

* A BRIEF CONCEPTUAL HISTORY OF AIR FORCE DOCTRINE
FOR (DAY/EYEBALL-CONTACT) AERIAL COMBAT

(1) FUNDAMENTAL CONCEPTS

(2) HISTORY

* By Major Barry Watts, 1977

PHASES OF AERIAL COMBAT (task classification*)

- (1) PATROL PHASE LOCATE and IDENTIFY the enemy
Begin the fight from the best possible tactical situation
- (2) ENGAGEMENT PHASE SURVIVE (first)
KILL BOGIES (second)
- (3) DISENGAGEMENT PHASE SEPARATE from the engagement without being killed

* Watts, "A Comparison of 'Team' and 'Single-Ship' Approaches to Aerial Combat," 1976

PHASES OF AERIAL COMBAT

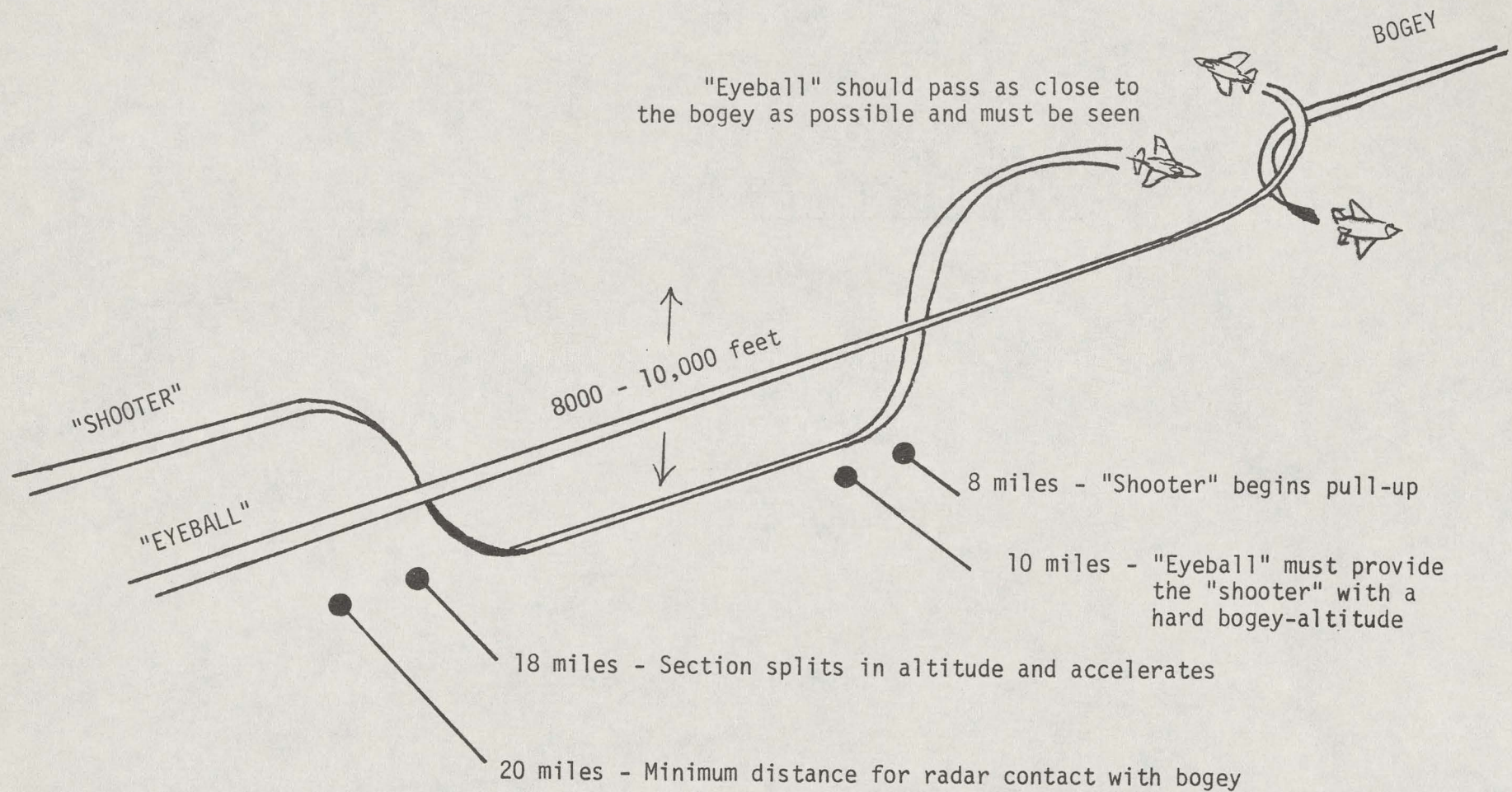
(1) PATROL

(2) OPENING MOVES

(3) ENGAGEMENT

(4) DISENGAGEMENT

AN OPENING MOVE: THE "HOOK" ID (IDENTIFICATION)



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PHASES OF AERIAL COMBAT (alternative classifications)

MANEUVER CLASSIFICATION (Blesse, "No Guts, No Glory," 1954):

- (1) OFFENSE - attacking - offensive maneuvers
- (2) DEFENSE - defending - defensive maneuvers

CLASSIFICATION by PATROL FORMATION SIZE (Moelders, 1938; Bader, 1940):

(1) FINGER-FOUR (World War II Luftwaffe, RAF, USAAF)

FLUID-FOUR (USAF, 1951)

(2) LOOSE DEUCE (US Navy, late 1950s on)

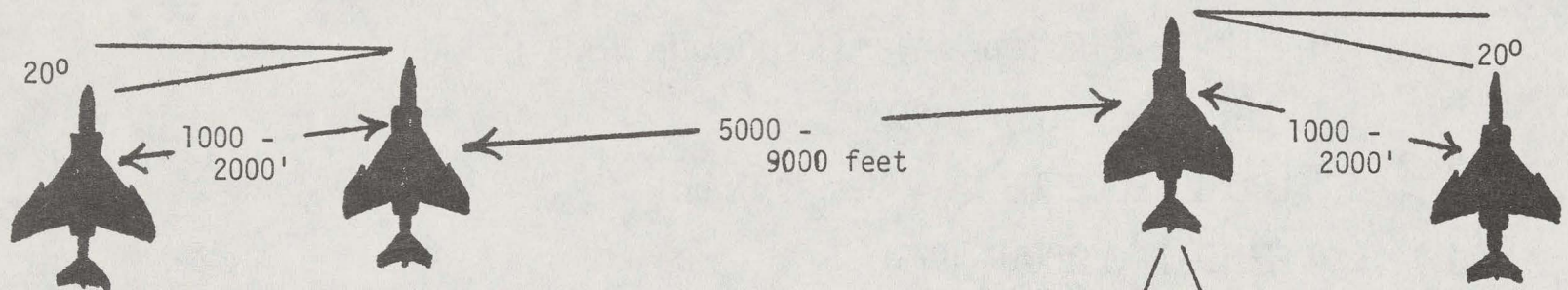
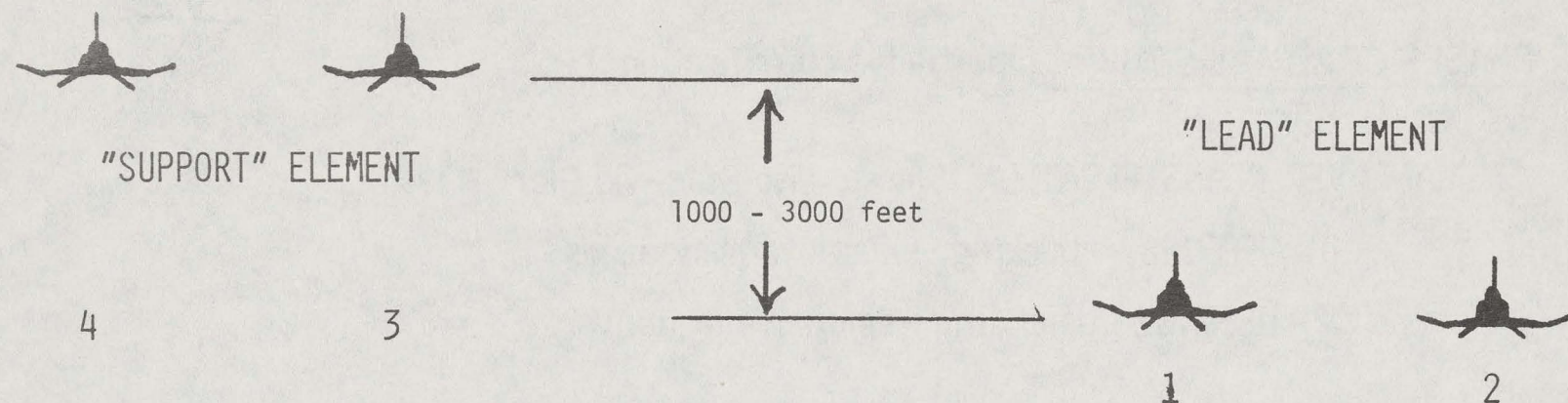
FLUID-TWO (USAF, 1973)

COORDINATED PAIR (RAF, early 1960s)

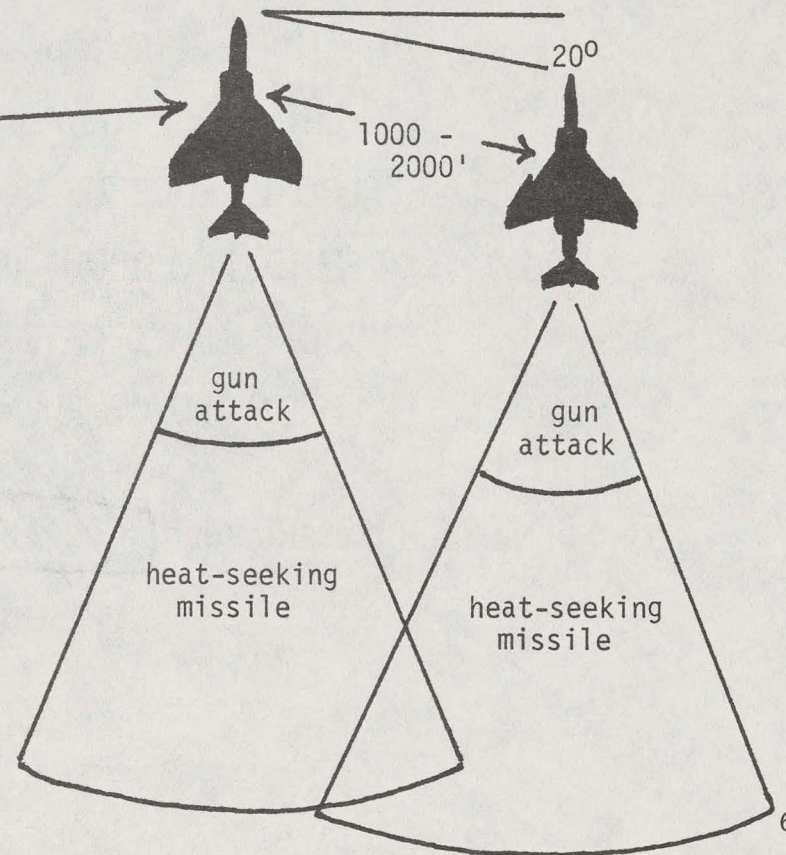
(3) LONE WOLF (World War I)

No such classification ~~should be~~ made (Boyd, AERIAL ATTACK STUDY, 1960)

"FLUID-FOUR" PATROL FORMATION



The intent of the formation is to provide a defense against both gun and missile attacks from all quadrants (but especially from the rear). The distances shown are optimized for the F-4.



ENGAGEMENT CONCEPTS

SINGLE-SHIP (World War I, Mideast "War of Attrition,"
"October War" 1973)

SHOOTER-COVER (Spanish Civil War, World War II,
Korea, Vietnam)

DOUBLE ATTACK (Luftwaffe in Battle of Britain,
NO US Navy in Vietnam, *NO*
Israeli AF)

TEAM
APPROACHES

↓
connecting with page

SINGLE-SHIP (LONE WOLF)

World War I: "In the early phase individualists with great courage and skill and an aggressive nature ran up the highest scores. . . . The attrition rate among such individualists became awesome as the war progressed." (Sims, The Aces Talk, pp. 23-24)

World War II: "Mutual protection achieved in formation was lost when one pilot flew alone, which proved highly dangerous--as it had in the last part of the First World War."
(Sims, The Aces Talk, p. 107)

". . . 90% of all fighters shot down never saw the guy who hit them." (Lt Col Mark Hubbard, 20th Ftr Gp; Kepner, The Long Reach: Deep Fighter Escort Tactics, p. 10)

". . . I am sure that 80% of my kills never knew I was there before I opened fire."
(Hartmann in Toliver & Constable, The Blond Knight of Germany, p. 173)

MIG Alley: "In general, we were briefed to get our nose down and get out of the area anytime we became a 'single.' People who did not adhere to this principle were very fortunate not to be shot down. Even experienced pilots who attempted to tangle with the MIGs as a single were not successful and, in fact, most of the people who were repatriated toward the end of the war, were guys who had inadvertantly gotten themselves in the single ship situation." (Jim Robins, "Flying the F-86 in Korea, Wings, Oct 75, p. 24)

Vietnam: Of the 75 American aircrews downed by MiGs, 60% did not see their attacker until AFTER the ordnance struck their plane, and another 21% did not spot the bogey in sufficient time to avoid being hit. (Source: Project Red Baron III: Air-to-Air Encounters in Southeast Asia, Volume I (Executive Summary), p. 18)

1973 Mideast Communications-Jamming;
War: Multiple-Bogies (40 to 60 plane engagements)

MESSAGE: ALTHOUGH TEAM APPROACHES ENHANCE SURVIVABILITY--AND THEREFORE ARE GENERALLY PREFERABLE TO SINGLE-SHIP--YOU CAN BE FORCED TO FIGHT AS A SINGLE!!!

CLASSIC (MIG ALLEY) SHOOTER-COVER

WINGMAN'S ROLE: "What is it we want from the wingman? We want him to do two things: (1) fly his aircraft in such a way that regardless of the leader's maneuvers, he will not become separated and (2) look around. If item (1) is not put first in his duties, he obviously will not perform his primary purpose in being there, that of supplying the eyes to the rear for the lead aircraft." (Blesse, "No Guts, No Glory," p. 4)

SUPPORT ELEMENT'S ROLE: "The element leader in this type formation is invaluable to the Flight Commander. He must take a position on the lead element that affords him an advantage on any aircraft trying to attack the lead element. His primary purpose is to cause the attacker of the lead element to break off, thus allowing the lead element that period of time necessary for the destruction of the aircraft he is attacking. The element obviously performs other defensive and offensive functions; but with the four-ship flight on the offensive, it must be kept in mind that the primary function of the element is that of allowing the lead element to complete successfully any attack begun." (Blesse, "No Guts, No Glory," p. 8)

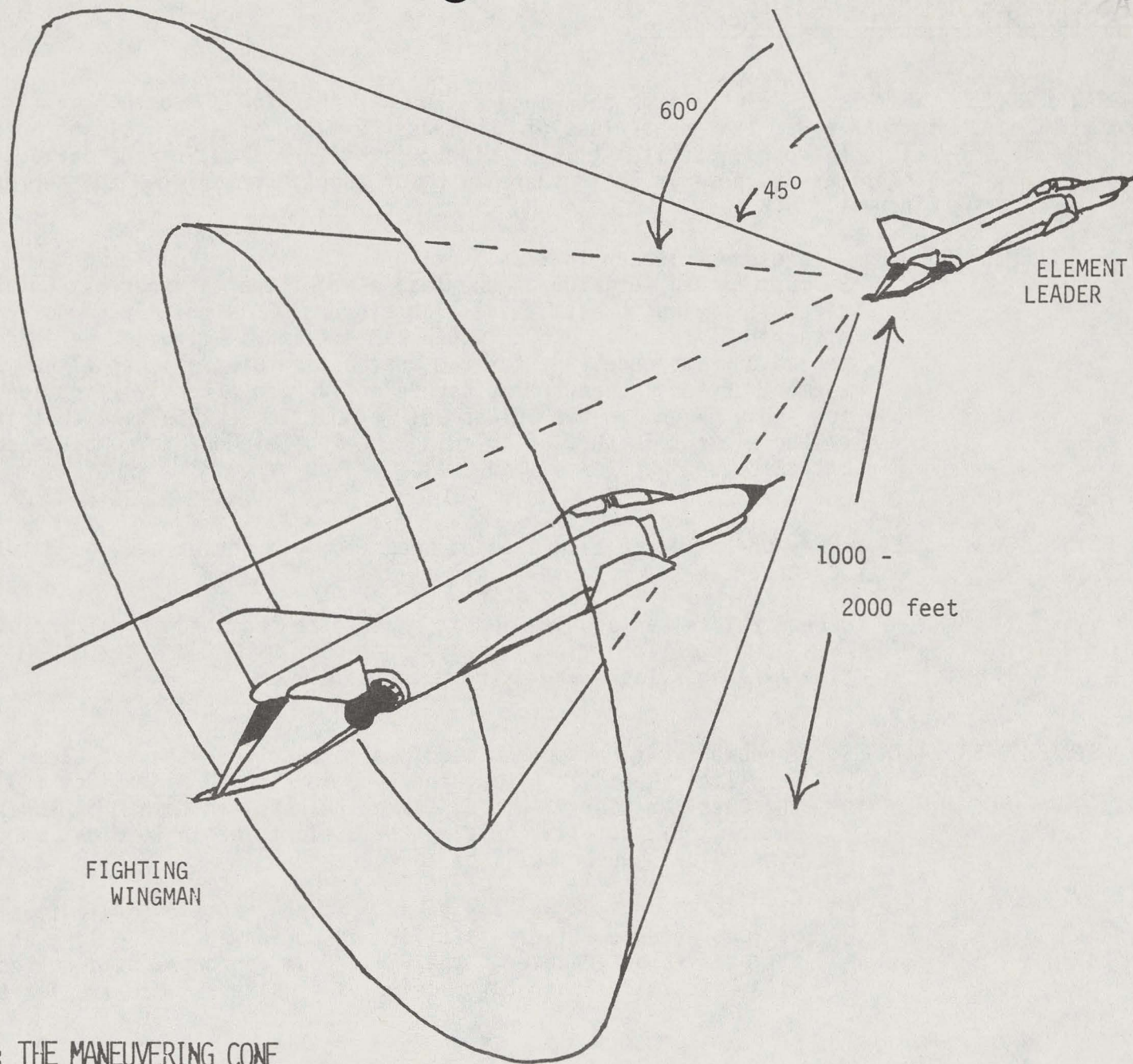
SYSTEM ADVANTAGES: Only one pilot in each element needs to be experienced enough to function as a leader.

Green pilots can acquire combat experience "on the wing" in relative safety.

The wingman's tasks are extremely simple.

SYSTEM DISADVANTAGES: In combat, it has seldom been possible to keep the two elements together very long (Robins, "Flying the F-86 in Korea," Wings, Oct 75, p. 24; Blesse, "No Guts, No Glory," p. 15; Thyng, "Air-to-Air Combat in Korea," AUQR, Summer 1953, p. 41). Anytime the elements begin to fight on their own, some mutual support will be lost.

Classic Fluid-Four evolved in an era when the air-to-air fighters of all nations were relatively "similar" in performance. So long as it remained strictly "shooter-cover," the Fluid-Four approach could not cope efficiently with "dissimilar" aircraft scenarios (F-4 versus MiG-17, for example).



FIGHTING WING: THE MANEUVERING CONE

CLASSIC LOOSE DEUCE/FLUID TWO

The basic team size is TWO fighters instead of four (carrier operations).

"DOUBLE ATTACK" Instead of a single attack carried out by the flight leader and
ENGAGEMENT STRATEGY: supported by the rest of the flight (as in Fluid-Four), both team
members participate equally as attackers.

First one team member puts pressure on the bogey, then the other,
and so on until a kill is achieved.

When the sequenced attacks are properly coordinated, pressure on
the bogey will be continuous; as a result the bogey will find himself
constantly reacting to one or the other of the "double attackers," thus
leaving the other free to maneuver towards a position of greater
advantage.

ORIGINS: Boyd's "FLUID SEPARATION"; Riccioni

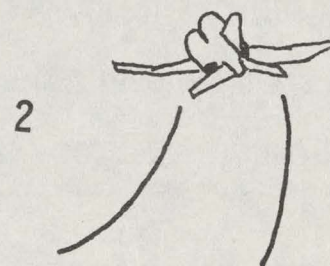
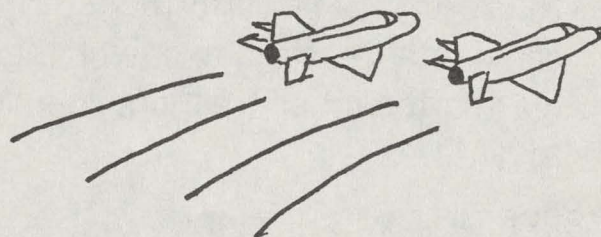
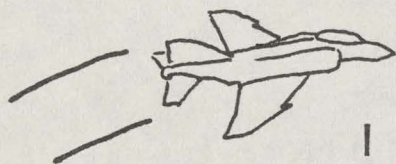
ADVANTAGES: Solved the problem of fighting slower, better-turning opponents with faster
machines (F-100 versus F-86; F-4 versus MiG-17).

Economy: everyone is a shooter.

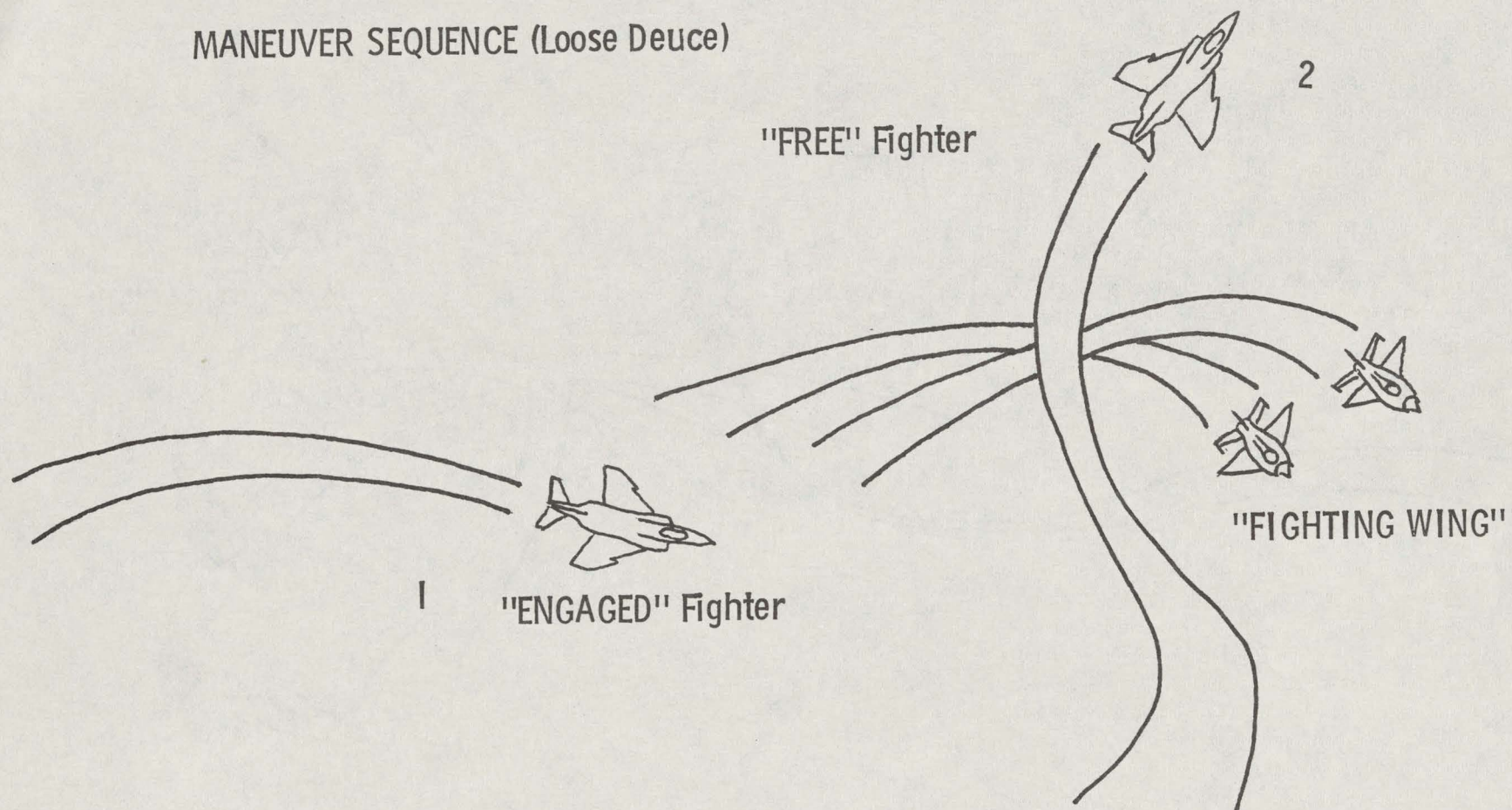
COSTS: Sophistication: everyone must be a skilled leader; otherwise you end up single-ship
and somebody gets shot down.

A high rate of information exchange between team members is necessary (hence
extreme vulnerability to comm-jamming).

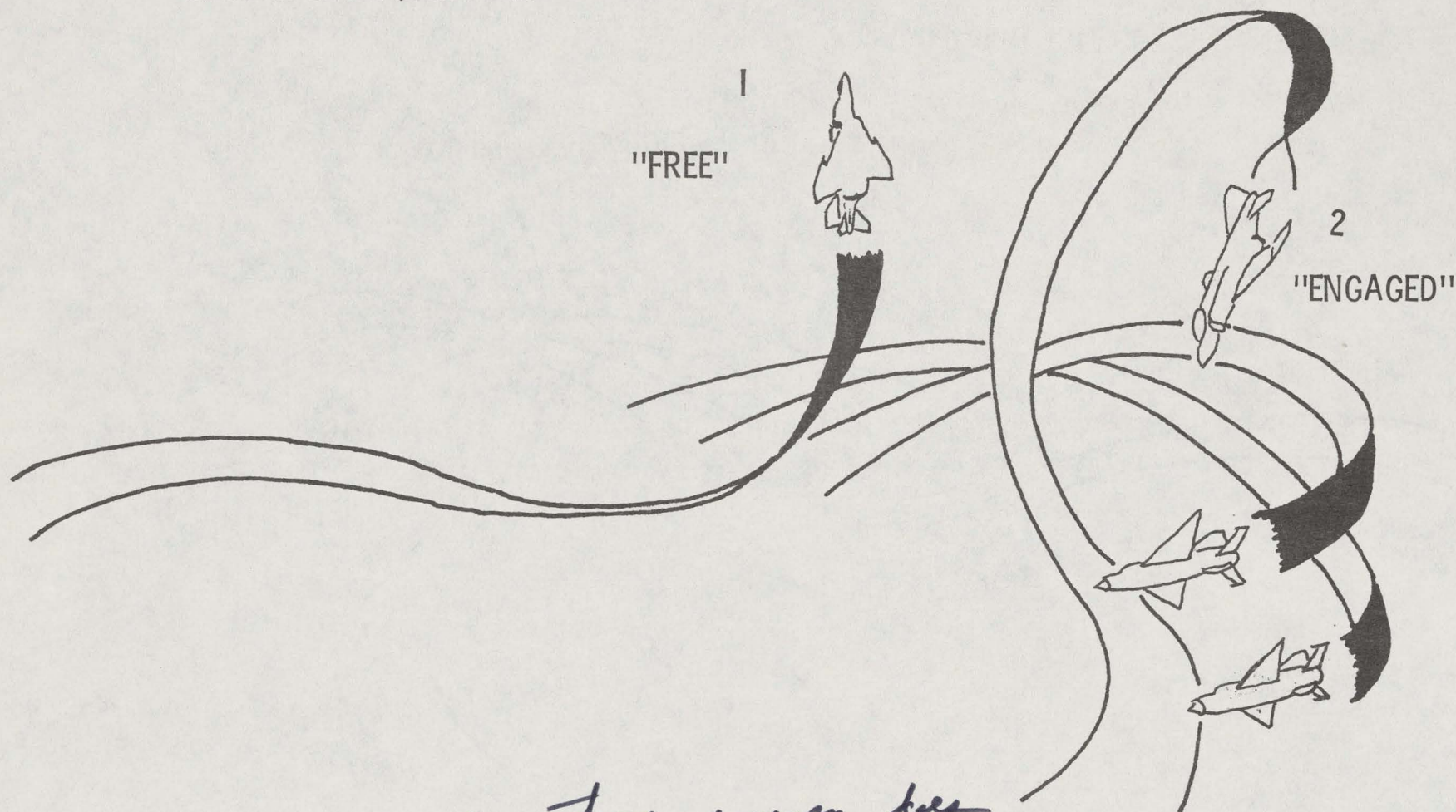
MANEUVER SEQUENCE (Loose Deuce)



MANEUVER SEQUENCE (Loose Deuce)



MANEUVER SEQUENCE (Loose Deuce)



Not accept when every does
~~not~~ cooperate and maintain
rigid formation

LOOSE DEUCE AS A BUILDING-BLOCK FOR TEACHING MUTUAL SUPPORT

What happens to your "double attack" when you go two-versus-two and the bogies maneuver independently?

THINGS GET MESSY FAST.

YOU HAVE REACHED THE LEVEL OF REAL-WORLD AIR-TO-AIR

A BUILDING-BLOCK APPROACH TO AIR COMBAT MANEUVERING

Step 1: THE BASIC FIGHTER MANEUVERS

Practice at I-versus-I maneuvering

Step 2: CLASSIC LOOSE DEUCE

Practice at mutual support between two
fighters (teamwork)

THE REAL WORLD . . .

BASIC (I-versus-I) FIGHTER MANEUVERS

In an air-to-air engagement you are either WINNING, STAYING NEUTRAL, or LOSING. This obvious proposition provides one way of grouping the basic fighter maneuvers.

OFFENSIVE MANEUVERS

High (speed) yo-yo

Low (speed) yo-yo

Roll-offs

Lag Pursuit

Barrel Roll Attack

DEFENSIVE MANEUVERS

Defensive turn

Break-turn

Defensive spiral

High-G Barrel Roll (over
or under)

Horizontal Scissor

Vertical (rolling) scissor

Extension maneuver (for subsonic bogies)

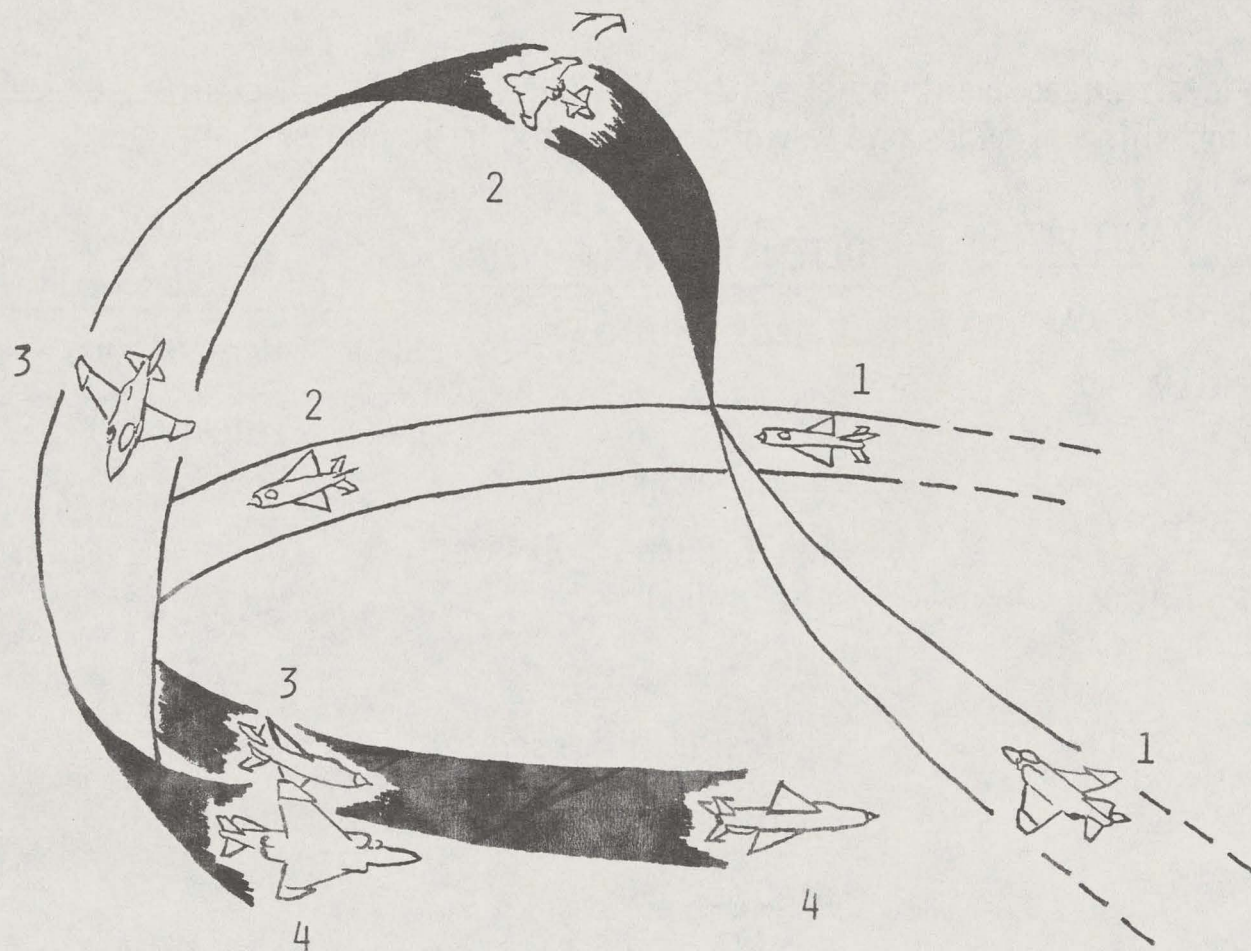
Last Ditch

MANEUVERS FOR NEUTRAL SITUATIONS

Head-on pass

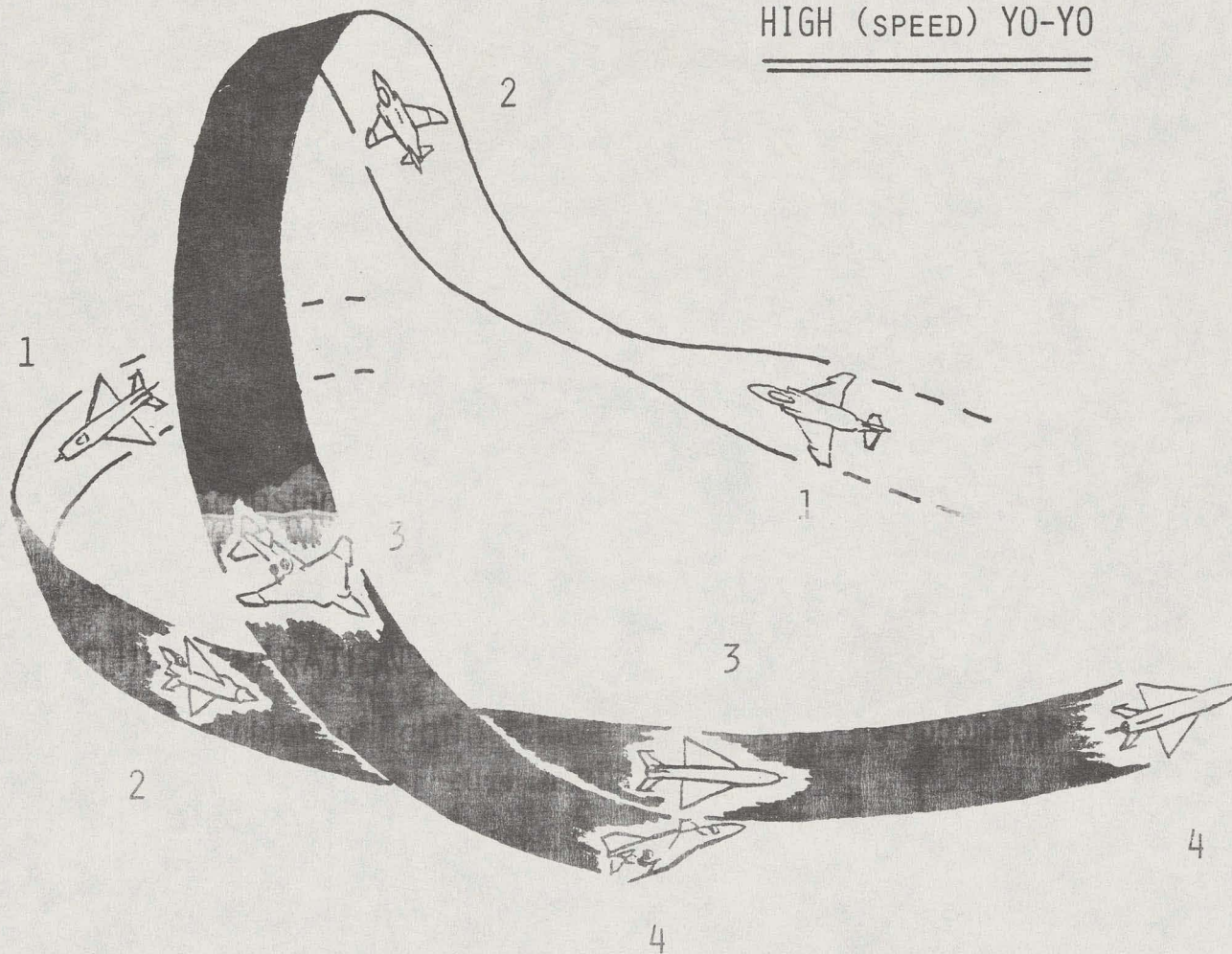
Lufbery

ANY MANEUVER SEQUENCE (no matter how complicated) CAN BE BUILT UP OUT OF THE finite array OF BASIC FIGHTER MANEUVERS.



BARREL ROLL ATTACK

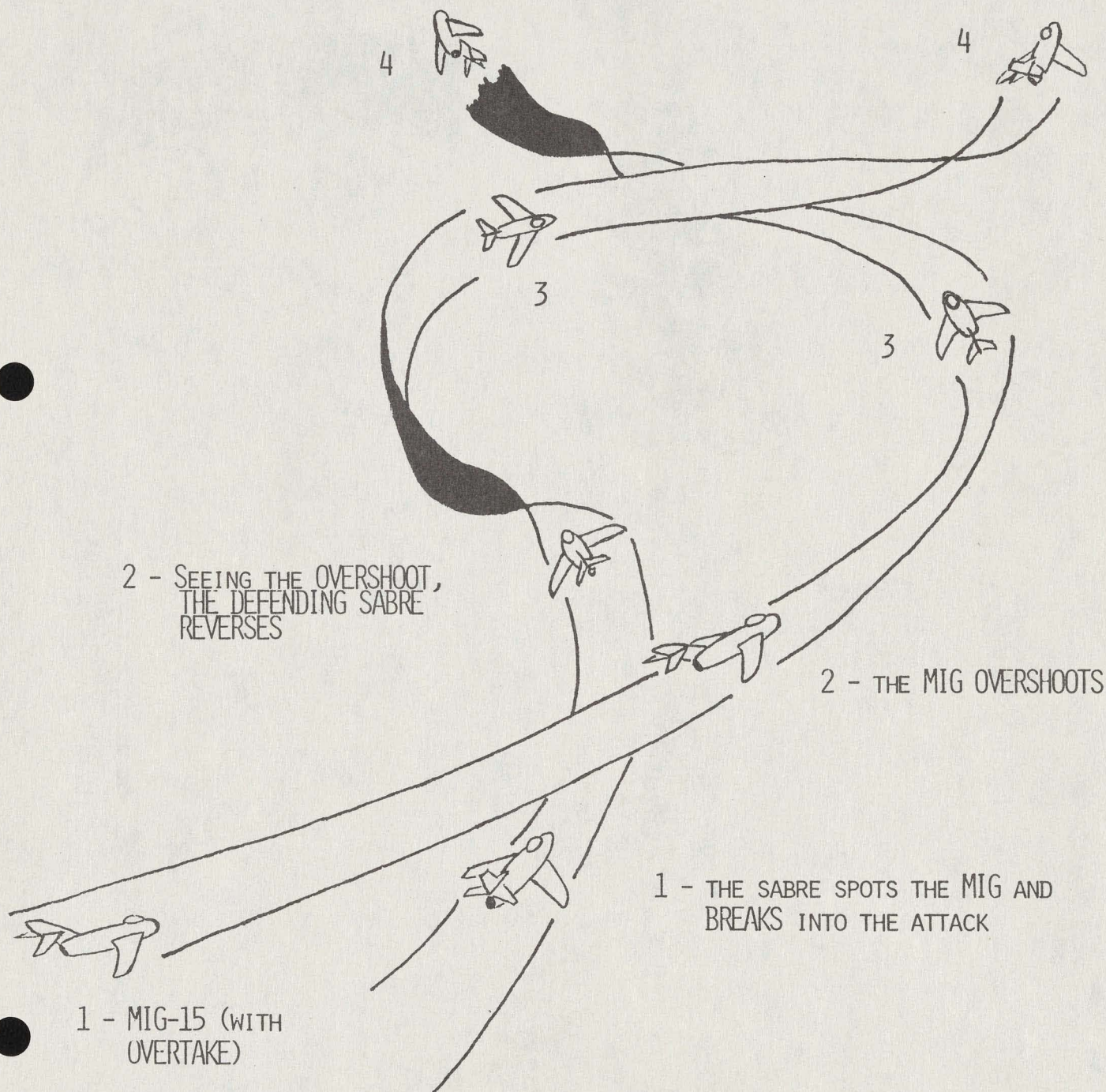
HIGH (SPEED) YO-YO

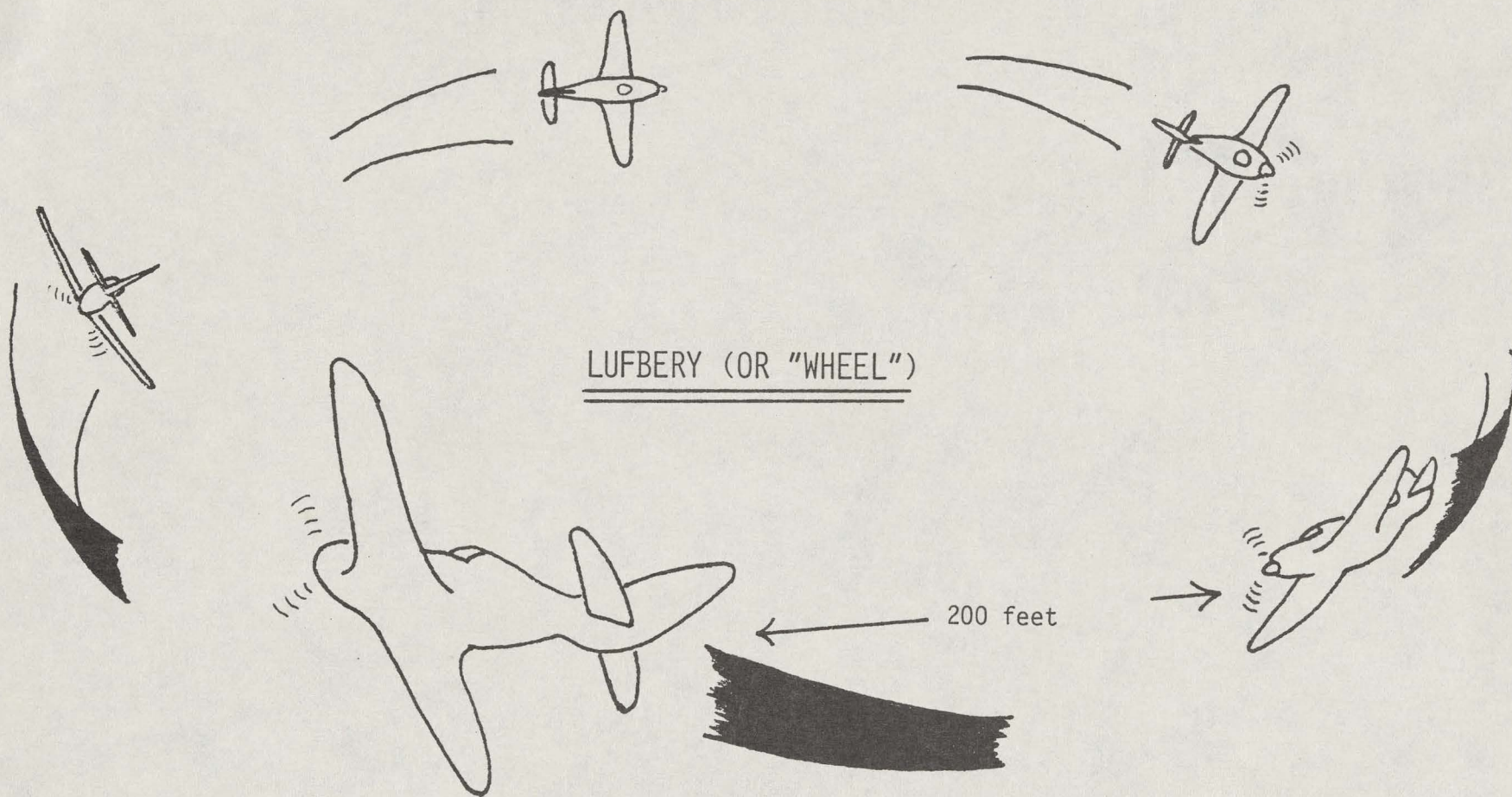


HORIZONTAL SCISSOR (MIG ALLEY)

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"This scissor maneuver is the one maneuver with which you must become familiar. Anytime two aggressive pilots meet in comparable fighters, the eventual result will be a series of maneuvering turns for advantage. These turns kill airspeed, and the pilot who is most familiar with the low speed maximum performance of his aircraft will come out the winner. Those fights that wind up at low speed we call a scissor." (Blesse, "No Guts, No Glory," p. 20)

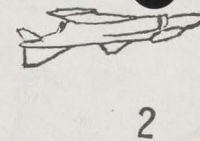
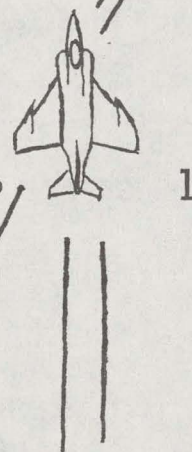
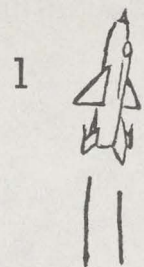
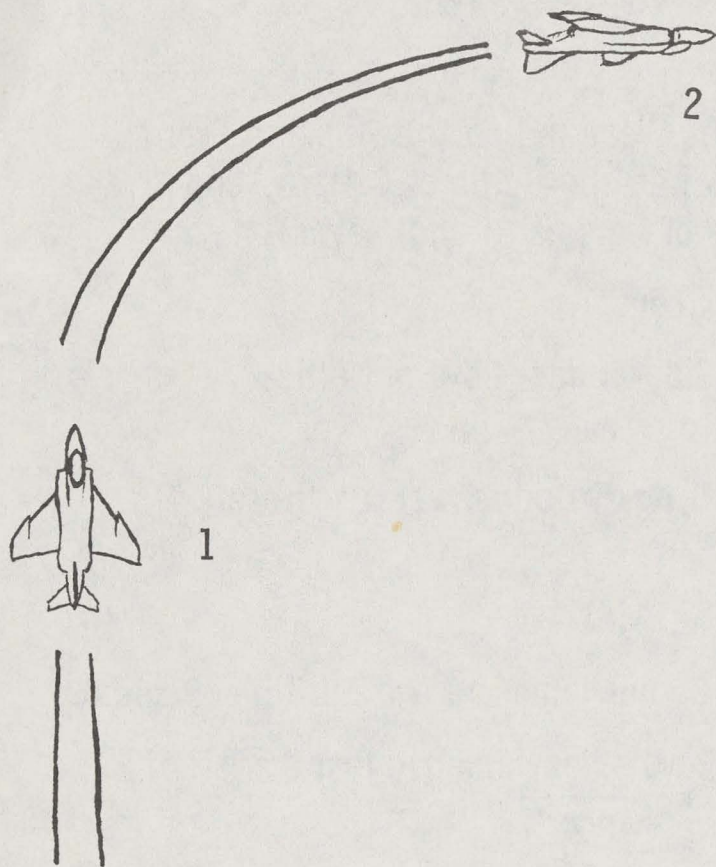




On 6 June 1942, the Luftwaffe ace Marseille, flying the Me-109 in North Africa for JG-52, downed seven Allied Tomahawks in only eleven minutes when they sought refuge in a Lufbery (Sims, The Aces Talk, p. 147). Of course, Marseille was flying the superior machine, and, at that point in his brief career, had become such a deadly shot that he was averaging only 15 rounds per kill (Constable & Toliver, Horrido!, pp. 83-84).

MIG-17 EXTENSION MANEUVER





SANDWICH

A BRIEF HISTORY OF AIR-TO-AIR TACTICS

World War I ('single-ship' versus 'team' approaches; Boelcke)

Spanish Civil War (Moelders' FINGER-FOUR)

World War II (Magnitude of the air combat in the West and on the Russian Front, the Luftwaffe experten, retrospect on the Battle of Britain, and the trend embodied by the tactics of Hartmann and Meyer)

MIG Alley (Blesse's FLUID-FOUR; the "ace" syndrome)

Post-Korean War Developments (F-104 and the Sidewinder; Boyd at Nellis; Riccioni in Europe)

VIETNAM (the all-missile F-4; results from "Rolling Thunder" versus those from "Linebacker")

Energy Maneuverability and Fighter Design (F-15, F-16)

MIDEAST (Israeli pilot selection and training; Comm-jamming and Multiple-Bogies)

Today (USAF FLUID-TWO, Realistic Training, Boyd's "asymmetric fast transient" concept)

Tomorrow (Night ACM, Boyd's Riccioni's SUPERCRAUISER, Concept ground defenses against the manned fighter and other technological possibilities)

PHASES IN WORLD WAR I

FIRST PHASE--LONE WOLF/SINGLE-SHIP TACTICS

Evolved out of the simple fact that scout planes were sent up as singles for reconnaissance purposes.

Produced Albert Ball (44 victories), Georges Guynemer (53), and Willy Bishop (72).

SECOND PHASE--TEAM/FORMATION APPROACHES

Systematic team tactics were first used in September 1916 by Oswald Boelcke's Jagdstaffel 2 (Johnson, Full Circle, p. 46).

Boelcke's innovation was motivated by a desire to improve pilot survivability. As Johnson describes it:

"He reasoned that in order to fly his Fokker, navigate to his patrol line, quarter the big sky for hostile machines, dodge antiaircraft shells, and guard himself from surprise attack he required another pair of eyes. Especially did he want this assistance when he focused his eyes on a particular segment of sky, because although at first he saw nothing, he often picked out an aeroplane after searching for 20 or 30 seconds. But, Boelcke asked himself, could not some Allied fighter creep up on him within those 30 seconds?

"The greatest danger lay when an enemy approached unseen to within lethal firing range, about 200 yards. If, somehow, another pair of eyes could be positioned alongside his Fokker, on his flank, then those eyes could protect him from a surprise attack while he searched and led. And who better than Max Immelmann to provide the other eyes? . . .

"Thus Boelcke and Immelmann began to fly and fight together. They guarded and protected each other." (Full Circle, pp. 19-20)

What was the result of Boelcke's use of teamwork within Jagdstaffel 2? By the end of the first month (September 1916), his unit had destroyed 25 enemy aeroplanes at a loss of only three pilots.

THE DEATH OF BOELCKE (28 Oct 1916)

The usual battle began. Boelcke went after one, and I the other. Close to Boelcke flew a good friend of his [Erwin Boehmel]. It was an interesting fight. Both fired, and at any moment the Englishman had to fall. Suddenly an unnatural movement was observed in both German planes. The thought flashed through my brain: collision! I had never seen a collision in the air, although, like many others, I had imagined it. But this was not a collision; rather, it was a mere touching. But at the great speed of an airplane, even a mere touching is a violent concussion.

Boelcke immediately pulled away from his intended victim and fell to earth in great spiraling curves. I still did not have the feeling he would crash, but as he glided below I noticed that a section of his wing was broken. I could not observe what happened next, but in the clouds he lost a whole wing. His airplane became uncontrollable and he plunged down, accompanied all the way by his faithful friend. When we got home, the report was already there: "Our Boelcke is dead!" One could hardly conceive of it.

It was most grievous, of course, to the one who survived the accident [Boehmel].

It is strange that everyone who came to know Boelcke imagined he was his one true friend. I have met about forty of these "one true" friends of Boelcke, and each imagined that he indeed was the one true friend. Men whose names Boelcke never knew believed they were especially close to him. It was a strange phenomenon that I have observed only in Boelcke. He never had a personal enemy. He was equally friendly to everyone, no more to one, no less to another.

The one who was perhaps closest to Boelcke was the one who collided with him.

(Manfred von Richthofen, THE RED BARON, pp. 57-58)

REFLECTIONS ON WORLD WAR ONE

In the face of awesome attrition among lone wolf scout pilots, single-ship tactics gave way to team approaches.

The Germans produced the only real theorist: Oswald Boelcke.

The Americans produced some outstanding individual performers (Rickenbacker with 26 kills, Frank Luke with 21, Rauol Lufbery with 17, etc.), but no real theorists.

By 1917, virtually all of the fundamental concepts, basic fighter maneuvers, and air-to-air stratagems which would eventually be articulated in systems such as Finger-Four and Loose Deuce had been tried out in combat.

THE SPANISH CIVIL WAR (1937-38)

WERNER MOELDERS takes command of FIGHTER SQUADRON 3 from Adolf Galland in May of 1938 (Constable & Toliver, Horrido!, p. 48).

Moelders eventually scores 14 victories to become the leading German ace of the Spanish Civil War; later he will become the first German pilot to surpass Manfred von Richthofen's World War I record of 80 kills, as well as the first fighter pilot in history to reach 100 victories (Toliver & Constable, The Blond Knight of Germany, p. 295).

FIGHTER SQUADRON 3 soon converts to the Me-109C. The 109C is the first German fighter to be equipped with TWO-WAY RADIOS and OXYGEN (Mizrahi, "Defending the Reich; Part I: Intercepting the American Bomber Streams," Airpower, Sept 75, pp. 25-26).

Around this new machine Moelders hammers out the fundamentals of the ROTTE (or pair)/SCHWARM (or four-ship flight) tactics which, in the Battle of Britain, Douglas Bader will label "FINGER-FOUR." Finger-four is basically a "SHOOTER-COVER" system.

By 1943, every major air force in the world--the RAF, USAAF, Japanese and Russian air forces--will have adopted the German system (Price, World War II Fighter Conflict, p. 140).

The U.S. Air Force will later adapt Moelders' "shooter-cover" approach to the F-86, call it "FLUID-FOUR," and use it throughout both the Korean and Vietnam wars.

What was wrong with the tight, 3-ship "vic" and other formations which the RAF and USAAF brought into World War Two?

The RAF and USAAF formations were greatly inferior to the Rotte and Schwarm arrangements worked out by Werner Moelders in three crucial areas:

1. The ability of each aircraft to MANEUVER as required and yet still maintain COHESION.
2. The ability of pilots (in the formation) to search each others' blind areas and thus PREVENT A SURPRISE ATTACK.
3. The ability of the formation to provide RAPID SUPPORT to any plane in the formation coming under attack. *

* Price, World War II Fighter Conflict, pp. 134-35.

MOELDERS (in a conversation with ADOLF GALLAND): "You can be the Richthofen of the Luftwaffe Adolf. I will be its Boelcke." (Horrido!, p. 59)

Toliver & Constable: "Only a few men in military life, in any country, have the vision, insight, and force of personality to fit new tactics to new technology. Moelders was such a man." (Horrido!, p. 49)

Hartmann Grasser (103 kills), who served as Moelders' adjutant during the Battle of Britain and in Russia, says of him:

"Werner Moelders was a very well-educated and highly intelligent man with an exceptionally good character. His character was such that it guaranteed everything else about him. He had a direct line of thought, was brilliantly analytical, and he was especially a man with good discipline.

He had an ear and an eye for everybody in his GESCHWADER. He had a good discipline without harshness, and an understanding for the mistakes of others . . .

"He was an outstanding teacher and instructor. He could teach you to fight in the air. His special attention was given to every new pilot who came to the wing. He would take these young men to himself and introduce them to the conditions and demands of aerial fighting. . . .

"He had a gift for tactics, an outstanding tactical imagination. He was mature beyond his years, an analytical thinker, a practical man and with it all a humanist. I owe my life entirely to Werner Moelders. He not only showed me how to fight in the air, he showed me how to stay alive and come back from a fighter operation. His men were devoted to him." (Horrido!, pp. 52-53)

DIMENSIONS OF THE AIRWAR IN THE WEST DURING WORLD WAR II

In World War II, USAAF pilots claimed 20,626 enemy aircraft destroyed (in the air and on the ground) in Western Europe, and other 8,899 in the Pacific (Armed Forces Journal International, May 74, p. 30).

In Europe the 56th Fighter Group (one of fifteen 3-squadron fighter groups in the 8th AF) scored the most air-to-air victories with 647 1/2 confirmed kills; the 4th Fighter Group (which would later serve in MIG Alley) claimed 583 1/2 kills in the air and another 469 on the ground (Stafford & Hess, Aces of the Eighth, pp. 20 & 8).

Over the course of the Korean War, F-86 pilots scored only 792 confirmed MiG-15 kills (Wagner, The North American Sabre, p. 78).

Eight years of air operations over North Vietnam produced about 600 engagements, and only 181 confirmed kills (127 USAF, 54 Navy). (Armed Forces Journal International, May 74, p. 38)

Thus only TWO of the 15 USAAF fighter groups of the 8th AF shot down more enemy planes in World War II than did Sabre pilots throughout the Korean War! And the 56th alone scored more aerial victories in the West during World War II than U. S. pilots had aerial engagements during the Vietnam war.

THE AIRWAR ON THE RUSSIAN FRONT IN WORLD WAR II

"There is a natural tendency in Western countries to regard the Anglo-American air assault on Germany as the major arena of aerial conflict. In truth, the aircraft losses sustained by the Soviet Union were approximately twice those suffered by the Anglo-American air forces. The biggest air war was fought on the Eastern Front." (Toliver & Constable, The Blond Knight of Germany, p. 120)

The LUFTWAFFE'S GREATEST TRIUMPH: According to the Soviet sources, by noon of the first day of the invasion of Russia (1 Sept 1941) the Luftwaffe had destroyed 1200 Russian aircraft (Messenger, The Blitzkrieg Story, p. 166). And by the end of the first month, the Luftwaffe's tally had risen to almost 5000 Russian planes of all types (Constable & Toliver, Horrido!, p. 13).

THE LUFTWAFFE "EXPERTEN" IN WORLD WAR TWO

The ten top-scoring German fighter pilots from World War II are credited with a staggering 2551 kills! (Source: Sims, The Aces Talk, p. 291)

The Luftwaffe had no fewer than 103 pilots with more than 100 victories (including 10 who scored over 100 against RAF and USAAF pilots). (Gaal, "The Luftwaffe's 'Kills,'" FLYING INTERNATIONAL REVIEW, Dec 65, pp. 243 & 245)

JG-27 claimed 1,172 kills in North Africa during 1941 and 1942, but no fewer than 674 of these victories are credited to a mere 15 pilots (Gaal).

On the Eastern Front, 24,000 of the Luftwaffe's 44,000 "kills" are credited to only 305 pilots (Gaal).

ERICH HARTMANN: From 5 Nov 42 through 8 May 45, Hartmann scored 352 kills (345 against Russian pilots and another 7 against American-flown Mustangs). (Toliver & Constable, The Blond Knight of Germany, pp. 282 & 292)

His first kill came on his 19th combat sortie and his last on his 1405th, just 2 1/2 years later.

He was forced to bail out or crash land 16 times, but at least 8 of those downings resulted from flying into the debris of Russian aircraft he had exploded at point-blank range (Horrido!, p. 104).

THE LUFTWAFFE'S "KILLS"

YEAR	RAF-USAAF LOSSES DUE TO ENEMY ACTION	LUFTWAFFE CLAIMS BASED ON DAILY GERMAN HIGH COMMAND (OKW) COMMUNIQUES
1941	3, 408	3, 621 (excl. 1-14 Jan 41)
1942	4, 733	4, 903 (excl. 11-31 Dec 42)
1943	8, 275	7, 985 (excl. Dec 43)
1944	19, 396	16, 194
1945	6, 110	3, 768 (excl. Apr-May 45)
TOTALS	41, 922	36, 471

Source: Julius Gaal, "The Luftwaffe's KILLS," Flying International Review,
Dec 1965, p. 245.

EXCERPTS FROM THE LOGBOOKS OF BOB JOHNSON & "DADDY" MOELDERS

ROBERT S. JOHNSON (28 kills)

WERNER MOELDERS (115 kills: 14 Spain,
68 West, 33 Russia)

<u>Victory</u>	<u>Mission</u>	<u>Date</u>	<u>Type</u>
1	11	13 Jul 43	FW-190
5	43	10 Oct 43	FW-190
10	54	31 Dec 43	FW-190
15	64	20 Feb 44	Me-110
20	73	15 Mar 44	FW-190
28	91	8 May 44	Me-109

<u>Mission</u>	<u>Date</u>	<u>Type</u>
6	21 Sep 39	Curtiss
53	2 Mar 40	Hurricane
78	23 Apr 40	Hurricane
110	21 May 40	Morane
116	27 May 40	Curtiss
129	28 Aug 40	Spitfire

JOHNSON: 28 kills in 91 missions
over less than 11 months

MOELDERS: 28 kills in 129 missions
over slightly more than
11 months

(Constable & Toliver, Horrido! Fighter Aces of the Luftwaffe, pp. 56-57)

THE BATTLE OF BRITAIN (10 July 1940 - Oct 1940) RECONSIDERED

RAF LOSSES: 915 fighters, 300 bombers

GERMAN LOSSES (all types): 1,733 (GAF admitted--Johnson, Full Circle)
2,698 (RAF claimed)

1,789	{	1,385 combat losses	{	502 Me-109s
		404 other causes		224 Me-110s
				488 bombers
				59 Stukas

"RAF fighter losses . . . were considerably higher than the Luftwaffe's, perhaps by a ratio of as much as two to one. . . . In the dogfighting the Me-109 apparently acquitted itself, all things considered, very well."
(Sims, The Greatest Aces, p. 37)

THE BATTLE OF BRITAIN RECONSIDERED

Given their air-to-air expertise, HOW DID THE GERMANS LOSE?

BAD INTELLIGENCE led to BAD TACTICS

Tied their fighters to their bombers

Failed to concentrate on the British radar network

Employed large gaggles of airplanes instead of small groups; crossed the Channel at medium altitudes rather than low level.

"In my view the Luftwaffe could have won air domination over southern England within two weeks and would then have been ready for the next phase of their campaign--the isolation of the battlefield--by blasting cities, towns, railway centres and harbours. Then, opposed only by the British Army still handicapped by the loss of much equipment at Dunkirk and by a Royal Navy fighting at great disadvantage in the narrow confines of a Channel dominated by the Luftwaffe, the German airborne troops might easily have seized a suitable piece of Kent in which to establish and build-up an invading force."

(Johnson, Full Circle, p. 174)

LEADING ARMY AIR FORCE ACES OF WORLD WAR TWO

Maj Richard T. Bong	40	Maj David L. Hill	18.25
Maj Thomas B. McGuire	38	Lt Col Charles H. Older	18.25
Col Francis N. Gabreski	28 (6.5 Korea)	Col Walter C. Beckham	18
Lt Col Robert S. Johnson	27	Col Herschel H. Green	18
Col Charles H. MacDonald	27	Col Hubert Zemke	17.75
Maj George E. Preddy	26.83	Lt Col John B. England	17.5
Col John C. Meyer	24	Maj Duane W. Beeson	17.33
Col David C. Schilling	22.5	Maj John F. Thornell, Jr.	17.25
Lt Col Gerald R. Johnson	22	Maj Robert W. Foy	17
Col Neel E. Kearby	22	Maj William N. Reed	17
Col Jay T. Robbins	22	Capt James S. Varnell	17
Capt Fred J. Christensen	21.5	Col Gerald W. Johnson	16.5
Capt Ray S. Wetmore	21.25	Capt John T. Godfrey	16.33
Lt Col Walker M. Mahurin	20.75 (3.5 Korea)	Lt Col Clarence E. Anderson, Jr.	16.25
Maj John J. Voll	20.5	Col William D. Dunham	16
Lt Col Thomas J. Lynch	20	Lt Col Bill Harris	16
Lt Col Robert B. Westbrook	20	Maj George S. Welch	16
Capt Donald S. Gentile	19.83	Capt Donald M. Beerkbower	15.5
Col Glenn E. Duncan	19.5	Maj Richard A. Peterson	15.5
Maj Leonard K. Carson	18.5	Maj Willaim T. Whisner	15.5 (5.5 Korea)
Lt Col Glenn T. Eagleston	18.5 (2 Korea)	Col Donald J. M. Blakeslee	15

"There are two things a fighter pilot must have to do his work in combat and that he can't really acquire anywhere else except in combat: confidence in his ability to kill and confidence in his ability to get away when in trouble."

DON S. GENTILE--One-Man Air Force, p. 28.

"A thousand missions could be flown and be of no use if the pilot had not exchanged fire with the enemy."

JOHN T. GODFREY--The Look of Eagles, p. 114.

"When you look back at it or see it from the outside, it just seems like one whoosh and, bang! the Hun is dead. But not when you're in it. Oh, no, not then.

"And when the enemy has got you and is clobbering you, that's slow too. It's like lighted matches being dragged slowly across the bunched-up flesh of your brain. It feels like your brain is dissolving away under the pain on top of it. It's a fight to keep your brain together, and while you're fighting this fight, putting, it seems, your two hands on your mind holding it in one piece with all the strength in your fingers, how long it seems to last and how far away the end you want seems to be.

"I've had help in fighting this kind of fight from two Huns with whom I struck up a brief acquaintance on separate occasions. Each fought very well. They were crafty and had courage. One of them I thought was going to be real, serious trouble to me. The other I thought was going to be able to get away to fight another day.

"But suddenly, I don't know, something happened in their minds. You could see it plainly. Their brains dissolved away under the pressure of fear and had become just plain dishwater in their heads. They froze to their sticks and straightened out and ran into their graves like men stricken blind who run, screaming, off a cliff."

DON S. GENTILE--One-Man Air Force, pp. 10-11.

TRENDS IN AIR-TO-AIR TACTICS DURING WORLD WAR TWO

Hartmann's crytic tactical motto: "SEE - DECIDE - ATTACK - REVERSE or COFFEE BREAK"

Once you SPOT the enemy, DECIDE if he can be attacked from a position of tactical advantage. If he cannot be SURPRISED, then don't attack--take a coffee break instead.

Or if you attack and the enemy spots you before you can shoot him down, again, take a coffee break--wait--pull off the opponent and AVOID A TURNING BATTLE WITH AN ENEMY WHO KNOWS YOU'RE THERE.
(Toliver & Constable, The Blond Knight of Germany, p. 54)

John C. Meyer (24 kills in WW II,
2 MiGs in Korea): "I didn't turn with the enemy as a rule. I might make one turn--to see what the situation was--but not often. It was too risky . . ."
(Sims, The Aces Talk, pp. 205-206)

TRENDS IN AIR-TO-AIR TACTICS DURING WORLD WAR TWO

SIMS' SUMMARY: "In the intensified air fighting towards the end of the Second World War it is significant that the most successful pilots generally avoided the classic dogfight. Instead, they developed specialized attack patterns, usually a fast pass from above taking opponents by surprise, a close-in burst, then disengagement by diving or climbing out of range with a speed advantage. The classic dogfight, featuring turns and just about every maneuver, which thousands of pilots had believed standard combat procedure, was rejected by these fighter leaders as excessively dangerous. Some of the aces using these tactics taught replacement pilots their philosophy of fighter combat, though many flew to the end of the war without being aware of the trend. It was not, of course, a new approach. Richthofen in the First World War, and others had adopted similar, cautious tactics and had been highly successful in pursuing them." (The Aces Talk, p. 205)

"As soon as you get a better machine you can take on all those low performing aircraft (and shoot them all down). You've got historic examples of that that are just as applicable today as when they happened. Look at the German Stuka; it was a great airplane (for attacks on ground forces) as long as it didn't run into anything that could shoot it down. As soon as they started using it in the air where the British Spitfires and P-40s were available to fight it, it disappeared from the battlefield. The Me-109 and FW-190 were a similar example because they set their production on those two aircraft prior to the time we set the production on ours, and ours were the superior aircraft. And we beat them. Now, if they'd come out with the Me-262 (jet fighter) sooner, they would have beaten us. I don't think there is any question about it, in the air-to-air business you've got to have a superior aircraft." (Gen Disosway, 1970 interview, American Defense Policy, 3rd Edition, pp. 438-39)

WHY? ". . . I came to the conclusion that eight P.51s were the equal of one Me.262 if each knew of the other's presence." (John C. Meyer in The Aces Talk, p. 208)

BUT . . .

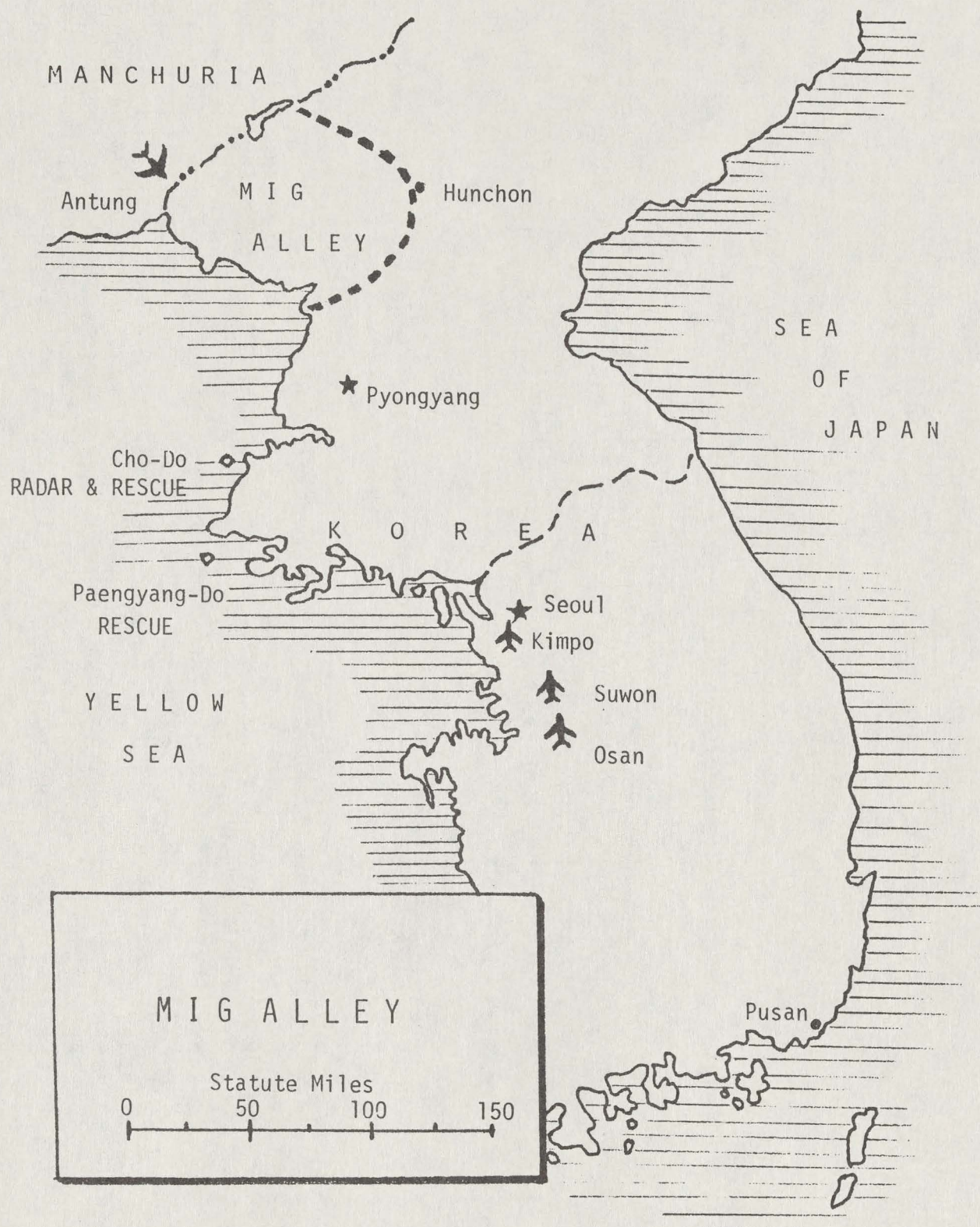
Hartmann once held eight P-51s at bay in a lone Me-109G (until they ran him out of gas). (Recounted in the "Mustangs" chapter of The Blond Knight of Germany)

Robert S. Johnson: "Generally speaking, I'd say the best 109s and the P.51 were very close in performance; the difference was probably in the pilots in those combats." (The Aces Talk, 230-31)

Riccioni (after flying F-100Cs against Mark VI Sabres in Spain):	"I had won only about five scissor fights despite some thirty initial attempts and had been humiliated frequently in other maneuvers." (<u>Tigers Airborne</u>, p. 89)
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Pete Petigrew: ". . . I doubt that any Navy or Israeli pilots will say that the MiG 17 is less capable. In fact, the MiG 17 when engaged was considered the hardest to kill, followed by the MiG 19; moreover, the supersonic MiG 21 statistically proved the easiest to dispatch, its turning capability being far less than the 17 and its ability to take hits seemingly nil." (Aviation Week, 3 Dec 73, p. 62)

TOPGUN pilots have had consistent success fighting the "superior" F-14 with two F-5s.



AERIAL COMBAT IN WORLD WAR TWO AND KOREA

	USAF			USN & USMC			TOTALS		
	Kills	Losses	Ratio	Kills	Losses	Ratio	Kills	Losses	Ratio
World War II	29,525	22,948	1.3-1	9,291	907	10.2-1	38,816	22,855	1.6-1
Korea	918*	147	6.2-1	23	4	5.8-1	941	151	6.2-1

* Excludes 175 "probable" kills; includes some kills by USMC land-based aircraft.

Source: ARMED FORCES JOURNAL INTERNATIONAL, May 74, p. 30.

THE SABRE versus THE MIG-15 IN KOREA

On the balance, the MiGs downed 78 Sabres for certain and probably most of the 26 unknown and missing F-86s. In exchange, the MiGs lost at least 792, for any exaggerated reports by Sabre pilots are offset by the 119 "probable" Sabre victims. Thus a kill-ratio of around 10-to-1 was achieved over the MiG-15 in Korea. (Wagner, THE NORTH AMERICAN SABRE, p. 79)

WHY? WHAT ACCOUNTS FOR THIS LOPSIDED EXCHANGE-RATIO?

MACHINES ??

MIG-15 versus F-86

Wing Loading: MIG -- 50.23 lbs/ft² F-86A -- 50.06 lbs/ft²

Speed: MIG was faster than the F-86A above 30,000 ft and faster than the F-86E above 35,000 ft; below these altitudes the Sabre was faster (for example, at Sea Level the MIG-15 could go 668 mph, the F-86A 679, and the F-86E with slats 695). The F-86F with leading edge slats was faster than the MIG from Sea Level up to its service ceiling.

WEIGHT: MIG -- 11,070 lbs with ammo F-86A (clean) -- 13,790 lbs

Initial Rate of Climb: MIG -- 10,100 ft/min reaching 30,000 ft in 4 minutes F-86F -- 9,300 ft/min reaching 30,000 ft in 8.8 minutes

Turn Radius: The MIG had the smaller turn radius, but this advantage was compromised by poor stall characteristics.

Roll Rates: The Sabre's roll capability was considerably superior (hydraulic aileron boost in the F-86E plus the "flying" tail).

Stability: Test flights of an actual MIG-15 by U. S. pilots revealed that the MIG showed a loss of control and poor lateral directional stability at high altitudes and speeds.

Armament: MIG -- one 37 mm cannon plus two 23 mm guns; manual ranging & slow fire-rates F-86 -- six 50 calibre machine guns, a better sight, and radar ranging in some models.

Cockpit Visibility: It was much better out of the F-86.

MIG - 15 versus F - 86

One U. S. Sabre pilot (Col. Sommerich) who was able to test fly an operational MIG-15 provided by a North Korean defector had this comment:

Overall the MIG was ". . . not a bad airplane for acceleration, climb and maximum altitude, but I could still whip it with an F-86 any day in the week. Seeing them above us so often was only one problem--how to get them down where we were so we could fight. When he stayed over 50,000 feet he was safe." The Russian plane was ". . . nowhere a match for the F-86, if the F-86 kept a high Mach." (Wagner, The North American Sabre, p. 83)

But James Jabara said: ". . . the fact remains, the MIG could outperform the F-86 at any altitude, except in a dive, and was a better fighting machine at the higher altitudes." (Air Force Magazine, August 1960, p. 60)

TACTICS ??

Col. "Gabby" Gabreski, commanding the 51st Fighter-Interceptor Wing, is an expert on Luftwaffe technique and recognizes the MIGs practicing standard anti-bomber tactics developed by the Germans against B-17 formations during World War II.

(AIR FORCE MAGAZINE, April 1952, p. 27)

EXPERIENCE ??

Nuggets versus the "Honchos"

"Two years of jet warfare over North Korea have failed to produce a MIG aircraft-pilot combination of a high standard. While in general the characteristics of the MIG itself are considered to be on a par with those of the F-86, the Red pilots have rarely demonstrated the ability to exploit fully the aircraft's capabilities. However, in certain engagements enemy pilots have shown a proficiency in a variety of tactics and have demonstrated their ability to maneuver with the best of the U. N. pilots."

(Air University Quarterly Review, Spring 1953, p. 89)

THE DISTRIBUTION OF MIG-15 KILLS AMONG USAF SABRE PILOTS IN MIG ALLEY^a

KILL SCORE	NUMBER OF PILOTS	PERCENTAGE OF PILOTS	NUMBER OF KILLS ^b	PERCENTAGE OF TOTAL KILLS
0	428	53.5%	0	0.0%
1/2 - 1	212	26.5%	191	24.5%
1.5 - 2.5	83	10.4%	158	20.4%
3 - 4.5	39	4.9%	132	16.9%
5 - 9	27	3.4%	167.5	21.5%
10 - 16	11	1.4%	130	16.7%
	800 pilots		778.5 kills	

38 aces

4.8%

38.2%

a Only includes MIG-15s destroyed in the air by USAF pilots.

b Only includes F-86 pilots with 25 or more counter-air missions.

(Torrance, Rush, Kohn & Doughty, FACTORS IN FIGHTER-INTERCEPTOR PILOT EFFECTIVENESS, Technical Report AFPTRC-TR-57-11, Nov 1957, p. 1)

Comparison of responses on a "Life Experience Inventory" by 31 aces and 31 non-aces (matched for similar age, rank, and World War Two combat experience to the aces) ". . . suggested that the aces were likely to differ from the nonaces in the following respects:

1. They exhibited fewer childhood neurotic behaviors.
2. They achieved better social adjustment.
3. From an early age, they enjoyed and participated in a large number of everyday activities involving risk and strategy.
4. As boys, they exhibited more of the testing-of-limits or "trouble-making" behavior.
5. They received more early independence training."

(Torrance, Rush, Kohn & Doughty, FACTORS IN FIGHTER-INTERCEPTOR PILOT EFFECTIVENESS, p. 29)

Don S. Gentile, who scored over 20 air-to-air victories with the 4th Fighter Group during World War Two, gives this account of his adolescence in Piqua, Ohio:

The general reputation I had in Piqua was not, I think, too good. The folks around there thought I was a pretty crazy kid. I played football and baseball for Piqua Central High and managed to make the second team in basketball and was average in my studies . . .

But when I got into an automobile that had a lot of horses to gallop, I galloped them. I'd race every car on the road. I'd go 100 miles an hour sometimes when the cops chased me, because they were in Fords and could make eighty, while I had Dad's Lincoln Zephyr.

Maybe twists and turns and skids and looking back while driving wasn't good citizenship on the Ohio roads, but it turned out to be good training for driving over Germany.

On Saturday afternoons I would beat up the town in my airplane, and the cops chased me in that too. I could see their cars running after me, trying to get my number. I'd raise the hair on everybody's head with my propeller. I'd blow the curtains on Betty Levering's house and make the geraniums in Marge Dill's front yard give up their pedals.

Then the cops would come into our parlor and Dad would give them cigars. "Was that you flying low?" they'd ask me.

"Did you see a number on the plane?" I'd say.

"Hell," they'd say. "You was going 900 miles a minute. Who could count the numbers?"

After a while they'd go off, saying, "You've got to quit this low flying around town. You know it ain't safe."

And it was against the law, but I did it. I did it because I wanted to.
(Gentile & Wolfert, One-Man Air Force, pp. 22-23)

THE "ACE" SYNDROME

Interview results which compared 27 aces and near-aces (i.e. pilots with four or more kills) with 27 pilots of similar background who scored three or less kills contained ". . . evidences of superior motivation among the aces and near-aces." Specifically:

1. They exerted unusual efforts to obtain assignments to fighters, F-86s and/or combat in a fighter-interceptor organization.
2. They gave much more elaborate descriptions of the satisfactions derived from fighter-interceptor flying and expressed almost no dissatisfactions.
3. They expressed stronger motivations for additional combat duty and reported acts which reflect strong motivation for such duty.
4. Their lives seem to have been characterized by singleness of purpose and intensity of effort.

(Torrance, Rush, Kohn & Doughty, FACTORS IN FIGHTER-INTERCEPTOR PILOT EFFECTIVENESS, p. 30)

Bob Johnson gave this description of his feelings when it appeared, on his last mission, that the Germans might not appear (he was already working on a 25 hour extension of the normal 200 combat hour tour):

My disgust mounted. I had remaining only five and a half hours of combat time; when the last minute went, I would be finished with the combat tour and the extension. The thought of flying my last mission appalled me. Up to this moment I still had time remaining to break out of formation and run for home; I would land with enough time to fly another mission during which the Luftwaffe might show some signs of life. I was so disgusted I tried to find serious fault with the airplane so I could claim a mechanical failure and abort the mission. As it was, I had a headache, the engine was running rough, and I thought the prop was going to come off. The more I thought about it the worse things became. I could just make it back to the base with perhaps a half hour left to complete my tour; enough to justify another flight into Germany. And that made up my mind; I pressed the radio button and began my call to Joe Perry to have him take over.

I made one final study of the bombers--a B-17 exploded with a dazzling glare! There they were; fighters diving through the formations. Suddenly my headache was gone and the big Pratt & Whitney purred smoothly. I stabbed my finger down and yelled, "The bombers are being hit--let's go get 'em!"

(Johnson with Martin Caldin, Thunderbolt!, pp. 289-290)

THE DISTRIBUTION OF OPPORTUNITIES TO SCORE KILLS AMONG F-86 PILOTS IN MIG ALLEY

Jet fighter pilots have often been characterized as "hungry tigers." The following few statistics show how well the "typical" tiger's appetite was satisfied. The typical pilot (in the 4th Fighter Interceptor Wing, which destroyed an estimated 484 enemy aircraft for 48 losses during the Korean War and had a pilot population of 520 individuals) flew 41.5 - 102.4 combat missions in Korea. During all of these missions he sighted 1.9 - 12.6 enemy aircraft. Of these aircraft 0.3 - 4.3 were fired upon and he was credited with destroying 0.4 - 1.5. . . . The implications of this series of events may be emphasized by considering the kills/mission ratio of the typical pilot. The value of this ratio is .002 - .017. The probability that the pilot would destroy an enemy airplane given that he flew a combat mission was only about one chance in 100. In brief, the "hungry tiger" almost starved to death in Korea.

(Strawbridge & Kahn, FIGHTER PILOT PERFORMANCE IN KOREA, IAWR Report 55-10, Nov 1955, pp. 16-17)

How many pilots had reasonable opportunities to score kills in the 4th F.I.W. during the Korean War? Strawbridge and Kahn point out that of the 520 pilots who flew combat with the wing, only 69 (or 13.3%) had 15 or more encounters with the enemy while serving as a flight or element leader (FIGHTER PILOT PERFORMANCE IN KOREA, p. 19).

"So he said, 'Pick one of them and stick him in front and see what you can do,'" General Meyer reported. 'They want one.'

"So I decided on Jabara as the most likely candidate. Anything that was a milk run, he didn't go, and anything up on the Yalu, he did go and we saw that he was in the flight-leader position, which was usually the best."

("A Race for an Ace," Airman Magazine, November 1975, p. 20)

TO WHAT EXTENT ARE "KILLS" A VALID MEASURE OF INDIVIDUAL AIRCREW SKILL??

USING "KILL SCORES" OVERLOOKS

the fact that some kills are easier than others (compare, for example, a standoff Sparrow kill to one resulting from a hard-fought maneuvering contest against a skilled, courageous opponent),

the significance of defensive skills (if you are "bounced" but only manage to disengage--that is, you do not reverse your initial defensive situation and go to score a kill--your accomplishment cannot be reflected in any "box score"), and

the increasing complexity of the air combat arena.

A THOUGHT FOR THE NEXT WAR:

"In a period characterized by fewer aircraft and skilled pilots, and combat areas where the enemy enjoys a large numerical superiority, the ability to escape being shot down could loom large." (Peter deLeon, Rand Report R-2070-PR, January 1977, p. 44)

FIGHTING WORDS

Which is to say -- "The Fluid Four is Dead!" (p. 2)

If a man is spending 50% of his time maintaining his position, he can use only the remaining 50% of his time looking around. Also, since the wingman is flying in the so called maximum performance cone behind the leader, he also is in the leader's blind spot; and THE WINGMAN HAS THE IMPOSSIBLE DUTY OF GUARDING THEIR six o'clock position. Only a valorous call from the wingman as he goes down in flames will save the leader in these circumstances. Ultimately, it will be shown that THE WORST POSSIBLE POSITION FOR A WINGMAN TO FLY IS THAT DICTATED BY THE OLD SYSTEM of fighter employment (p. 3).

The new system is the literal manifestation of the concept --- attack, attack, then attack, attack, attack -- WAR'S NATURE LIES IN THE ATTACK! (p. 12)

Attack is the artful and powerful aspect of the new system. Once the light is seen, the superiority of the new system is made completely clear (p. 5).

Recent association with men of considerable experience in past conflicts REVEALS A GREAT TENDENCY TO RELY ON METHODS THAT HAVE PROVEN RELIABLE IN THE PAST RATHER THAN TREAT THE PROBLEM WITH AN OPEN MIND . . . This backward thinking would result in fighting the new war with the methods of past war - a severe limitation and certainly unacceptable thinking! It has been a great fallacy of our fine Fighter Weapons School to discuss the methods which work reasonably well against other F-100s rather than face up to the enemy at hand (p. 13).

* All page references are to Everest E. Riccioni, A PROPOSED NEW METHOD OF EMPLOYING THE F-100C IN COMBAT, unpublished paper dated 1957.

I have witnessed an almost complete sterility in the development of aerial attack doctrines. A doctrine that I created to solve a specific problem some ten years ago is neither understood nor solved by forces facing the same problem today (Preface).

Despite the very powerful, flexible nature of the airplane as a weapon, its applicability in war is a subject that has not remotely been fully explored. . . . Almost no names of the U.S. Air Forces can be considered innovators of grand strategies, strategies, doctrines, tactical doctrines, or even fighting maneuvers (Preface).

The Double Attack System is very new, or very old, depending on one's insight into history. I created this system essentially in the deep blue skies over Germany (while assigned to the 36th Fighter-Day Wing) during a period of about eight months in 1957 (p. 66).

- * All quotes from Riccioni are from his unpublished book TIGERS AIRBORNE, which was completed around 1966 while he was assigned to the Academy faculty.

AN EMBARRASSING FACT

"Lt John Boyd . . . has just completed a very comprehensive set of instructions on the best recommended techniques and procedures for using the F-100 as an offensive Air to Air weapon. This is a radical departure from 'No Guts - No Glory' and is very applicable to our operations here at Bitberg. I brought a draft copy of this manual and also secured several hundred feet of tape on the subject."

--Maj Carl Schneider, from a letter dated 28 Feb 1957 which was written following a TDY to Nellis from the 36th Day-Fighter Wing. The "comprehensive set of instructions" he refers to was later published in the June 1957 issue of the FIGHTER WEAPONS NEWSLETTER (later the USAF FIGHTER WEAPONS REVIEW).

WHO SHOULD GET "PRIORITY" FOR THE DEVELOPMENT OF MODERN LOOSE DEUCE MANEUVER OPTIONS?

Boyd articulated the essentials of the "double attack" engagement concept as an evolution beyond Blesse's 1954 "No Guts, No Glory" in his June 1957 article "Air Combat Maneuvering."

Within individual elements, his "FLUID SEPARATION" concept ENVISIONED INDEPENDENT BUT COORDINATED MANEUVERING BETWEEN ELEMENT MEMBERS.

AN ILLUSTRATIVE PASSAGE FROM THE "FLIGHT TACTICS" SECTION OF HIS ARTICLE FOLLOWS:

"The DEFENSIVE SPLIT is employed when an element has been unable to force an overshoot or gain separation upon an attacker. Since this maneuver REQUIRES EXCELLENT JUDGMENT to execute properly and places the defenders in an extremely vulnerable position if used at the wrong time, do not use the defensive split as a standard evasive action.

"The VERTICAL SPLIT is nothing more than the application of the defensive split in the vertical plane. The maneuver is employed when an attacker appears to make an overshoot that could easily result in a slow-speed scissors. Rather than have a dangerous standoff, a FLUID SEPARATION is performed in the vertical plane . . .

"When operating as a flight of four on the defensive the basic consideration in any supporting action against an attack is the idea of KEEPING BOTH ELEMENTS' LINE OF FLIGHT PARALLEL. This allows the defenders in a FLUID SEPARATION, whether near vertical or horizontal, TO SET UP EFFECTIVE SUPPORTING ACTION in an attempt to achieve an offensive advantage. By contrast, when making an attack with a flight of four, a separation of the elements will be necessary in an effort to prevent the defenders from setting up effective mutual support."

(Boyd, "Air Combat Maneuvering," June 1957 issue of the FIGHTER WEAPONS NEWSLETTER, p. 26; emphasis added.)

BOYD'S 1960 AERIAL ATTACK STUDY

"In discussing fighter-versus-fighter combat, it is evident that many pilots believe that there are an infinite number of situations and solutions in a given tactical encounter. Such is not the case! The field in which a fighter pilot must operate is three-dimensional and finite. The size and shape of the field is determined by the pull of IG gravity and the performance limitations of the aircraft and its pilot. . . . Thus, in a fighter-versus-fighter situation, the pilot can do two things to gain an advantage over the opponent: Change turn and/or velocity, in respect to the opponent. He can accomplish either or both by maneuvering through both the vertical and horizontal planes by employing either a two-dimensional maneuver through three-dimensional space, or a three-dimensional maneuver (barrel roll)." (Page 49*)

". . . our first maneuver for discussion will be the defensive turn. We choose to start with this maneuver because it is the basic maneuver by which the defender tries to nullify the attacker's advantage. This may cause our approach to appear to be defensive in nature, however, we feel that this is necessary since ANY OFFENSIVE ACTION IS DIRECTLY DEPENDENT ON THE PRECISE MANEUVER WHICH THE DEFENDANT CHOOSES TO EXECUTE [emphasis added]. If the defender's knowledge is limited in scope, the attacker's corresponding maneuvers will reflect this limitation." (Page 51)

"To employ a flight of four or an element of two in a fighter-versus-fighter engagement, only a few new basic maneuvers must be mastered. The previous maneuvers we have learned still apply in flight tactics." (Page 122)

(* Source: Capt. John R. Boyd, AERIAL ATTACK STUDY, from the 11 Aug 64 revision of the study originally published at Nellis in 1960)

BOYD'S MANEUVER/COUNTER-MANEUVER SCHEME (1960)

INITIAL SITUATION: One F-4 attacking one MiG-21 from the rear, 150 knots of overtake, 20 degrees angle-off.

INITIAL DEFENDER OPTIONS (upon visual contact):
BREAK
DEFENSIVE TURN (level, climbing,
or descending)
SPLIT-S and RUN
UNLOAD AND EXTEND/RUN

DEFENDER CHOOSES A LEVEL DEFENSIVE TURN INTO THE ATTACK.

ATTACKER OPTIONS: OVERSHOOT (which opens up the prospect of a reverse by the
Mig-21)
HIGH YO-YO
BARREL ROLL

ATTACKER CHOOSES TO YO-YO HIGH.

DEFENDER OPTIONS: ~~TIGHTEN DEFENSIVE TURN~~ (attacker's yo-yo is too low)
~~QUARTER ROLL AWAY~~ UNLOAD, EXTEND (attacker's yo-yo is too high)
~~DEFENSIVE PULL-UP~~ once the attacking F-4 starts down to press
the attack (attacker's yo-yo was properly
executed)

AND SO ON . . .

D. M. Stachurski

SOME KEY FEATURES OF BOYD'S MANEUVER/COUNTER-MANEUVER SCHEME

- *** THE NUMBER OF BASIC FIGHTER MANEUVERS IS FINITE (hence, as you move forward in the engagement, you keep digging back into the same bag for maneuver options).
- *** AT ANY "DECISION POINT" (for either the attacker or the defender), THERE ARE ONLY A FEW REASONABLE MANUEVER OPTIONS (usually no more than three or four).
- *** FOR ANY "MOVE" THERE IS A "COUNTER-MOVE."
- *** WHILE THE EVOLUTION OF AN ENGAGEMENT FROM DECISION POINT TO DECISION POINT IS NOT, IN THEORY, LIMITED, THE SEQUENCE WILL EVENTUALLY BE TERMINATED BY FUEL EXHAUSTION OR THE ATTAINMENT OF A "KILL" BY ONE OPPONENT OR THE OTHER.

IDEALLY, EACH PILOT WOULD CARRY AROUND IN HIS "MIND'S EYE" THE WHOLE ARRAY OF MANEUVERS AND COUNTER-MANEUVERS. THEN, ONCE HE BECAME ENGAGED, HE WOULD SIMPLY MAKE OPTIMAL SELECTIONS FROM THAT MANEUVER/COUNTER-MANEUVER ARRAY IN LIGHT OF HIS TACTICAL SITUATION AT THE MOMENT. BUT FEW PILOTS CAN DO THIS, especially when they first start out, AND SO WE HAVE TRADITIONALLY HAD "TACTICS" TO HELP.

WHAT THEN IS A TACTICAL SYSTEM (like Fluid-Four or Loose Deuce)? IN EFFECT, TACTICAL SYSTEMS SUCH AS FLUID-FOUR AND LOOSE DEUCE ARE SIMPLY EXPRESSIONS OF INTENT (among pilots on the same side) ABOUT PREFERRED CHOICES FOR THE DECISION POINTS THEY ANTICIPATE ENCOUNTERING.

A SPECTRUM VIEW OF TACTICAL SYSTEMS FOR AIR COMBAT

██████████ Degree of Independent Maneuvering Permitted ██████████
between Aircraft on the Same Side

3-ship RAF
"vics"--early
World War II

FLUID-FOUR
(MIG Alley)

FLUID-FOUR
(in theory
at Nellis in
the late 60s)

DOUBLE ATTACK
(simultaneous
attacks--1957)

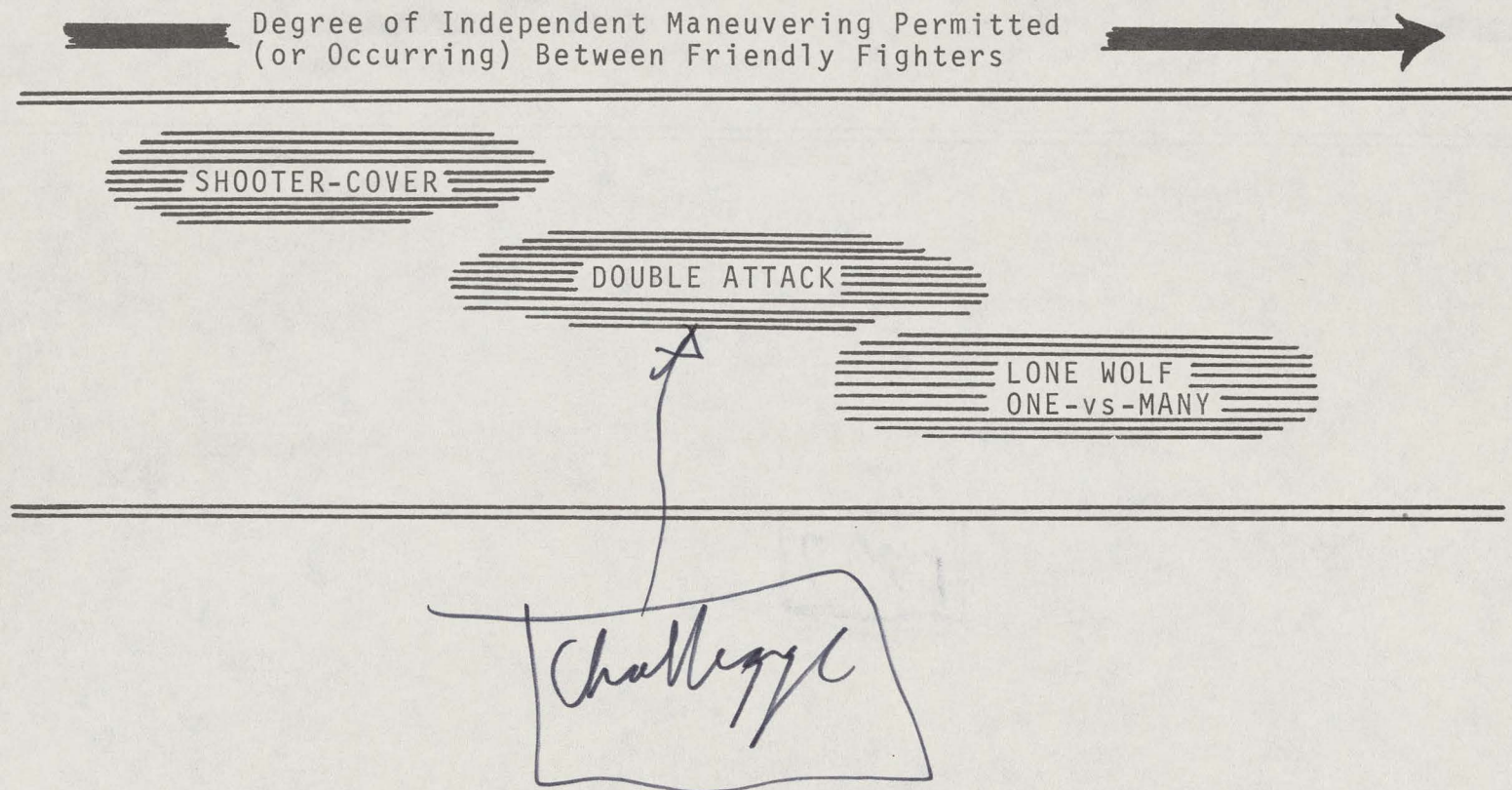
LOOSE DEUCE
(in theory)

LONE WOLF
&
ONE-vs-MANY
(Mideast 1973)

Loose Deuce (as actually flown in
85% of the Navy's MIG kills in
Southeast Asia)

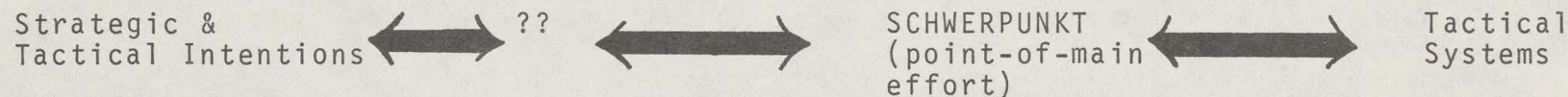
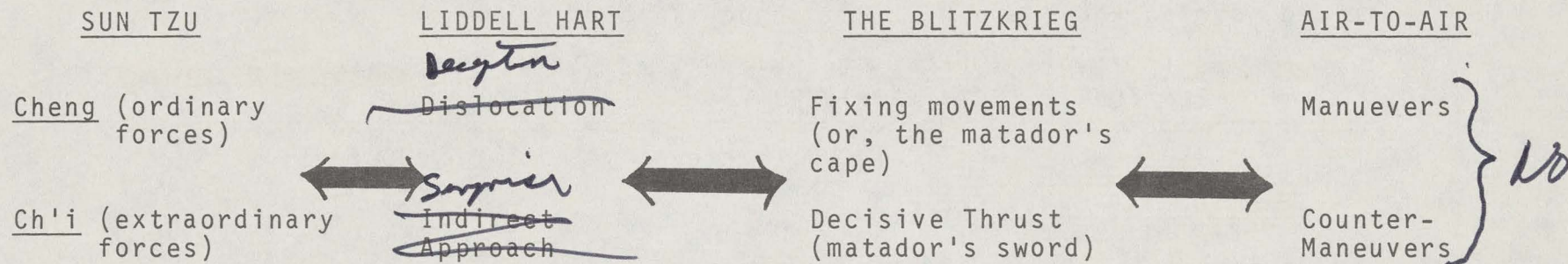
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A SPECTRUM VIEW OF "ENGAGEMENT CONCEPTS"



AN EXTENSION OF THE FUNDAMENTAL ELEMENTS OF AIR-TO-AIR
COMBAT INTO BROADER CONTEXTS

h i



NO

ENERGY-MANEUVERABILITY (Boyd - early 1960s at Eglin)

The ORIGINAL INTENT was to quantify one-versus-one comparisons of fighter aircraft. The hope was to be able to answer questions such as: WHERE AND HOW SHOULD AN F-4 FIGHT A MIG-21? Energy-maneuverability comparisons yielded, during the Vietnam era, guidance such as:

AVOID TURNING WITH A MiG-21; INSTEAD, FIGHT VERTICALLY AND
KEEP YOUR ENERGY (MACH) UP.

TRY TO KEEP THE FIGHT LOW (preferably below 15,000 feet).

Energy-maneuverability analysis has been refined more and more since the early 1960s. The latest version is dated 1972 (Boyd, Christie, Drabant, The Maximum Manuever Concept, 25 Sept 1972). It makes the following points:

"Maneuverability can be defined as the capability to perform a change, or combination of changes, in altitude, airspeed, and direction." (p. iii)

A "maximum maneuver strategy" for aerial combat eventually emerges from this understanding of maneuverability. This strategy suggests that, in general, the pilot should fly his aircraft so as ". . . to retain energy for future maneuver/countermaneuver options" (p. 13). The idea, in short, is to conserve energy relative to your opponent.

Interpretation of energy-maneuverability data prior to the F-16/F-17 flyoff suggested that in the low-speed, high angle-of-attack regime, the F-17 should be able to beat the F-16 (due to the 17's ability to sustain higher energy levels in this regime).

In the actual flyoff (one-versus-one engagements between the two prototypes), the 16 predominated in the low-speed, high angle-of-attack regime--contrary to energy-maneuverability predictions.

WHY??

What happened was very simple. The F-16 had a large and very effective speed brake in comparison with the F-17's. As a result, even though the 17 could sustain higher energy levels in the flight regime in question, the 16 could LOSE ENERGY FASTER. In brief, the 16 pilots simply dropped the speed brake, spit the 17 out in front, and killed it. *no*

BOYD'S ANALYSIS: Since the basic energy-maneuverability data was correct, the problem had to lie in our INTERPRETATION of that data.

More specifically, while higher turn-rates/lower turn-radii generally indicate a superior machine for POSITIVE ENERGY RATES, the same thing does not necessarily hold for NEGATIVE ENERGY RATES.

Rather, "goodness" in a fighter aircraft should be thought of in the following terms. What we want is a machine ". . . THAT CAN BE USED TO INITIATE AND CONTROL ENGAGEMENT OPPORTUNITIES-- YET HAS A FAST TRANSIENT ("NATURAL HOOK") THAT CAN BE USED EITHER TO FORCE AN OVERSHOOT BY AN ATTACKER OR TO STAY INSIDE A HARD TURNING DEFENDER." (Source: Boyd's briefing slides)

Put another way, ". . . IN ORDER TO WIN OR GAIN SUPERIORITY, WE SHOULD OPERATE AT A FASTER TEMPO THAN OUR ADVERSARIES OR INSIDE OUR ADVERSARIES' TIME SCALES." (Boyd's briefing slides)

AIR-TO-AIR IN VIETNAM¹

	U.S.A.F.			NAVY			OVERALL MIG/US RATIO
	MIGS DOWNED	LOSSES	RATIO	MIGS DOWNED	LOSSES	RATIO	
1965	2	3	0.67	3	1	3.0	1.25
1966	16	5	3.2	6	4	1.5	2.44
1967	55	21	2.62	14	4	3.5	2.76
1968	8	7	1.14	6	3	2.0	1.46
1969	0	0		0	0		
1970	0	0		1	0		
1971	0	1		0	0		
1972	47 ²	23	2.04	23	2	11.5	2.73
1973	1	0		1	0		
TOTALS	129	60	2.15	54	14	3.86	

ROLLING THUNDER³

LINEBACKER

- 1 SOURCE: ARMED FORCES JOURNAL INTERNATIONAL, MAY 1974, P. 38. NOTE THAT THE TOTAL NUMBER OF AIR-TO-AIR ENGAGEMENTS AGAINST MIGS DURING THE VIETNAM WAR WAS ABOUT 600. THE AVERAGE KILL-PER-ENGAGEMENT RATIO FOR ALL FIGHTERS (AIR FORCE AND NAVY) WAS 0.20.
- 2 INCLUDES 2 MIG-21s DOWNED BY B-52s. IN 1972 THE 432ND WING AT UDORN LOST 5 F-4s TO THE MIGS WHILE SCORING 33 KILLS FOR A 6.6 KILL-RATIO.
- 3 IN THE LAST MONTHS OF ROLLING THUNDER, THE NAVY FIRED MORE THAN 50 MISSILES WITHOUT OBTAINING A SINGLE KILL; THIS PRECIPITATED THE "AULT" STUDY.

U.S.A.F. AIR-TO-AIR TRAINING DURING THE VIETNAM ERA

"During the 1960's, some commanders considered air-to-air training as being 'too risky' and discouraged extensive training programs. One fighter wing in England did not fly a single air-to-air training mission for three years."

(USAF FIGHTER WEAPONS REVIEW, Fall 1975, p. 2)

During Vietnam ". . . most RTU graduates were going to war with less than 40 minutes of actual air-to-air engagement time."

(USAF FIGHTER WEAPONS REVIEW, Spring 1975, p. 24)

"During the Southeast Asia conflict, an extensive study was accomplished to reconstruct each MIG encounter that occurred in the war. The objective was to determine the reasons for success or failure in the encounter and to identify problem areas that could be resolved to provide the United States with a better fighting force.

"The most common problem found could be summed up in the words 'insufficient training and experience at 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 grossly inadequate to detect the smaller MIG's. 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 estimation 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."

(Lt Col Jerry Nabors, testimony before Congress, Senate, Committee on Armed Services, Hearings on S. 920, 94th Congress, 1st session, 1975, p. 4190)

A CONTRAST: NAVY AIR-TO-AIR TRAINING AFTER "ROLLING THUNDER"

TOPGUN -- Begun in late 1968 as the "US Navy Post Graduate Course in Fighter Weapons and Doctrine"

Resulted from the "Ault Report," whose major recommendations included injunctions to

IMPROVE MISSILE RELIABILITY

IMPROVE ACM TRAINING for all Fleet fighter units

DEVELOP A HARD CORE OF AIR-TO-AIR SPECIALISTS

FORM A GRADUATE LEVEL SCHOOL TO TRAIN Fleet fighter crews in ACM and weapons employment.

(Drendel, . . . And Kill MIGs, p. 30)

". . . by the spring offensive of 1972 literally all the Navy F-4 crews in Southeast Asia had seen at least three dissimilar ACM programs: the A-4E (MIG 17 simulator) from the Navy Fighter Weapons School; the Navy F-8; and the F-106 (MIG 21 simulator) provided by the joint NAVY ADC dissimilar program. The seeds that were sown by the Ault Report in 1968 bore fruit in 1972 when Navy fighter crews established and maintained complete air superiority over their whole area of assignment. Besides the 12:1 kill ratio, Navy crews established a 1.05 kill-per-engagement rate.

"In other words, every time they were engaged they got a kill and then used only two missiles to do it . . .

"... The U.S. can never again afford a 2.3:1 kill ratio. Realistic training is the only answer, or, as Col Boots Boothby put it, the time should never come when on a fighter pilot's epitaph we should put: 'I told you I needed more training.'"

(Pete Petigrew, AVIATION WEEK & SPACE TECHNOLOGY, 3 Dec 1973, p. 62)

Franz Stigler's comments on Jagdgeschwader 27's losses to Allied fighters during the winter of 1944-45:

"During this time, most of the pilots shot down by Allied fighters were inexperienced recruits. Once in a while an old hand's luck would run out, usually when we tried to go to the aid of a newcomer who was already helplessly lost, but the ratio was about 25 or 30 novices for every veteran." (AIRPOWER, Sept 1975, pp. 36-37)

Herbert K. Weiss (based on analysis of pilots in Richthofen's Jagdgeschwader 1, American pilots who served with the French in World War One (including with the Lafayette Escadrille), and Jagdgeschwader 26 in World War Two:

"The initial almost vertical drop in the probability of being killed between decisive combats one and five was completely unexpected.

"The question immediately arises whether the initial decline in p with score represents learning, or the elimination of the least skilled pilots."
(ANNALS OF RELIABILITY AND MAINTAINABILITY, 1966, p. 306)

Blesse (1954): "Two good aerial training flights a week are the minimum number necessary to stay in practice. If you aren't fighting the enemy, practice among yourselves." (USAF FIGHTER WEAPONS REVIEW, Spring 1973, p. 13)

Randy Cunningham: "YOU FIGHT LIKE YOU TRAIN"

SOME EVIDENCE OF CONCEPTUAL RIGIDITY IN THE AIR FORCE FIGHTER COMMUNITY

ONLY AFTER THE "LINEBACKER" OPERATIONS DID THE AIR FORCE FINALLY ADOPT THE NAVY'S LOOSE DEUCE SYSTEM (under the labels "THE FLUID ATTACK SYSTEM" and "FLUID TWO").

Moody Suter, who was head of the Aerial Attack Flight in the Fighter Weapons School at Nellis when Fluid-Two was written into TAC/USAFE/PACAF Manual 3-1, says that the "new" system was an explicit copy of Loose Deuce.

ONLY AFTER THE "LINEBACKER" OPERATIONS DID THE AIR FORCE BEGIN TO UNDERTAKE REALISTIC AIR-TO-AIR TRAINING (with the founding of the first "AGGRESSOR" squadron at Nellis, the acquisition of an Air Combat Maneuvering Range like the Navy's at Yuma, and (later) the advent of programs like "RED FLAG").

ISRAELI AIR FORCE*

SIX DAY WAR (June 1967):	IAF KILLS	IAF LOSSES (air-to-air)	RATIO
	about 60	3	20 : 1

Notes --The preemptive Israeli air strike on the morning of 5 June 1967 was primarily aimed at taking out the Egyptian Air Force on the ground. Israeli pilots claimed 374 Arab aircraft destroyed (mostly on the ground) during the first 24 hours for 19 losses (AVIATION WEEK & SPACE TECHNOLOGY, 3 July 67, p. 18). Little air-to-air occurred. In fact, the Israeli pilots were under strict orders to avoid air combat unless enemy fighters directly interfered with air strikes on the Arab airfields (AWST, 3 July 1967, p. 25). These orders were followed to an amazing extent; in one case, four Mirages ignored Jordanian fighters bombing the Israeli town of Natanya and went on to strike their target (AWST, 19 June 1967, p. 18). Almost all the Israeli air-to-air kills during this war were close-in gun kills.

END OF SIX DAY WAR TO 1 MAY 1973:	IAF KILLS	IAF LOSSES	RATIO
	125	2	62.5 : 1

Notes --During the War of Attrition (July 69 - Aug 70), the Russians took over the air defence of Egypt. On 30 July 1969, Russian-flown MIG-21MFs engaged Israeli Mirages and F-4s. The numbers were even: 8 MIGs versus 4 F-4s and 4 Mirages. In about 5 minutes of combat, the Russians suffered 4 losses and 1 damaged. One Israeli flight lead (who scored a kill that day) commented that while the Russians were reasonably adept at formation and airmanship during the initial set-up, they showed a total breakdown of organization, air discipline and mutual support once the fight was joined.

* Source: ARMED FORCES JOURNAL INTERNATIONAL, Oct 1973, p. 61.

ARAB STRATEGY: Destroy the Israeli Air Force with missile/AAA defenses. The Arab air forces would not be committed to battle until this goal was accomplished (and, in the event, they were never fully committed because the Israeli Air Force was not destroyed; it is estimated that the Arab air forces combined did not mount even as many as 1000 air-to-mud sorties, and those they did fly were not overly effective due to a lack of modern delivery systems).

ECM: The Arabs were able to jam completely the F-4's DIVE TOSS system; they were able to significantly degrade the Sparrow system in the F-4.

COMM-JAMMING: Average maximum usable transmission time on a given radio frequency was 30 seconds, and the automatic jammers would follow Israeli pilots from channel to channel. In many cases, Israeli pilots could not even get five seconds on a frequency. The only radio frequencies they had were Arab VHF GCI channels (which they elected not to jam so they could talk on them and try to extract information through comm-sampling).

HARDENING: In contrast to the Six Day War, when the Israelis were able to eliminate the Egyptian Air Force on the ground in 2 hours and 50 minutes, they found the Egyptian planes well-dispersed in solid, hardened shelters. (After the Israelis got on the west side of the Suez Canal, they tested captured Egyptian hangers and found that it took a direct hit with at least a 1000 pound bomb to penetrate effectively; 500 pound bombs were useless).

SAM TACTICS: The Egyptians elected to fire SAMs into some of the engagements. The hope was that new IFF equipment would enable the SAM operators to tell the Egyptian planes from the Israeli fighters. The new gear was not effective, and the Egyptians consequently downed perhaps as many as 30 of their own fighters. Nevertheless, Egyptian air force and air defense commanders "... agreed that losses from friendly missiles were so relatively small that the tactic of using both interceptors and missiles in the same airspace was operationally sound and militarily effective against offensive formations." (AVIATION WEEK & SPACE TECHNOLOGY, 7 July 1975, p. 18)

OVERALL COMMENTS ON THE YOM KIPPUR WAR IN THE AIR

Since the ARAB AIR FORCES WERE NEVER FULLY COMMITTED TO BATTLE, the war can be largely viewed as a CONFRONTATION BETWEEN ISRAELI FIGHTERS AND ARAB SAM/AAA DEFENSES. How successful were the Israelis in penetrating these defenses?

Unquestionably, the Israeli Air sustained a large number of aircraft losses as compared to previous wars:

102 AIRCRAFT LOSSES TOTAL	32 F-4s
	53 A-4s
	11 Mirages
	6 Super Mysteres

These losses were fairly evenly divided between the Syrian and Sinai fronts. About 40% of them were caused by SAMs, 3-10% by enemy fighters (sources vary on Israeli air-to-air losses), and the rest were due to AAA. But notice that the majority of these losses occurred within the first five days of the war:

57 TOTAL LOSSES (in the first 5 days):	16 F-4s
	32 A-4s
	5 Mirages
	4 Super Mysteres

Why? Since the Israelis were surprised by the Arab attacks, they were not mobilized. Hence, for the first few days, the Israeli Air Force was compelled to stop tank thrusts PRIOR TO ATTEMPTING TO TAKE OUT THE ENEMY DEFENSIVE SYSTEMS. Moreover, they were forced to operate this way in the face of perhaps the densest and most advanced defenses any air force has ever faced. The Egyptians, for example, had 146 SAM batteries, of which 62 were concentrated on the Suez front. And it was the case that these defenses took far longer to negate than the Israelis had anticipated (indeed, they were not able to punch holes in the Egyptian SAM defenses until they got across the Canal and overran many sites with tanks). YET THE ISRAELI LOSS-RATE PER 1000 SORTIES WAS LOWER IN THE '73 WAR THAN IT HAD BEEN IN 1967:

SIX DAY WAR:	nearly 2000 sorties flown	YOM KIPPUR WAR:	around 12,000 sorties flown
	averaged 19 losses/1000 sorties		averaged 9 losses/1000 sorties

IMPLICATION: WHILE THE MANNED AIRCRAFT--LIKE THE TANK--HAS BECOME MORE VULNERABLE BECAUSE OF THE MULTIPLICITY OF MODERN MISSILE/AAA DEFENSES, IT NEVERTHELESS APPEARS MISTAKEN TO CONCLUDE THAT THE DAY OF THE MANNED FIGHTER IS OVER.

AIR-TO-AIR RESULTS IN 1973

ISRAELI KILLS: about 335 { 60 gun kills
7 with Sparrow
rest Shafrir/Sidewinder

ISRAELI LOSSES: 4 officially admitted
but at least 6, maybe 10 or 11
(In 1975 3 Egyptian MIG-21 squadrons claimed
22 gun kills--AWST, 30 Jun 75, p. 14.)

- *** Close to 70 of the Israeli kills occurred in dogfights where so many planes were engaged at once that, even months later, it was still impossible to sort out which weapon--gun, Sparrow missile, or Shafrir/Sidewinder--actually made the kill.
- *** Few combats in 1973 finished close enough for gun kills. The Israeli pilots found that in a dense MULTI-BOGEY/COMM-JAMMING environment, they had to go for the quick shots (which usually meant taking IR missile shots) and then break immediately in order to avoid being shot down themselves.
- *** The Egyptians and Syrians had EQUIPMENT PROBLEMS. The MIG-21 gunsight tumbled at about 2.75 Gs and they found it very difficult to coordinate the aural target-lock-on tone of their Soviet-built ATOLL missiles with the pipper (AWST, 30 June 75, p. 18). As a result, many times their pilots got into firing positions but could not achieve kills--a point which the Israelis admitted to be true ("They didn't take all the shots they had."--AWST, 10 March 75, p. 17).

(Source of kill-figures: ARMED FORCES JOURNAL INTERNATIONAL, April 1974, p. 32)

CURRENT THINKING ON COMM-JAMMING

In the 1973 Mideast war only 10-12% of the total Soviet comm-jamming capability was actually employed. Moreover, in keeping with Soviet policy of exporting only older, less sophisticated pieces of military equipment, it is evident that the latest Russian equipment was not used in October 1973. (This is known in light of the numerous pieces of Soviet-built comm-jamming equipment recovered by the Israelis -- complete with maintenance publications written in English.) Thus, in the future, U.S. fighter crews should plan on encountering significantly wider-band Soviet communications jammers able to provide much greater outputs than that which the Israelis faced. Since many Mirage pilots simply took to turning their radios off after takeoff, it appears that the Soviets now have the ability to deny completely the use of UHF/VHF communications to American fighter crews.

It is currently estimated that it will take ten years to build an unjammable radio.

(Source: A comm-jamming seminar at Nellis, 27-28 Aug 1974; Driscoll was the Navy rep and these comments are from his report.)

LOOKING BACK . . . HOW MUCH HAS REALLY CHANGED??

IN SOME WAYS NOTHING: ". . . most of the tactics, formations and maneuvers employed during 1972 were already developed by 1921. Some improvements have been made but the principles remain the same."
(USAF FIGHTER WEAPONS REVIEW, Winter 1972, p. 25)

NO NEW "BASIC FIGHTER MANEUVERS" have been discovered since Boyd tried to lay them all out in his 1960 Aerial Attack Study.

"Usually new ideas are only 'a reinvention of the wheel,' or the application of some old and proven concept to a new piece of hardware or tactical situation."
(Gail Peck, USAF FIGHTER WEAPONS REVIEW, Fall 1973, p. 27)

BUT THE ARENA HAS BECOME MORE COMPLEX SINCE THE EARLY DAYS:

"Wire and fabric" planes have been replaced by sophisticated machines capable of Mach 2 flight.

Air-to-air missiles (and their ground-to-air brothers) have greatly complicated the problem of SURVIVAL in the modern air combat arena.

Pilot tasks under heavy G-loadings are more complex (three different weapons in the F-4, F-14 & F-15) and must be performed in shorter time-spans.

AND MODERN TACTICAL SYSTEMS LIKE LOOSE DEUCE ARE GREATLY MORE ELABORATED AND SYSTEMATICALLY WORKED OUT THAN THOSE USED IN WORLD WAR ONE.

PILOT RULES OF THUMB

WHAT ARE THEY?MISTAKES THAT HAVE GOTTEN PEOPLE SHOT
DOWN TIME AND AGAIN, WAR AFTER WAR

WW I

Richthofen instinctively
went for the easy kill
and avoided the turning
fight.

WW II

Hartmann: See - Decide -
Attack - Reverse or
"Coffee Break".

Meyer: "I didn't turn
with enemy pilots as a
rule".

POST 73 WAR THINKING

Be unpredictable! That is, avoid
the turning fight, take shots of
opportunity only, don't follow
your kills.

? How

. KEEP YOUR HEAD ON A SWIVEL & CHECK SIX!!

Watts, "A Comparison of 'Team' and 'Single-Ship' Approaches to Aerial Combat," 1976

LOOKING AHEAD.....

** IS THE CLOSE-IN, MANEUVERING FIGHT, whose outcome depends largely on pilot skill, aircraft performance, and tactics, A THING OF THE PAST?

** THIS PREDICTION HAS BEEN MADE AFTER EVERY CONFLICT SINCE WORLD WAR ONE.

Examples: 1967--"And it seems almost certain that, with the end of the [Second World] war, this singularly colorful form of individual aerial combat also ended for all time. Modern-day fighters and interceptors are much too fast for the twisting-turning dogfights of the two world wars." (Sims, THE GREATEST ACES, p. 14)

1977--"Air combat tactics are changing, and the big reason is technology. Long-range identification and kill capabilities are reaching the stage of development where tomorrow's jet ace no longer will have to see an enemy to destroy it. New launch-and-leave missiles, coupled with better means of target identification, will become more important than the air combat maneuvers themselves." (Blesse, AIR FORCE MAGAZINE, Oct 77, p. 34)

LOOKING AHEAD.....

- ** CAN WE AFFORD NOT TO SELECT FUTURE FIGHTER PILOTS ? (Researchers such as Norman Walker maintain that a third of typical pilot populations will never be successful in air-to-air combat no matter how much training you give them, and that such individuals can be identified in advance.)
- ** WILL THE MANNED FIGHTER BE ABLE TO SURVIVE ON FUTURE BATTLEFIELDS ?
- ** WILL MANNED FIGHTERS GIVE WAY TO REMOTELY PILOTED VEHICLES ?
- ** NIGHT ACM--We don't do it, but infra-red night-vision devices might make full-scale night maneuvering engagements possible.
- ** RICCIONI'S SUPERCRAUISER--The advent of an aircraft that retained all the maneuverability of current transonic fighters like the F-16, but could cruise efficiently at supersonic speeds, would render the air forces of the world obsolete overnight. Riccioni believes that such a machine can be built.
- ** WILL FUTURE FIGHTER ACES DO MOST OF THEIR TRAINING IN AIR COMBAT SIMULATORS ?