton, p. 55.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Air superiority is the primary mission of the United States Air Force, but our participation in previous conflicts (at least initially) has demonstrated a definite weakness and a lack of preparedness in this vital mission. Fortunately, sufficient time has been available to rebuild and retrain our air-to-air forces to a credible level in each of these instances. In many cases the pilots were required to learn their "trade" in the combat zone. The aircrew's skill in aerial combat tactics remains the key to success, especially in light of today's sophisticated aircraft and weapons.

The United States involvement in the air battle over Korea demonstrated a need to have aircraft and pilots capable of fighting for, winning and maintaining air superiority. However, this need was not recognized nor prepared for adequately until after the war had commenced. By the end of the war a highly trained and efficient fighter force had evolved.

The years between the end of the Korean War and the beginning of the Vietnam War saw a decline in the combat capability of our tactical fighter forces. This decline and lack of preparedness of aerial combat forces can be primarily attributed to the fact that most of

the emphasis was placed on our nuclear forces and air-to-ground delivery capability. An additional contributing factor was the reliance on multiple role fighters and aircrews training for diverse missions.

Because of the above mentioned factors, our pilots were ill prepared to engage in air-to-air combat when the United States Air Force became involved in the air war over North Vietnam. Increased emphasis on tactics and training was required while the war was in progress to build the proficiency of our aircrews to compensate for pre-war deficiencies. The relatively poor showing in the aerial arena over North Vietnam can in part be attributed to the lack of organization and training in the air superiority role.

These facts coupled with the lessons learned from the 1967 and 1973 Mid-East Wars spurred increased concern and need for more emphasis on realistic air-to-air combat training and readiness to gain and maintain air superiority over a well-equipped, well trained and numerically superior enemy. Two significant examples of the outgrowth of this increase on realism and readiness are, formation of Aggressor Squadrons for dissimilar air combat tactics training and the Red Flag exercises for exposure to multiple simulated threats.

The enemy we will most likely face has recently designed and produced large numbers of tactical fighters and is closing the gap on our qualitative advantage in that area. This numerical superiority coupled with a renewed offensive tactical doctrine poses a tremendous threat to our air superiority forces should they be called to battle the enemy in the aerial domain anywhere in the world.

Today's training programs are a quantum step forward from pre-1972 days. The formation and utilization of the Aggressor Squadrons for Dissimilar Air Combat Tactics (DACT) has added a new dimension to our training by having a highly trained and realistic "threat" to engage. The Red Flag exercises provide exposure to simulated combat conditions to hopefully enhance the survivability of our aircrews in any future conflict. However, training at the unit level has not kept pace with some of the other more recent initiatives. There is a requirement at unit level for additional emphasis and improvement in tactics development and realistic training scenarios.

Recommendations

This thesis has dealt with the air-to-air training conducted in the United States Air Force. It is a proven fact that much progress has been made in correcting for previous unpreparedness. Yet, more could and should be accomplished at the operational unit level, especially to increase the combat capability of today's air superiority forces. Generally, the level of training conducted at certain fighter units does not sufficiently challenge the crews beyond the requirement to prepare for the most immediate threat - annual check rides and unit inspections. By placing more emphasis on daily preparedness through more realistic and innovative training methods/sorties we can alleviate this apparent chronic condition evidenced in some fighter units in the USAF. It is recommended that squadron commanders, operations officers, flight commanders, and instructor pilots

allow more latitude and demonstrate more enterprise in daily flight operations in order to permit realistic training and tactics experimentation and development. In this way the USAF will be better prepared and able to cope with the growing threat and have a proficient and professional air-to-air fighting force, "ready to fight and win."

Beyond this overriding general recommendation, I believe that the following more specific recommendations deserve consideration.

1. Select, train and retain a highly competent air combat instructor cadre at squadron level to increase emphasis on realistic operations within present limited flying hours, the eroding experience base and the requirement to employ sophisticated weapons systems.

2. Conduct more "few versus many" and "one versus many" scenarios involving numerous types of aircraft.

3. Allow more wild card aircraft to enter into tactical training missions.

4. Incorporate realistic and effective kill removal procedures into Red Flag and all other advanced tactical training scenarios.

5. Integrate Ground Controlled Intercept (GCI) flights immediately into those squadrons with primary air-to-air missions.

6. Expand, update and exploit the Air Combat Maneuvering Instrumentation (ACMI) range facilities to the maximum.

7. Eliminate face to face flight briefings between flights engaging in advanced aerial combat tactics training, when possible,

to enhance realism.

8. Provide Aggressor squadrons with a new aircraft which more closely simulates the size and performance characteristics of the Flogger and possibly other newer generation fighters.

9. Revise Red Flag scenarios to more closely reflect anticipated "real world" situations.

10. Improve GCI location and facilities for the Aggressor forces participating in the Red Flag exercises to reflect the capacity and capability of the expected threat.

11. Relax Rules of Engagement (ROE) for DACT. In particular, the minimum altitude needs to be lowered, and altitude blocks should be eliminated to permit full use of aircraft performance characteristics, anticipated employment zones, as well as for tactics experimentation, development and validation.

12. Identify more over-land, air-to-air ranges closer to units with an air-to-air role. These ranges must be of sufficient size to allow expanded scenarios and supersonic flight.

APPENDIX A

FEAF Report on the Korean War--Vol. II
(Copy, pages 2-30)

C O P Y

REPORT ON THE KOREAN WAR -- Pages 2 - 30

THE FIGHT FOR AIR SUPERIORITY . . .

THE UNC GAINED AIR SUPERIORITY IN THE FIRST MONTH OF THE WAR AGAINST THE SMALL AND OBSOLETE NORTH KOREAN AIR FORCE. THIS CONTROL WAS MAINTAINED FOR THE NEXT THREE YEARS DESPITE THE ENTRY OF RED CHINA'S MODERN JET FIGHTERS.....

On 1 November, 1950 Russian-built jet fighters made their initial appearance in the Korean Air War by attacking four F-51's over Namsidong. Eight days later, one of these swept-wing jet fighters was destroyed by an RB-29 tail gunner. Thus, the Communist Air Forces, flying MIG-15's from Manchurian bases entered the Korean conflict to challenge U.N.C. air superiority.

To counter the MIG-15 threat, the 4th Fighter Interceptor Wing was deployed to Korea in November and began combat operations the following month. In December 1951, the day interceptor arm of Fifth Air Force was doubled when the 51st Fighter-Interceptor Wing converted to F-86E's. In the spring of 1953, the F-86 force was again doubled when two fighter-bomber wings were converted to F-86F's. Normally, Fifth Air Force's mission would have included the destruction of enemy aircraft both in the air and on the ground, however, political considerations prevented our attacking the MIG's on the ground at their Manchurian airbases, and thus counter-air efforts were devoted for the most part to air-to-air fighting. Only on the rare occasion when the Communist Air Forces risked a few of their planes on Korean bases were we able to destroy aircraft on the ground.

Enemy propeller-driven fighters were rarely seen after the first two months of the war. Engagements with these enemy aircraft were recorded by virtually all types of U.N. aircraft, in addition to the F-86's; however, they were never encountered in significant numbers, and from the U.N. standpoint, such engagements were incidental to the missions of the units concerned. Except for historical value, there is little of tactical significance in these engagements. This article, therefore, is devoted primarily to the major part of the air-to-air war in Korea involving the F-86 and MIG-15. In the following paragraphs and subsections, the many factors involved in that struggle will be discussed in an attempt to determine the lessons resulting from the first jet air war.

Much of the jet experience gained in Korea should prove useful to fighter organizations throughout the world; however, to fully understand the problems and solutions, the reader must

first understand the geographical and political position in which we found ourselves. The entire air war in Korea was characterized and influenced by several conditions which rendered this conflict unique and unprecedented in the annals of military history.

The United Nations Command established an artificial "foul" line three miles South of the Yalu River, and our aircraft were not permitted to pursue the enemy into Manchuria. Enemy aircraft were able to take-off, form, climb, and maneuver unmolested, prior to entering the battle area. Whenever the enemy chose, he was able to withdraw under the same conditions. Also, however, in refraining from operating over U.N. territory or even in his own forward areas, he granted us a similar, though more remote "sanctuary".

With few exceptions, the north-western quarter of the Korean Peninsula was the scene of the F-86 and MIG-15 operations. The enemy operated from three main bases established close to the battle area: Antung; Ta-Tung-Kou; Ta-Ku-Shan; and later, from two additional fields at Fen-Chen and Juan-Tien. Each of these fields was capable of supporting continued operations by up to three hundred fighter aircraft. Situated as they were, just north of the Yalu River, lying well within sight of many air battles, these bases presented the enemy with the advantage of fighting close enough to home to eliminate serious fuel problems, and also offered a nearby refuge for aircraft damaged or in mechanical difficulty.

There was some indication that the airfields in the Mukden area were used as backup facilities for the Antung complex. The rapidly fluctuating strength of aircraft sighted on the five fields mentioned tended to support the theory that units continually staged-in from distant points.

As a matter of interest, it should be noted that the limited combat zone where the F-86 - MIG-15 encounters took place extended out into the Korean Bay only a short distance. Prior to January 1953, the enemy generally avoided flight over the Yellow Sea. His sudden departure from that practice subsequent to that date is worthy of attention. In the period 1 February, 1953 to 25 March, 1953, tracks on 64 enemy flights, conducted over water, were recorded by U.N.C. radars. This activity centered in the area west of Pyongyang, and extended out to sea approximately 60 miles. These sorties, started at an earlier date, or in greater strength would have necessitated a review and possibly a revision of our combat procedures and tactics. However, throughout most of the war the over-water

area seemed to be exclusively used by friendly forces and offered U.N. pilots another "sanctuary" of their own. Disabled aircraft, or those very low on fuel, could be reasonably certain that they would not be pursued any appreciable distance out to sea.

The section of Korea held by United Nations Forces lay generally south of the 38th parallel, while the aerial battlefield was located 140 miles to the north. This geographical advantage allowed the enemy effective radar coverage of the entire combat area, and at the same time made radar coverage by friendly forces difficult. This disadvantage was only in part overcome by the establishment and operation of a U.N. radar station on the island of Cho-Do in the Yellow Sea. It was obvious throughout the war that enemy forces had adequate radar information concerning air activity over North Korea.

MIG-15 operations during the war fall into approximately five distinct phases, each apparently resulting from a change in enemy tactical concept.

The first ten months of the air war seemed a phase of acquiring aircraft and operational experience. From September 1951 through April 1952, the enemy sent large numbers of aircraft over North Korea. The nature of the enemy tactics indicated that this phase was a period of mass training and familiarization. From April to September 1952, activity was reduced. It appeared that the enemy, for the time being, was making a token effort, while the majority of Communist fighters were carrying out their training over Manchuria rather than over Korea. In the remaining months of 1952, and in 1953, there was a noticeable increase in the aggressiveness of the MIG pilots (to the delight of the F-86 units), and kills by friendly aircraft in a single month rose to a record high of 75 in June 1953.

During the first ten months (November 1950 to August 1951), MIG sightings were confined largely to the Yalu River section. Red jets were seldom seen more than a few miles south of their Manchurian sanctuary. As USAF pilots approached the Yalu patrol area, they often observed dust clouds raised by MIG's taking off from Antung airfield just across the river. After climbing rapidly to altitude (in most cases a height greater than that of USAF aircraft), the enemy jets swept across the border in flights of four, and broke into elements of two for the attack. One pass seemed to satisfy them after which they immediately raced back to their Manchurian bases. These hit-and-run passes characterized initial enemy air-to-air tactics.

By April 1951, increasing numbers of MIG's were being encountered over the Sonchon-Taechon area, and were occasionally engaged as far south as Sinanju. Employing a more refined version of the tactics first displayed over Korea, MIG pilots used the sun to hide their initial attack, and relied on the exceptional climbing ability of their aircraft to evade back into the sun.

Increased Red pilot aggressiveness was evidenced by MIG-15 attacks on the B-29's. On the morning of 12 April 1951, the enemy launched his most determined and largest counter-air effort. Approximately 105 MIG's attached 46 B-29's, escorted by 56 F-86's and 54 F-84's, in the vicinity of Sinuiju. These MIG pilots appeared more experienced and determined, as they pressed attacks against the Superforts through their own flak and in spite of heavy losses. Friendly pilots claimed 14 MIG's destroyed, 10 probably destroyed, and 20 damaged. Two B-29's were lost.

In spite of sporadic indications of improvement, overall enemy pilot proficiency seemed greatly inferior to the MIG performance characteristics and capabilities. The enemy pilot and aircraft combination was a poor match for USAF pilots flying F-86's. The MIG-15 pilot was far less reluctant to oppose F-80, F-84, and B-29 aircraft, over which he had a definite performance advantage.

PHASE TWO

During the next eight months (September 1951 through April 1952), a different type of aerial war developed in the Korean skies. Enemy air activity was characterized by mass training over North Korea, with poor pilot performance and poor gunnery. Operations were generally concentrated over the triangle formed by Antung, Anju, and Wonsan, although small numbers of MIG's were occasionally observed and engaged in the Pyongyang area. Mass sorties were frequently mounted by the Communists over the eight-month period, with as many as 366 MIG's observed on a single day, and 180 at one time. December 1951, with a total of 3997 observed MIG sorties, was the high month of the war. However, in spite of the high number of sorties, the number of enemy aircraft actually engaged decreased steadily as the weeks passed.

This phase of operations saw the introduction of MIG pincer and envelopment tactics. A force of 60 to 80 MIG's would cross from Manchuria over the Suiho Reservoir and fly southeast, and at the same time, a similar MIG force would proceed from Manchuria down the west coast of Korea, sending out scouting flights to the Chinnampo and Cho-Do Island areas.

Crossing the Yalu River at approximately 35,000 feet, these forces converged over Pyongyang before sweeping northward over the main supply routes in search of U.N. fighter-bombers or homeward-bound F-86's. An additional force of MIG's usually came straight down the jaws of the pincers as far south as Sinanju.

From December 1951 through the first two weeks of February 1952, the MIG forces employed routine tactics in their fighter sweeps. They climbed, formed and built up speed prior to crossing into North Korea from Manchuria. They proceeded south and made a wide, sweeping 180 degree turn to the right, ending up at the mouth of the Chong Chon River. A total force of from 100 to 200 MIG-15's was usually split into three sections, and the altitudes and times of entry into the area by these three sections varied. One section would fly just below the contrail level, the second in the contrails, and the third above the contrails - sometimes as high as 55,000 feet.

That this eight months was chiefly intended to give training and familiarization to enemy pilots was indicated by the masses of jets that flew high over North Korea with no apparent intent to engage. Perhaps the Communists believed something could be gained by having their new pilots observe tbe application of classroom theory, even while flying at relatively high altitudes. Sabrejets continued their attempts to join contact with a generally reluctant enemy, but engagements did not keep pace with the enemy sortie rate.

In spite of a reluctance to engage, enemy's losses continued to exceed those of the U.N.C. indicating that his selection of this "training area" was both tactically and economically unsound. In April 1952, 44 MIG's were destroyed and more than 50 damaged. Shortly afterward, the Communists withdrew their fledglings for the safer skies over Manchuria.

PHASE THREE

After this period of mass aerial training, there followed five months (May to August 1952), of greatly reduced enemy sortie totals. Enemy air operations were concentrated over northwest Korea very near the Yalu River. Engagements, if measured by aggressiveness, indicated more proficient Red pilots. Despite these indications, however, the Communist pilot-plane combination remained greatly inferior to its USAF counterpart.

Of interest on 23 June 1952, was the lack of MIG opposition to air strikes on the Suiho hydro-electric plant, despite the

total of 250 jet aircraft observed on the Antung complex immediately prior to the attack. At the time the attack was concluded, visual reconnaissance reported that the jet count on the two airfields had fallen to 90. One hundred and sixty MIG's had taken off and disappeared. These aircraft had either withdrawn in fear of an attack on the Antung complex, or their leaders were reluctant to engage the more than 100 F-86's escorting the fighter-bombers.

PHASE FOUR

The Communists again changed their operational concept in August and September 1952; this was the fourth phase of the air superiority war in Korea. The lull in enemy sorties ended during the first week of August when the total number of observed MIG's climbed to 673 during six days of action -- the highest figure for any one week since April 1952. Engagements and U.N. claims paced the rise in sorties. Friendly fighters claimed 37 MIG's destroyed or damaged. Then, for several days there was an almost complete cessation of enemy activity, and at no time during the remainder of August did the number of MIG's observed on a single day total more than 97. September proved to be the most lucrative month of the war to that date, when 64 MIG's were destroyed, 8 probably destroyed, and 61 damaged. It is possible that the enemy, heartened by a drop in his loss rates for the preceding three months, had initiated a moderate effort to defeat the F-86's by attrition. But if such was his idea, the results must have been disappointing.

PHASE FIVE

Heavy MIG losses in September evidently made the enemy realize his training had not progressed sufficiently to cause significant attrition of the F-86's. The Communist pilots returned to sporadic engagements of the F-86's through the winter and spring of 1952-1953, displaying a wide variation in aggressiveness and ability. At various times, all of the previously developed tactics were used by MIG pilots to position themselves for combat. More often, however, the enemy pilots sought every means of escape - cloud cover, violent maneuvers, and protection in the area north of the Yalu. MIG pilots frequently appeared to panic at the approach of F-86's and broke into their usual evasive tactics.

The over-all engagements indicated that a majority of the MIG fliers were inexperienced, lending credence to the possibility that new pilots were undergoing training.

In May and June 1953, the MIG sortie rate (based on sightings of enemy aircraft) was much lower than the peak of December 1951-January 1952, although the enemy pilots were considerably more aggressive. The percentage of MIG's engaged versus those sighted remained at approximately 40 percent, but the percentage of engaged MIG's destroyed jumped from approximately 5 to 15 percent. In May 1953, 56 MIG's were destroyed, 4 more were probably destroyed, and 27 were damaged. In June, 75 MIG's were destroyed, 11 were probably destroyed, and 41 were damaged. No F-86's were lost to enemy action during this month.

Thirty-two months of jet warfare over North Korea failed to produce a MIG aircraft-pilot combination of a high standard. While in general, the flight characteristics of the MIG were considered comparable to those of the F-86, the Red pilots rarely demonstrated the ability to exploit the aircraft's capabilities. In certain engagements, enemy pilots demonstrated a high state of tactical proficiency and an ability to maneuver with the best of the F-86 pilots. However, despite a willingness to alter their operational concept when the need arose, the Communists did not produce an effective counter-measure to the USAF F-86-pilot team. It should be noted, however, that the battle with the F-86 did not represent a true test of the designed function of the MIG-15 since this aircraft was intended for use as an interceptor of bomber aircraft, and specifically as a counter to the B-36, B-50, and B-29 USAF types. In this role the MIG armament system should function far better. The results of the limited number of medium-bomber-MIG-15 engagements seems to bear out this conclusion.

The advantages enjoyed by the enemy, especially the superb radar coverage and numerical superiority, made it difficult to place our aircraft in an advantageous striking position. Tactics and procedures (described in a later section) were developed to enable the F-86 pilots to attain positive advantage over the enemy. The fact that these tactics were at least partially successful is indicated by the number of enemy aircraft destroyed. At the time the cease-fire was signed, the score read: 792 MIG's destroyed; 79 F-86's lost, of which only 58 were destroyed by enemy air action.

THE AIRCRAFT

In the initial phases of the air-to-air war, factual information on the performance of the MIG-15 was extremely meager.

That data, essential in the development of tactics, was eventually accumulated over a period of time from the experience of pilots who flew against the MIG-15. The following paragraphs regarding the relative performance of the two aircraft are based on the observations and opinions of these pilots.

The MIG-15 consistently outclimbed the F-86 at all altitudes, with this characteristic becoming more apparent at the higher altitudes. The ability of the MIG-15 to outclimb the F-86 was particularly obvious at altitudes between 30,000 and 40,000 feet. In most instances, when climbing away from an F-86 that was 2000 feet or more behind, the MIG-15 would pull up to a high angle and continue to climb. As the F-86 stalled, the MIG would still be climbing. Pilots encountered the MIG-15 at 40,000 feet, and watched it do a climbing turn that almost amounted to a "chandelle", while the F-86 pilot, in attempting to match the rate of turn, had to nose down to keep from stalling.

As a general rule, the MIG-15 had a greater rate of initial acceleration than an F-86 in a dive; however, the F-86 had a higher terminal velocity at all altitudes, and consequently the advantage in a sustained steep dive. On the other hand, the greater acceleration of the MIG gave it initial advantage in a dive, and Communist tactics generally were to roll over steeply, accelerate away from the F-86 for a few thousand feet, and then either shallow the dive to level flight were speeds were almost equal, or initiate a steep pull-out and climb. In acceleration, the MIG-15 out-classed the F-86 at all altitudes because of its more favorable power to weight ratio.

The ability of the MIG-15 to convert speed into a high angle "zoom" was outstanding. For example, after chasing a MIG-15 for about five minutes in straight and level flight with full power at 12,000 feet altitude, the lead F-86 in a flight of four got good "strikes" along the right wing and fuselage of the MIG-15. The MIG-15 pulled up to a 60 degree climb angle and continued at least 6000 feet above the point where the F-86 had to level off to keep from stalling. The MIG then leveled slightly and continued climbing across the Yalu River.

Although this is difficult to understand, many MIG-15 pilots opened speed brakes while under attack by F-86's. If the closing speed was not too high, or the range too

close when this occurred, the F-86 pilot could open his speed brakes and remain behind the MIG-15. However, there were occasions when F-86's overshot, even though the speed brake switch was operated immediately upon seeing the speed brakes open on the MIG-15. In most of these cases, by reducing power, the F-86 was able to stay behind the MIG-15 by "S-ing" behind it. The F-86 speed brakes were generally more effective than those of the MIG-15, but they opened more slowly than the MIG's at high speed.

Rate of roll of the F-86 and the MIG-15 appeared equal. No F-86 pilot ever had any trouble in rolling into any kind of maneuvering that a MIG-15 initiated at any speed above stalling.

The F-86 appeared to enjoy a very slight speed advantage at all altitudes. This was more noticeable below 20,000 feet. The better acceleration characteristics of the MIG-15 over the F-86, caused many pilots to form contrary opinions, but the evidence seems clear that the F-86 is the faster aircraft.

The F-86 had a slight advantage in very high speed turning duels, due, no doubt, to its hydraulic control system. At slower speeds, the lower wing loading of the MIG-15 allowed it to turn inside the F-86 with comparative ease. This light wing loading and favorable weight-power ratio, was also responsible for the 5000 foot higher ceiling of the MIG-15 over the F-86.

The MIG armament system consisted of 23 and 37 mm cannon combined with a K-14 type gunsight. This system was effective against bomber targets, but was not suitable for combat against the F-86 (see section on Medium Bombers). The cannon shells had a high terminal effectiveness, but a low rate of fire and slow muzzle velocity decreased hit probability. The gunsight was not flexible enough to compute lead angles against a rapidly maneuvering target.

In the F-86, with one notable exception, six .50 caliber M-3 machine guns were the standard armament configuration throughout the war. That exception was the Gun-Val test, F-86's conducted in 1953, utilizing four 20 mm T-160 cannons in lieu of the standard installation (see section on Combat Testing). The complete report on this test is contained in APGC Final Report, Project No. APG/ADA/43-F-1.

Early F-86's used the Mark 18 gyro gun sight, which is similar in function to the K-14. This sight was replaced

by the A-1CM Gun-Bomb-Rocket Sight, and later by the A-4 sight, an improved version of the A-1CM. The value of the A-1C sight was the subject of controversy throughout the war. Its early lack of reliability, and lack of a positive method of checking accuracy while airborne, caused many pilots to mistrust the system entirely. Effectiveness was hampered by a low incommission rate, which was aggravated by a shortage of qualified maintenance personnel and inadequate supply support.

THE PILOTS

Until the last six months of the war, MIG activity, ability, and aggressiveness appeared to run in cycles which led many FEAF officers to believe that entire units were being rotated through a training program in "MIG Alley". Beginning in 1953, a new trend in aggressiveness indicated that the enemy had stabilized his forces, and was beginning to spread experience throughout his units. Our pilots believed that the Communists lacked average pilots. They seemed to be either experts or novices, with the great majority falling in the novice class. The good ones were very good, using team work, aggressiveness, and pilot ability to the maximum. The majority of MIG pilots, however, did not appear to utilize mutual support and team work to advantage, and lacked the aggressiveness and ability to get the most out of their aircraft.

USAF, as well as the Communists, gained a tremendous amount of valuable training from the Korean Air War. Pilot strength in the initial phase of the war, was drawn for the most part from the large pool of Regular, National Guard, and Reserve fighter pilots with World War II experience. As the training program in the ZI expanded to keep pace with the war, this original force was augmented by large numbers of young and inexperienced, but highly trained crews. Throughout the war, however, leadership in the air was exercised by highly experienced pilots who, by World War II standards would have been considered "old men".

One of the first lessons learned in the war was that youth with its attendant peak physical condition is not the most essential ingredient of the jet fighter pilot. With modern equipment, the physical stresses imposed on the pilot of a modern jet fighter are actually less than in World War II types. The factors of maturity, judgement,

and experience are of greater concern in modern jet warfare than in any previous aerial combat. The combination of experienced leaders, and the young, well trained flying school graduates was ideal, and has given USAF a new pool of experienced jet combat veterans.

A successful fighter pilot must possess certain attributes, whether a wing man or formation leader. These attributes have been stated many times in different forms, and the Korean conflict has served to re-emphasize them. It is believed that they bear repetition here.

As in any field of endeavor, the desire to succeed is paramount. The survival of a fighter pilot in combat often depends upon his aggressiveness. Of greater importance than survival, though, is the fact that aggressiveness is essential to destroying the enemy. By hitting the enemy hard and aggressively he can be knocked off balance, and his confidence in his aircraft and ability shaken. Once this is accomplished, the battle is nearly won.

To see the enemy first is a great advantage and to develop this ability to its fullest requires hard work and constant practice. This factor has become increasingly critical as the speed and altitude of aerial warfare have increased. Many potentially good fighter pilots have been unsuccessful, simply because they cannot learn to search the sky effectively.

Jet aerial combat above 40,000 feet has placed great emphasis on precision flying ability. At these altitudes throttle movement is relatively ineffective, and maintenance of formation integrity requires skill and thorough knowledge of aircraft characteristics. It is always true that opposing aircraft will have certain advantages and disadvantages in the various categories of performance. A thorough knowledge of characteristics, and the ability to obtain maximum performance from the aircraft is an essential attribute of the successful fighter pilot.

A fighter pilot who possesses all the other attributes, but who cannot shoot accurately will probably survive for a time in combat, but his value is negligible in destroying the enemy. When firing proficiency is low, the enemy can afford to make many mistakes, but when proficiency is high, the enemy's first mistake may well be his last.

The successful fighter pilot must be thoroughly imbued with a team spirit. The individualist is of no value to

his comrades in combat, and his chances of survival are greatly reduced if he doesn't work constantly with the team.

TACTICS

The primary factor affecting tactics employed in Korea was the Manchurian "Sanctuary". Also, the hit and run tactics employed by the Communist Air Forces throughout the war indicates defensive thinking. That the United Nations was able to maintain air superiority over North Korea in the face of a modern air force, numerically superior, and enjoying immunity from attack over his bases or on the ground, is difficult to understand. Had the enemy employed his forces differently, the consequences to the United Nations air effort might have been serious. As an example, the Manchurian "Sanctuary" allowed the enemy to take-off and land without regard to USAF interceptors. With this advantage and his numerical superiority, he could have deployed his aircraft in time and depth, engaging F-86 flights continuously during their withdrawal and capitalizing on their low fuel supplies.

MIG-15's (100 plus) attempted to over-power the United Nations Air Forces. Tremendous aerial battles ensued, with group and squadron formations engaging the enemy in mass "dog fights", often outnumbered 8 or 10 to one. The large majority of enemy encounters were made by F-86 aircraft, although United Nations fighter-bombers operated within thirty miles of the Yalu River. It appeared as though the MIG pilots hoped to eliminate the F-86 first; however, this concerted enemy effort against the Sabrejet failed as the MIG's, on all occasions, were driven back across the Yalu River.

The enemy continued these tactics until the latter part of January 1952, at which time an abrupt change was noted. Smaller formations were flown at both high and low altitudes. A few flights were directed against the F-86's while others attempted to attack the fighter-bombers. This made it difficult to place our large formations in the right place at the right time; however, the enemy was never able to seriously hinder the fighter-bomber effort.

During this period, increased pilot proficiency and a new Red air tactic were noted. The new maneuver was promptly and appropriately labeled the "Yo-Yo". Twenty or more MIG's

would orbit at an altitude exceeding that of the F-86 formation and, from that group, some would swoop down upon Sabre flights, then climb back upstairs, while others repeated the routine. As an example of pilot adaptability, it was often noted that MIG pilots frequently continued to "yo-yo" after the Sabres had descended in spirals to altitudes where the enemy lost the advantage of his superior performance at high altitude.

In World War II, fighter sweeps generally employed squadrons of twelve and sixteen aircraft. In Korea, many difficulties were encountered with this practice. Maneuverability was limited by the position of flights and elements. Lack of maneuverability complicated the already difficult problems of setting up high altitude, high speed, surprise attacks. Speed was seriously reduced, as formation leaders were limited to speeds which insured formation integrity and did not create stragglers. Firepower was limited twenty-four guns out of an available ninety-six. Coverage of the combat area was limited to that space through which the formation passed.

Each of these disadvantages was turned into an advantage when small, aggressive units were substituted for mass formation. Saturation of the area was obtained by using time interval between units. Utilizing this concept, it was difficult for enemy controllers to find targets large enough to warrant mass attack, and it was even more difficult for him to keep track of all the small forces thrown into the area.

"Jet Stream" (offense in depth) tactics were therefore adopted in order to accomplish the assigned mission. The "jet stream" consisted of flights of four aircraft dispatched into the combat area at various time and altitude intervals. Each flight climbed to altitude as quickly as possible, and joined formation enroute to the target area. Instead of large formations in the area, there were eight or more separate, aggressive, high speed forces, all within easy supporting distance of each other, both in time and air space. The "jet stream" was projected into the combat area by altitude, time, or route to provide depth and breadth to the force.

Flight leaders entering the area were briefed on the location of other friendly flights on the sweep. The first F-86 flight observing enemy fighters called out the

location, altitude, and heading of the enemy fighters. All flights within the area immediately positioned themselves for an attack on the enemy formation. When a fight developed at any one point, all flights immediately converged on that area. Flights unable to reach the fight because of distance problems were usually able to reach the area through which the enemy had to withdraw, or intercept elements that were thrown out of the main engagement.

Maneuverability of the F-86 was exploited on every flight. The "fluid four" formation was developed in conjunction with the new tactics. It allowed flight and element leaders unlimited freedom in maneuvers, and in the use of high speed tactics. Having unrestricted freedom of maneuver, the flight leader, upon sighting enemy formations, could initiate an attack and have absolute confidence that his wingman and element would remain with him. The effectiveness and ease of operation of this formation made a "bounce" on any enemy as simple as possible. There was no waste motion, or time lost in initiating the attack.

Security of the "jet stream" was aided by the size of the force employed. Not only were these small forces difficult radar targets, but also extremely small visual ones. With speed and formation integrity, our small flights were able to slash through large enemy formations having top cover and achieve aerial victories before the top cover could enter the fight. With each flight responsible only to itself, these highly mobile, maneuverable, self-supporting forces could slash at the enemy with relative impunity, thus increasing the normal aggressiveness of the individual F-86 pilot.

With the use of small formations, there were fewer losses from enemy action. The accident potential resulting from landing patterns crowded with aircraft low on fuel was reduced because of the staggered take-off and landing times.

Subsequent to 1 January 1953, the F-86 units experimented with the "trains" type squadron formation. These "trains" were composed of up to six flights of four aircraft each, and were a refinement of the "jet stream" concept. The flights flew the usual "fluid four", but remained in a loose trail formation within support distance of the preceding flight. This formation, in face of the "train" formation used by the enemy, enabled us to get the maximum number of friendly fighters

into contact with enemy formations, by spacing the flights at approximately one mile intervals. Maneuverability of the squadron was not hampered, high cruising speeds were possible, and each flight maintained good offensive flexibility. The susceptibility of our aircraft to attack by MIG flights was appreciably reduced.

Enemy formations varied in structure. Flights of six MIG's, composed of two elements of three aircraft each, were observed. More frequently, the flights of six were observed to function as three elements of two. It appears that the Communists later returned to the conventional four ship flight, with the two elements well separated, and the second element high and slightly to the rear. Occasionally, formations of as many as sixteen MIG's were sighted, in which case the enemy flights were usually in train and stacked up behind the leading flight.

Enemy aircraft were observed to take-off from Antung and Ta-Tung-Kou airfields, climb and form-up on the north side of the Yalu River and enter the battle area over the Sui-Ho Reservoir, or over a point midway between there and Antung. The MIG altitude for crossing the river was changed regularly and varied from above 50,000 down to 1000 feet. Their crossing and operational speed was rarely less than .8 to .85 mach.

Until mid-1953, the enemy demonstrated a reluctance to do battle with the F-86's. It is felt that the increase in the tempo of air activity in the last few months may have been due to an increased commitment of MIG's to the air battle over North Korea rather than to an acquired taste for air-to-air battle with the Sabre. Earlier, the MIG's attempted to decoy the screening F-86's out of position by sending high, fast flights to the area of fighter-bomber activity. Then, a second force of MIG's would approach from low altitudes attempting to attack the fighter-bombers. To counteract these enemy tactics, it was necessary for the F-86's to provide close, as well as medium and high, cover for the fighter-bombers. Operation at low altitudes increased fuel consumption, and created problems of tactical planning. However, losses of fighter-bombers and reconnaissance aircraft to enemy aircraft were maintained at a low level.

The most common type of mission flown by the fighter-interceptors was the fighter sweep. A typical sweep was made up of thirty-six or forty-eight aircraft, assigned to

patrol a certain area at a given time. These sweeps were made somewhere between the fighter-bomber targets and the many airfields across the Yalu River. Sweeps were almost never scheduled for the primary purpose of hunting enemy aircraft; rather, they were for the purpose of providing a screen between the enemy and the friendly fighter-bombers.

Areas to be controlled were pre-designated during the briefing. Normally flights were assigned patrol areas which overlapped somewhat, but which economically dispersed flights throughout the entire area of responsibility. For instance, if it were a Yalu River sweep, at least two flights were placed between Antung and the Sui-Ho Reservoir just south of the River. Other flights were assigned areas to the East. Still other flights were assigned as backup further south of the Yalu River. All of these flights remained in constant radio contact at all times, and each one dispensed information or requested assistance from any of the other flights at any time. Altitudes of the various flights varied from 38,000 to 45,000 feet. Each flight sought its most effective altitude, which was the highest altitude at which the highest Mach could be maintained, and varied with model of F-86 and fuel load aboard.

Upon reaching the area, where most contacts with enemy aircraft were made, each flight proceeded to its assigned location and started patrolling. Depending upon the amount of MIG activity in the area, the decision to drop wing tanks was made by the flight leader. Through combat experience, it was found advisable to maintain a Mach of at least .85 if there were danger of enemy attack.

The F-86's on many occasions provided close support escort for RF-80 aircraft. These missions were uniformly successful. Normally twelve aircraft provided the escort for one RF-80. One flight of four F-86's split into pairs and "S-ed" across the immediate top of the slower RF-80. This close support flight maintained .80 Mach. The other four-ship flights flew normal and high cover for both this flight and the RF-80. Occasionally an interception was attempted by the enemy. If it became apparent that the RF-80 would be subjected to attack, the mission was aborted. The RF-80 would dive toward the nearest water and the four F-86's on close escort would remain with him until he was out of danger. The remaining F-86 flights immediately attacked the enemy formation, and attempted to divert them from the RF-80.

In spite of the success of these tactics, it is doubtful if we could afford to escort reconnaissance aircraft on this scale in a global air war.

The tactics and techniques of fighter escort of bomber type aircraft developed in World War II did not prove effective in the Korean War. The jet, a high performance aircraft, in the role of the escort fighter was limited to operation at less than optimum performance by the slow flying medium bombers.

Air-to-air combat, specifically fighter to fighter, is dependent on performance. The aircraft with the superior performance differential can maintain the initiative, and by aggressive action, destroy or deter an opposing force. The speed differential between the MIG-15 and the F-86 was slight or negligible, with the MIG-15 having a decided advantage in a higher combat ceiling and the capability to accelerate to maximum velocity in a shorter period of time. The MIG-15 was able to climb to altitudes in excess of 50,000 feet and choose the time and place of the engagement. Using these advantages, the MIG-15 was able to penetrate our B-29 escort screens with relative ease.

In Korea, two general types of missions were flown by F-86 aircraft in support of B-29 daylight attacks: close escort; and area coverage (and at times a combination of both). Close escort missions were characterized by two four-ship flights flying to either side of the bombers, 1000 to 1500 feet above. These flights maintained position by reducing speed and weaving across the bomber formation. In addition, one flight was positioned in front and one flight 1000 to 2000 feet above the bombers. Area coverage was provided by fighter sweeps along the Yalu River during the penetration, on target, and withdrawal times. Close escort of bombers, whose speed and other performance characteristics were much less than those of the escorting fighter, proved operationally impractical, and the fighter aircraft used in area support were easily circumvented by the MIG's. The number of attacking enemy fighters that were deterred or destroyed by escort aircraft using these tactics was negligible.

The use of fighter-interceptor "screens" or "sweeps" in conjunction with small escort for fighter-bomber or reconnaissance missions in the "sensitive" area, was particularly adaptable to the Korean War. With enemy bases lying

north and west of the target complexes which were open to attack, it was possible to employ a screen between the enemy and our targets with maximum effect. Under a different arrangement of enemy fighter bases and target complexes, as in Europe, it is questionable if fighter sweep as a protective device for friendly operations would be as effective. It is probable, under these conditions, that a much greater percentage of the interceptor force would be required for escort duties. The fact that the Communists failed to press an aggressive campaign against our fighter-bombers and reconnaissance aircraft should not be ignored, since they had the capability to do so in spite of our screens and escorts. A numerically superior force of equal performance can neutralize or circumvent the screen and attack through the close escort. In future conflicts the performance capabilities of the bomber, fighter-bomber, or reconnaissance aircraft, the opposing interceptors, and the geographical situation will be the determining factors in selecting the optimum method of interceptor employment.

The peculiarities of the Korean War greatly simplified cruise control and navigation procedures. By virtue of employing stereotyped missions over the same territory daily, our pilots were aware of exact fuel minimums and procedures to be used in almost any situation. The Korean Peninsula, with its distinctive coast line and major rivers offered superior opportunities for good pilotage navigation. Consequently, under conditions of good weather, there was little difficulty involved in the safe return of large numbers of aircraft even when low on fuel.

For adverse weather conditions, navigational aids in the form of non-directional radio beacons, VHF/DF, and GCI radar, were available. When ceilings were high enough so that closely controlled let-downs were unnecessary, these facilities were adequate for the safe recovery of maximum effort missions; however, they were entirely inadequate when close control had to be exercised down to traffic pattern altitudes. Flights of four aircraft safely operated in weather down to GCA minimums. Missions were normally cancelled or reduced in size when base weather was expected to be below safe minimums for rapid recovery under visual conditions.

A - 1 SIGHT CONTROVERSY

At the time the A-1 gunsight was introduced in Korea, few maintenance personnel were skilled in its care. Spares

and test equipment were in short supply, and the equipment possessed certain mechanical difficulties that were in need of correction. In addition, this equipment was intended for maintenance in an air conditioned building, and such facilities were not available in Korea. As a result, sight maintenance was extremely poor in Korea from mid-1951 to mid-1952.

Unreliable sight operation caused a complete lack of pilot confidence in the system. It should be noted, however, that many of the pilots arriving in the theater had no prior training on the sight, and a significant proportion of the difficulties must be attributed to improper operation.

In an effort to overcome some of the mechanical deficiencies of the A-1 sight system, project "JAYBIRD" was activated on 1 May 1952 for modification of the equipment. The work was accomplished by two teams of personnel from AMC and the manufacturers of the airframe, sight, radar, and range servo units.

"JAYBIRD" was completed on 1 June 1952. The fire control system, upon being refurbished by the "JAYBIRD" project, performed fairly well with one exception. This was the failure of the power supply. Somewhat more than the expected number of sight assemblies had to be replaced, and a considerable amount of work was required of the sight technicians to put the sights in proper condition. About half of the sights required some attention, which, however minor, was sufficient to make the sight inoperative.

Another effort to improve the effectiveness of the A-1 system was the installation of "Range Limiters" on all sights. The A-1 sight was designed to automatically compute lead at ranges up to 1500 yards, and was extremely sensitive to aircraft movement when the radar was locked into a target at these ranges. When used against slow-moving bomber targets, this feature was desirable, for it allowed long-range shooting. When used against a rapidly maneuvering fighter target, this feature was undesirable, because the violent movements of the attacker introduced false data into the computing mechanism. The "Range Limiter", originally designed by the Air Proving Ground Command, reduced the sensitivity of the sight at long ranges and provided a visual indication to the pilot when he was within a preselected maximum shooting range.

Prior to this modification, pilots had the necessity of looking at the range drum indicator during an attack detracted from concentration on the target. The modification proved popular immediately, and was eventually accomplished on all F-86 and F-84 aircraft equipped with the A-1 (or A-4) series Gun-Bomb-Rocket sights.

By mid-1952, the Air Training Command had received sufficient equipment to properly train pilots on effective use of the "A" series gunsights, F-86 crews arriving in the theater were familiar with its theory, and were fairly proficient marksmen.

Meanwhile, in the summer of 1952, fourteen Korean jet "Aces", who had fought against the MIG when the A-1 sights were performing at their worst, held a conference with the Chief of Staff, USAF, and vigorously recommended that the A-1 sight be removed from the F-86 (and future day fighters) and replaced with a manual-ranging, gyro-computing sight similar to the K-14 or Mark 18 series. The Chief of Staff, on 8 September, directed FEAF and the APGC to re-evaluate the sight problem and recommend a course of action.

APGC, utilizing six Korean jet "Aces" and two of its own test pilots, conducted a brief evaluation. Their final report concluded that, "The kill probability using the A-4 sight with radar ranging is twice that attained with either the A-1C or K-14 sights with manual ranging." The report further recommended that, "The APG-30, even in its present state, should be retained (and) efforts to improve the reliability of the APG-30 radar should be intensified".

FEAF, at the same time, conducted a seminar on its most successful Korean F-86 pilots to obtain an authoritative answer to the question. All FEAF pilots felt that all automatic features of the A-1CM gunsight should be retained. The A-1 series provided a fully automatic reference for firing, without any effort on the pilot's part except electrical caging and uncaging. Although superior pilots did well with a Mark 18 type sight, superior pilots were considered the exception rather than the rule. It was generally agreed that superior pilots were those of the higher experience level who had been associated with fighter aircraft and fighter gunnery for a

period of years. It was apparent for any future conflict, that this very limited source of aircrew personnel would be soon exhausted, with the burden falling on younger pilots who had little or no gunnery training. These pilots, to be effective would require the features afforded in the A-1CM gunsight.

Although the majority of MIG kills were obtained from low deflection shots, all pilots agreed this did not indicate a deficiency in the sight, but rather in the armament. With improved armament expected in the future, the deflection shot would become much more important. With increased enemy aggressiveness, it would become necessary to depend on high deflection shooting which requires an automatic computing sight. It was considered unrealistic to assume that time would always be available to set up, close, and fire from a low deflection angle.

It was a consensus of the group interviewed that the 205 pound weight of the A-1 or A-4 series was not significant in view of the advantages inherent in the gunsight. It was felt that much greater weight savings could be effected by excluding some "luxury" items included in the aircraft. By removing the A-1CM gunsight, all pilots felt that a step would be made backward instead of forward; and the possible development of tactics, training and employment of an automatic ranging and computing gunsight for use in future conflicts would be deterred at a critical time.

It was agreed by this group that the gunsight should be designed primarily for fighter versus fighter operations, but not to exclude fighter versus bomber as the secondary role of the air superiority weapon in its daylight air defense mission.

In summary, it was recommended that: the A-1CM sight be retained in F-86 aircraft; consideration be given its redesign to facilitate maintenance and use fewer technically trained personnel; future gunsight design include the features now included in the A-1CM sight; each pilot assigned to air-to-air operations receive comprehensive training in the functions of the gunsight to be used; the gunsight be designed with priority given to the fighter versus fighter role, with fighter versus bomber included as a capability; reliability be of primary concern in any future design; and weight and size be given due consideration in the initial design of gunsights.

BULLETLESS VICTORIES

During the course of the war, 35 MIG-15 aircraft were statistical victories for F-86 pilots - without being struck by a single bullet. These victories were achieved when hapless MIG pilots fell into spins during violent maneuvers, and then "bailed out" because they could not recover. Although a few of these incidents occurred at low altitudes, most were above 30,000 feet.

In early 1953, it was noted that five percent of the total MIG "kills" had resulted from this MIG flight characteristic. Accordingly, the situation was reviwed to see if it could be exploited to our advantage. A history of the year 1952 revealed that there were 23 occasions when MIG's were observed to go into uncontrollable spins which resulted in their destruction. Some of the more pertinent facts revealed follow. Altitudes at which these spins were observed ranged from 3000 feet to 45,000 feet, with more than half occurring above 35,000. In 13 of the incidents, the F-86 pilot was the initial aggressor. In only one-fifth of the instances was the F-86 with the new leading edge involved. In only four instances was the MIG being fired on by the F-86.

This initial investigation did not reveal any information that would allow exploitation of this adverse MIG flight characteristic. Pilots of the F-86 units were queried as to possible reasons for the MIG's entry into uncontrollable spins. A few pilots guessed that the inability to recover from these spins was due to a shift in the center of gravity when ammunition was expended. All had seen MIG's "snap" and "spin" as a result of turning too tightly, and some spin recoveries by the Red pilots had been noted. This led a few to believe that spins from which recovery was not accomplished was due to a lack of pilot proficiency. All were agreed, however, that it was not a result of some internal structural failure, since many observed exhibitions of brilliant flying would not have been possible unless the MIG were structurally sound.

When the MIG-15 stalled, it usually "snapped" in about the same manner as the F-86. (The "stall" term here applies to a level turn stall, brought about by application of more "G's" than the aircraft wings can

aerodynamically provide). No MIG-15 with an undamaged powerplant was ever seen to stall while in a climb. In spins, the MIG settled down to a "flat" spin after the first two oscillations. This spin was steady, and slightly nose high. A nose-up angle was assumed that was roughly halfway between the angle at which an F-86 lands, and level flight attitude.

MIG's were observed to come spinning down out of formation when there were no F-86's near them, and for no apparent reason. One interesting observation of the MIG-15 spin was that many MIG pilots fired their guns while in a spin. It was a matter of conjecture whether this was done to lighten the nose, or for some other reason.

However, many MIG pilots under attack by F-86's often fired their cannons with no target in front of them.

A quick engineering check of the basic MIG-15 design indicated that the aircraft should be susceptible to violent spinning. The height of the horizontal tail, and the 42 degree swept wing of light construction (tip bending under "G" loads) all added up to an unstable longitudinal condition at high angles of attack. Although the rudder apparently had enough effectiveness to stop spin rotation (based on observations of aircraft changing direction of spin), evidently the turbulent wing wake reduced elevator-effectiveness to the point where the required down-pitching movement could not be achieved.

This subject remained one of conjecture for the remainder of the war. However, it was never possible to exploit the spins tactically. Without detailed flight test information on the MIG airplane, it was impossible to calculate moments of inertia and thus allow the development of tactics which would enable our pilots to force a MIG into a spin.

JETTISONABLE FUEL TANKS

The external fuel tanks originally procured for the F-86's were intended only for range-extension purposes on "ferrying" missions. The large-scale jettisoning of these tanks in combat had not been foreseen, and they were built to last the lifetime of the aircraft. A pair of tanks cost approximately $1500, and only a few spare sets were authorized for each squadron.

In Korea, the F-86's had to carry additional fuel in external tanks to fly to "MIG Alley", fight, and return to their home bases in South Korea. The MIG's operating from nearby Manchurian air bases, normally did not carry external fuel tanks. Our F-86's were forced to jettison their external tanks to combat the MIG's on equal terms.

The high consumption of external fuel tanks began to use up available stocks at an alarming rate. Emergency procurement was initiated in both the United States and Japan. Tanks were airlifted to the theater, as fast as they were manufactured, until a backlog had accrued. At that time, normal waterlift was resumed. Japanese production of tanks gradually increased, and fewer numbers were required from the ZI.

The 120 gallon external tank was used exclusively by the fighter interceptor F-86's throughout the war. In the closing months, the fighter-bomber F-86's used 200 gallon tanks occasionally. Undesirable release characteristics were encountered with both tank sizes. When released, the tanks often struck various portions of the aircraft, causing damage to wing surfaces, flaps, pitot booms, and the horizontal stabilizer. These faulty releases were generally caused by poor aerodynamic characteristics of the tanks, faulty operation of the mounting shackles, or fuel and air pressure lines not releasing when the tanks were jettisoned.

Occasionally, tanks would not release from the aircraft (called "hung" tanks). This was usually the result of improper mounting of the tank on the wing rack. Whenever an external tank would not release, the unfortunate F-86 pilot had to "abort" the mission and return to his home base, because the aerodynamic drag of the tank was so high he could not attain sufficient speed to combat the MIG-15.

Tanks were shipped to the using organization by both air and surface transportation means. To conserve space, the tanks were usually disassembled and "nested" when shipped by either method. Many tanks were damaged in this process. Each fighter wing was forced to operate a tank assembly facility, wherein an average of 6 to 9 manhours were required to clean and assemble one tank. Shortage of water and inadequate cleaning equipment complicated the assembly

of tanks. The average tank "farm" required 50 men on full-time duty to support the operations of a wing; however, manning tables did not provide authorizations for this workload.

A disassembled tank required approximately 35 cubic feet of shipping spaces, which was 45 percent less than an assembled tank. The monthly transportation requirements to support the tactical operations of each wing were the equivalent of 133 C-119 sorties, based on an expenditure of 2600 tanks per month. Approximately 30,000 manhours were expended each month in the disassembly and assembly of tanks in support of each wing.

Several methods of providing tanks to jet organizations were studied, and it was decided that automatic supply, controlled by the depot in Japan and monitored by the Fifth Air Force in Korea, was the best solution to the problem. To effect this, a central sub-depot was established in a rear area in Korea, and all external fuel tanks were delivered there for storage and necessary issue to the units. This sub-depot was provided a stock control level based on the monthly sortie rate and the average expenditure rate for each organization. The F-86 wings reported the status of tank supply daily, and from this report, the sub-depot automatically issued the required number of tanks, and requisitioned a like amount from the main depot in Japan.

There were three different locations on the wings of the fighter-bomber and interceptor model F-86's for wing tanks. No one standard tank and fittings would fit all of these stations. It was necessary to manufacture fairings and fittings so that whatever tank was available could be used. Even so, the tanks often had to be "tailored" to fit an individual aircraft.

The numerous tank designs and aircraft configurations required units to maintain large quantities and varieties of tanks and fittings. Inventories of tanks in the ZI and the "pipeline" to the theater had to be increased accordingly, because we did not have one standard tank and sway brace combination that could be used on all three stations of the F-86. In the event of a global war, the requirement to provide different tanks for the same aircraft in large numbers would present a tremendous logistic

problem. Our scope of operation could well be limited by our ability to provide these items in sufficient numbers.

Dollar-wise, the use of these jettisonable fuel tanks was a costly operation. The average cost per tank, if manufactured in the ZI, was $400. It cost $57 more to ship the tank from San Francisco to Korea (via ship). Using a sortie rate of 1800 per wing per month, the potential cost of tanks was more than $24,000,000 annually for the two wings of F-86 fighter interceptors. Actually, the cost of jettisonable fuel tanks for the two wings during the last year of the war approximated $15,000,000.

The procurement of tanks in Japan resulted in a substantial savings in "pipeline" requirements, and 50 percent in direct cost. The 120 gallon Japanese tanks cost $223 each. Prior to the end of the war, the cost of these tanks dropped to $185 each, when the requirement for preservation treatment and crating were eliminated.

The accompanying charts clearly demonstrate that jettisonable fuel tanks represented the largest single operating cost of an F-86 fighter interceptor wing. In the event of an all-out war, these costs applied USAF-wide would rise to astronomical proportions. Partial relief from these expenditures could be realized by standardizing a single tank that would fit all wing stations of an F-86. A better solution would be the development of a cheap, mass producable tank in plastic or similar form. Our ultimate goal should be the development of jet fighter aircraft that have sufficient internal fuel capacity to perform their missions.

SUMMARY

Air superiority in Korea was gained by a relatively small force when compared to enemy resources in Manchuria. This success could create a false sense of security, if it were attributed solely to superiority of our pilots and equipment. The phenomenom of a smaller force, with aircraft performance approximately equivalent to that of the enemy, attaining air superiority must be attributed to the method of employment of the forces involved. The enemy consistently misused his available power by failing to exploit both his numerical advantage and the superior high altitude performance of his equipment. Unfortunately,

ineffective employment of enemy forces cannot be used as a planning factor in future air operations. By skilled application of a sound, aggressive doctrine, the Communists might have enjoyed a certain degree of air superiority over North Korea.

Performance advantages of the MIG-15, particularly in ceiling and rate of climb, gave rise to many proposals, which varied from reducing the weight of the F-86 and adding more power, to designing a new lightweight fighter. Nearly everyone agreed that the F-86 should be lightened, however, there was little or no agreement on which items or systems to delete, consequently, nothing was done on this matter. Requirements were established for a lightweight fighter, however, this was a long-range development which did not affect the Korean campaign. In the field of increased power, improved performance was apparent in the F-86F, equipped with a J-47 engine of approximately 800 pounds more thrust than its predecessors. Increased performance was also realized by removal of the slats and their replacements by the solid 6 x 3 leading edge. This was the best performance improvement device tested during the Korean conflict.

The lightweight air-to-air fighter was considered a practical solution to the problem of gaining and maintaining air superiority. This concept is appealing (at least to the fighter pilot) because one envisions small, highly efficient fighter aircraft, completely stripped of all non-essential equipment. This type appears practical because it should be relatively cheap to build, and could operate from less expensive air base installations. The elimination of multi-systems and extra equipment would provide ease of maintenance. The major drawback to such a vehicle is that it is a pure specialist, designed only for daylight combat with the enemy in a very limited area. The addition of equipment or structural strength would compromise its performance, and it would then become just another underpowered fighter, not capable of fulfilling the lightweight concept.

The air war in Korea demonstrated close escort to be ineffective as a method of reducing the attrition enemy jet interceptors can inflict on an escorted force. Enemy interceptors, with inherent performance superiority over escorting fighters (who must carry additional fuel) can

penetrate close defenses and damage the escorted force or deter it from the target. If the performance differential increased between interceptor and escort, the losses inflicted on the striking force may increase proportionately. The guiding principle of area coverage is to actively engage the enemy interceptor force at sufficient distance from the escorted force to provide a measure of early warning and to divert the enemy attack; however, the force requirements to provide effective area coverage on a large scale are prohibitively high.

It is felt that the most effective method of supporting an offensive force would be to aggressively apply the concept of support escort. This method of employment may be defined as a strategic penetration to unconditionally gain air superiority for a given period of time (limited to the penetration, on target, and withdrawal time of the strike). This tactic involves the use of escort fighters as penetration fighters, carrying special weapons, to attack enemy airfields and GCI radars and communications nets. The penetration escort attacks would be time-phased to lend direct support to the primary attacking force, but the effectiveness of such tactics is predicated on accurate and timely intelligence of the enemy interceptor air order of battle.

The support penetration fighter should be able to effectively deliver special weapons and possess sufficient performance to survive enemy interceptor attacks. The ability to combat and destroy these enemy interceptors on equal terms would be highly desirable, but not a prerequisite to the primary mission. The support escort concept could very well replace the tactics of close escort and area coverage as a means of providing maximum support to offensive, bomber, fighter-bomber and reconnaissance operation in enemy defended areas.

It is believed the ten to one victory ratio of the F-86 over the MIG-15 was gained by superior tactics, well-trained, experienced and aggressive pilots, and a superior armament and fire-control system. The virtual abandonment of large fighter formations in favor of small flights employing "offense in depth" appeared to be a valid principle for future employment of jet air superiority fighters, as did the "high speed" tactics employed by individual flights. On the other hand, the successful use of large-scale fighter sweeps in conjunction with small escort

groups as direct protection must be accepted with the understanding that these tactics were designed to meet a specific set of conditions which may not be duplicated in future conflicts. In generalizing on any air tactics used in the Korean War, it must be recognized that the Chinese Communists had an artificial defensive advantage in the Manchurian "Sanctuary" and did not utilize their full potential to seriously contest U.N. air supremacy, or our own South Korean "Sanctuary".

L E S S O N S . . .

1. HIGH SPEED AND FREEDOM OF MANEUVER IN THE BATTLE AREA ARE ESSENTIAL ELEMENTS FOR JET FIGHTERS WHEN OPPOSED BY ENEMY AIRCRAFT.

2. PILOT AGGRESSIVENESS AND A THOROUGH KNOWLEDGE OF AIRCRAFT PERFORMANCE CHARACTERISTICS ARE REQUIRED FOR A FAVORABLE VICTORY RATIO OVER THE ENEMY.

3. AIR SUPERIORITY AIRCRAFT SHOULD POSSESS SUFFICIENT RANGE TO CARRY THE FIGHT DEEP INTO ENEMY TERRITORY.

4. CLOSE ESCORT IS INSUFFICIENT TO PRECLUDE AN AGGRESSIVE ENEMY FROM PRESSING HOME ATTACKS ON BOMBER FORCES.

5. EXPERIENCE AND SOUND JUDGEMENT APPEAR OF GREATER VALUE THAN YOUTH IN JET FIGHTER OPERATIONS.

6. AIR WAR RESULTS IN KOREA SHOULD NOT LEAD US TO ASSUME AUTOMATICALLY AIR SUPERIORITY IN A GLOBAL CONFLICT.

APPENDIX B

Korean Era Aerial Combat Data Questionnaire

Request for Korean Era Aerial Combat Training Data

1. Major Van Gilder, an Air Force student at Command and General Staff College, is undertaking as part of his student curriculum a study of United States Air Force air-to-air doctrine, training and tactics development. Major Van Gilder is investigating current training concepts and programs for aerial combat and is making a comparison with historical concepts and programs. In that regard, his study would be incomplete without a detailed discussion of our fighter forces preparation for and participation in the struggle for air superiority during the Korean War.

2. Major Van Gilder requires the following specific information for his study:

Overall - What is your impression of the relevance of the Air Combat Training (ACT) you received prior to the war? Was adequate time devoted to realistic training or was it merely square filling?

a. How many hours/events per six-months training cycle were dedicated to air-to-air?

b. What types of sorties were they - Basic Fighter Maneuvers (BFM), Aerial Combat Maneuvers (ACM), Aerial Combat Tactics (ACT), etc?

c. Were upgraders in the air-to-air phase given adequate sorties to become combat ready - or simply upgraded when they received the minimum number of sorties/hours?

d. Did air-to-ground sorties take precedence - in other words, did Air Force doctrine at the time put air superiority low on the priority list?

e. Were safety considerations/regulations overly restrictive - a driving factor in your training scenarios?

f. Were the continuation training air-to-air sorties realistic - were there composite strike/air superiority packages with simulated ground and air threats; or were they merely 1V1's, 1V2's, 2V2's, etc? If so, what was the largest scenarios; 8V8?

g. Did you practice Dissimilar Air Combat Tactics (DACT); if so, against what types of aircraft? How frequently?

h. Were low-altitude (below 5000' AGL) air-to-air practice engagements allowed?

i. What impact did the Fighter Weapons School (FWS) at Nellis have on tactics and training - did the word get out to the wings?

j. Assuming you had Rules of Engagement (ROE), what was specified regarding the following:

- weather criteria?

- minimum altitude?

- slow speed fights (minimum airspeed limit)?

- kill removal?

- separate frequencies authorized?

- limited communication and communication jamming? (allowed and practiced?)

k. Did the advent of the F-86 cause a dramatic change in air-to-air training?

l. Was any air-to-air training conducted in theater (Korea) while the war was in progress? Why?

m. To what do you attribute the USAF's outstanding success during aerial combat in Korea? Was it the man or the machines which made the difference?

n. How would you compare the F-86 vs Mig-15, advantages - disadvantages?

o. What changes took place in TAC air-to-air programs after the war ended - were the lessons learned applied and expanded on?

3. Major Van Gilder has a data collection suspense of 30 March. Response by you would facilitate work on Major Van Gilder's study.

4. Your cooperation is appreciated on this study which is seeking to reveal new methods to improve the combat readiness capability of the United States Air Force air superiority forces.

Surveyed Individuals

*Major General (Ret.) Albert W. Schinz

*B/General (Ret.) Harrison R. Thyng

*Major General (Ret.) Levi R. Chase

General (Ret.) William W. Momyer

*Lt. General (Ret.) Joseph H. Moore

*Major General (Ret.) Franklin A. Nichols

*B/General (Ret.) Robin Olds

Major General (Ret.) Frederick C. Blesse

*Major General (Ret.) Foster Lee Smith

*Colonel (Ret.) Harold E. Fischer

*Colonel (Ret.) Vermont Garrison

*Colonel (Ret.) Ralph S. Parr, Jr.

Colonel (Ret.) George I. Ruddell

*Colonel (Ret.) Francis S. Gabreski

Colonel (Ret.) George L. Jones

*Lt General (Ret.) Winton W. Marshall

*Colonel (Ret.) Ralph D. Gibson

* RESPONDED

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