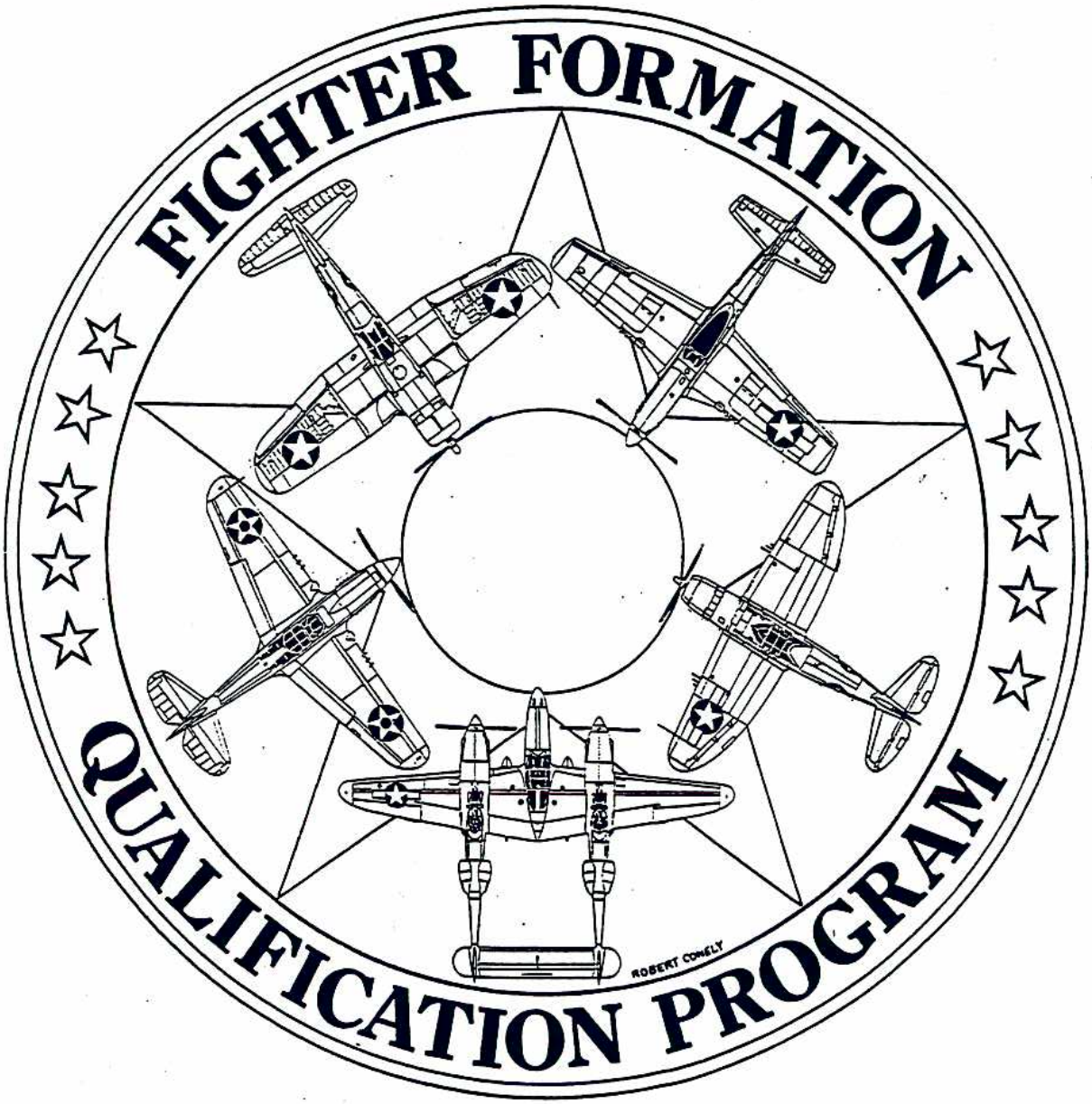
MUSTANG/FIGHTER FORMATION FUNDAMENTALS



FORMATION PHASE TRAINING MANUAL FOR THE P-51 & SIMILAR PERFORMING FIGHTER AIRCRAFT

BY: BRAD HOOD/HESS BOMBERGER 1996
FOREWORD BY: GEN CHUCK YEAGER

FOREWORD

THIS FORMATION FLIGHT MANUAL REPRESENTS CURRENT MILITARY FORMATION DOCTRINE MERGED WITH TECHNIQUES UNIQUE TO THE P-51 AND OTHER WWII FIGHTER AIRCRAFT. THIS MANUAL IS THE REAL THING...FORMATION PROCEDURES PROVEN THROUGH 50 YEARS OF FIGHTER OPERATIONS AND IN ACTUAL COMBAT.

IT TAKES A LOT OF PRACTICE, DISCIPLINE, AND PROFESSIONALISM TO BECOME A GOOD FORMATION PILOT. REMEMBER, YOU CAN'T DO ANYTHING WITH AN AIRPLANE THAT HASN'T BEEN DONE BEFORE. THAT INCLUDES ATTEMPTING TO FLY CLOSER THAN ANYONE ELSE IN FORMATION. FLYING VERY CLOSE IS NOT AS IMPRESSIVE AS SHOWING GOOD PROFESSIONAL JUDGMENT. MID-AIR COLLISIONS MAKE A MESS OUT OF YOU AND YOUR VALUABLE AIRPLANE!

GOOD LUCK AND FLY SAFE.

Chuck Yeager

BRIG. GEN. CHUCK YEAGER, USAF, RET.

August 28, 1996

The enclosed Fighter Formation manual is the result of an update to the fighter qualification materials. Many of you are familiar with "FAST" and the possible requirement by the FAA that we have a "Formation Card" in the future. While the "FAST" concept is supported, it was felt by the fighter group, that the P-51 formation training that has been in place for many years was, and is appropriate for the Fighters. It is certainly a good idea for a "new" guy to work his way up through the trainers. However, the enclosed material will be the standard for the "Fighters" unless your Flight Lead indicates otherwise.

LANCE TOLAND graciously offered to pay for the initial printing and distribution of this new manual to all of you. Many of you know Lance & have your aircraft insurance with him. We thank Lance for his continued support of the Warbird community.

A special thanks goes to the following: Brad Hood, for the many hours spent compiling this new manual. Vlado Lenoch, for the Mustang coordination. John Ellis, for the Fighter coordination. Hess Bomberger, for his efforts in getting the Mustangs in to formation back in the 70's. A special thank you to Gen Chuck Yeager for writing the forward to the manual.

In our conversations with the FAA, we have encouraged them to drop the idea of a formation card. They realize that the record keeping will be almost impossible. Hopefully we can convince them to leave the control in the hands of the Flight Lead.

We hope that you will enjoy the new manual...and most of all enjoy flying your airplanes. We look forward to seeing all of you in perfect formations.

Great Flying,

Connie Bowlin, Director, EAA Warbirds of America
Ed Bowlin
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ABOUT THE PROGRAM AND MANUAL

THE FORMATION MANUAL YOU HAVE RECEIVED WAS PRODUCED AS A BASIS FOR ALL WWII FIGHTER FORMATION. THE MUSTANG/FIGHTER FORMATION QUALIFICATION PROGRAM REPRESENTS OUR EFFORT TO STANDARDIZE ALL FIGHTER FORMATION PROCEDURES. THIS PROGRAM DOES NOT CHANGE ANY OF OUR IN-PLACE QUALIFICATIONS, THEREFORE, NO ADDITIONAL CHECK RIDES ARE REQUIRED. PILOTS UPGRADING TO FIGHTERS IN THE FUTURE AND THOSE UPGRADING TO FLIGHT LEAD WILL BE EVALUATED BASED ON THIS MANUAL SO WE URGE ALL OF YOU TO BECOME FAMILIAR WITH IT.

AS YOU KNOW THE FAA HAS BEEN HINTING TOWARD A FORMATION QUALIFICATION CARD IN THE FUTURE. GEN CHUCK YEAGER, COL BUD ANDERSON, CONNIE BOWLIN, AND I DEMONSTRATED THE NEW MANUAL, BRIEFINGS, AND PROCEDURES TO THE HIGHEST LEVELS OF THE FAA DURING OSHKOSH 1996 IN A FLIGHT OF FOUR P-51s WITH OUTSTANDING RESULTS. WE ARE URGING THE FAA TO KEEP THE FORMATION PROGRAM IN THE HANDS OF THE PILOTS. THEY WERE IMMEDIATELY AWARE THAT THE EXPERTISE IS WITH US AND NOT THE FAA.

ENCLOSED ALSO IS YOUR FIGHTER FORMATION QUALIFICATION CARD FROM VLADO LENOCH. HOPEFULLY, THIS IS AS FAR AS THE CARD PROGRAM WILL GO. AT ANY RATE WE ARE PREPARED NOW WITH A FORMATION PROGRAM IN PLACE WITH THE APPROPRIATE QUALIFICATION CARD.

WE HOPE YOU ENJOY THE NEW MANUAL. IT IS NEARLY IDENTICAL TO CURRENT USAF FORMATION MANUALS MODIFIED WHERE NECESSARY TO ACCOMMODATE WWII FIGHTERS. THERE IS NOTHING MADE UP HERE. IT IS JUST AS YOU WOULD READ IT OUT OF THE CURRENT BASIC FORMATION PROCEDURES MANUAL. IT WAS DESIGNED AS A SINGLE-SOURCE DOCUMENT AND THEREFORE MAY CONTAIN MORE MATERIAL THAN WOULD OTHERWISE BE REQUIRED, BUT IT'S ALL THERE FOR YOU TO USE.

GOOD LUCK AND FLY SAFE,

BRADLEY C. HOOD
FIGHTER OPERATIONS DIRECTOR
VINTAGE FIGHTERS

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MUSTANG/FIGHTER FORMATION FUNDAMENTALS

SCOPE

THIS FORMATION INSTRUCTION MANUAL HAS BEEN DESIGNED PRIMARILY FOR P-51 OPERATIONS, HOWEVER, THE BASIC PROCEDURES AND GUIDELINES ARE APPLICABLE TO ALL FIGHTER OPERATIONS. WHERE NECESSARY, SPEEDS AND PERFORMANCE FIGURES ARE SUGGESTED FOR THE MUSTANG. WITH DIFFERENCES BRIEFED PRIOR TO FLIGHT THE SAME PROCEDURES AND TECHNIQUES MAY BE EMPLOYED FOR ALL FIGHTER OPERATIONS.

INFORMATION IN THIS MANUAL WAS DERIVED FROM TWO SOURCES. CURRENT USAF UNCLASSIFIED FORMATION TRAINING MANUALS AND REGULATIONS MERGED WITH HESS BOMBERGER'S ORIGINAL P-51 FORMATION FLIGHT MANUAL. THIS MANUAL WAS WRITTEN TO REFLECT CURRENT MILITARY PROCEDURES AND TECHNIQUES. THE ORIGINAL P-51 MANUAL WAS INCORPORATED WHERE NECESSARY TO CLARIFY CONCEPTS, UPDATE PROCEDURES, OR ADD TO PREVIOUS MATERIAL. THE INTENT OF THIS MANUAL IS TO STANDARDIZE ALL P-51 FORMATION PROCEDURES AND ACT AS A BASIS FOR ALL FIGHTER OPERATIONS.

PHILOSOPHY

FLYING FIGHTERS, ALTHOUGH GREAT FUN, IS SERIOUS AND DEMANDING. FLYING FORMATION IN THESE AIRCRAFT IS NOT A GAME. AS IN THE MILITARY, IT DEMANDS PROFESSIONALISM, SKILL, AND KNOWLEDGE. FORMATION MEANS TEAMWORK. UNLIKE TEAMWORK IN MOST OTHER ENDEAVORS, THE LIVES OF OUR TEAM REST WITH EACH MEMBER OF THE FORMATION. IT IS YOUR RESPONSIBILITY TO KNOW THE MATERIAL IN THIS MANUAL AND THAT YOU CONDUCT ALL OPERATIONS PROFESSIONALLY AND SAFELY.

REMEMBER FINALLY, THAT GOOD CLOSE FORMATION FLYING TAKES YEARS TO MASTER. DON'T GET DISCOURAGED IF YOUR PERFORMANCE IS NOT WHAT YOU EXPECT WHEN STARTING OUT. FLY TO YOUR COMFORT LEVEL. THIS LEVEL WILL BECOME CLOSER AS YOUR SKILL INCREASES. PERSEVERANCE AND HARD WORK WILL PREVAIL. THE FIGHTER COCKPIT IS THE FINEST OFFICE IN THE WORLD AND CAN BE THE MOST DEADLY. THE CHOICE AND THE RESPONSIBILITY ARE YOURS.

REPUDIATION

THIS MANUAL IS PUBLISHED IN ORDER TO PROMOTE SAFETY THROUGH STANDARDIZATION AND KNOWLEDGE IN FORMATION FLYING. THE USE OF THIS MANUAL IS ENTIRELY AT THE OPTION AND DISCRETION OF THE FORMATION'S PILOTS AND ANY SUCH USE SHOULD BE FULLY BRIEFED BEFORE EACH FLIGHT. THE INDIVIDUALS WHO WROTE AND PUBLISHED THIS MANUAL DO NOT ASSUME ANY LIABILITY FOR THE USE OR FAILURE TO USE ANY OR ALL OF THE SAME.

INTRODUCTION

THE BASIC PREMISE OF FORMATION FLYING IS THE CONCEPT OF MUTUAL PROTECTION AND INCREASED FIREPOWER. THE DAY OF GOING IT ALONE IS BURIED IN HISTORY. THE TEAM CONCEPT IS ESSENTIAL TO SUCCESSFULLY ENGAGE THE ENEMY IN TODAY'S AIR WARFARE.

ALTHOUGH COMBAT IS NOT OUR MISSION, EACH MEMBER OF THIS TEAM HAS SOMETHING TO CONTRIBUTE IF THE TEAM IS TO PERFORM CORRECTLY, PROFESSIONALLY AND SAFELY. REGARDLESS OF THE FORMATION USED, EACH HAS ONE THING IN COMMON- A DEPENDENCE ON ALL MEMBERS OF THE FORMATION. TEAMWORK IS VITAL TO THE SUCCESSFUL ACCOMPLISHMENT OF EVERY FORMATION FLIGHT.

FORMATION, MORE THAN ANY OTHER TYPE OF FLYING, BUILDS CONFIDENCE AND TEACHES SELF-RELIANCE AND SELF-DISCIPLINE. DISCIPLINE IS A STATE OF MIND, AN ATTITUDE THAT IS KNOWING THE RULES AND PARAMETERS, RECOGNIZING DEVIATIONS AND MAKING EXPEDITIOUS, CONTROLLED CORRECTIONS. YOU WILL LEARN THE DUTIES AND RESPONSIBILITIES OF THE FLIGHT LEAD AS WELL AS THOSE OF THE WINGMAN. YOU MUST BE DISCIPLINED AND YOU MUST TRUST YOUR LEADER. GOOD FORMATION DOES NOT COME EASILY.

RESPONSIBILITIES

COLLISION AVOIDANCE

ALL FORMATION MEMBERS MUST BE CONSCIOUS OF THE MIDAIR COLLISION POTENTIAL ASSOCIATED WITH FORMATION FLYING. THIS MANUAL COULD NOT POSSIBLY ADDRESS EVERY SITUATION, WHICH IF MISHANDLED, COULD RESULT IN AN ACCIDENT OR INCIDENT. THE PROCEDURES IN THIS TRAINING MANUAL

ARE DESIGNED TO ACCOMPLISH COURSE OBJECTIVES AND MAXIMIZE SAFETY. BUT NOTHING PRECLUDES AIRCREW MEMBERS FROM TAKING WHATEVER ACTION NECESSARY TO AVOID COLLISIONS. THEREFORE, THE ULTIMATE RESPONSIBILITY FOR SAFE FLIGHT RESTS WITH EACH PILOT.

FACTORS WHICH CONTRIBUTE SIGNIFICANTLY TO THE MIDAIR COLLISION POTENTIAL ARE:

FAILURE OF THE LEADER TO CLEAR PROPERLY OR VISUALLY MONITOR THE WINGMAN DURING A CRITICAL PHASE OF FLIGHT, SUCH AS DURING A REJOIN OR TRAIL. A FORMATION LEADER MUST MONITOR THE WINGMAN. LOOK AT THE WINGMAN DIRECTLY OR USE THE MIRROR. BE PREPARED TO OFFER ASSISTANCE OR TAKE EVASIVE ACTION IF YOUR WINGMAN LOSES SIGHT OF YOU. DO NOT HESITATE TO GIVE INSTRUCTIONS ON WHAT ACTION SHOULD BE TAKEN SINCE YOU ARE NORMALLY IN A BETTER POSITION TO KNOW WHAT THESE ACTIONS SHOULD BE.

FAILURE TO KEEP THE LEADER IN SIGHT AT ALL TIMES. YOU ARE MOST LIKELY TO LOSE SIGHT OF LEAD DURING PITCHOUTS, REJOINS, TRAIL, OR IN IMC. ANY TIME YOU LOSE SIGHT OF THE LEADER, IMMEDIATELY FOLLOW LOST WINGMAN PROCEDURES AND BREAK OUT OF THE FORMATION. THIS CANNOT BE STRESSED ENOUGH.

FAILURE TO RECOGNIZE EXCESSIVE OVERTAKE. YOU MUST LEARN TO JUDGE EXCESSIVE OVERTAKE AND DETECT OVERSHOOTS. THE AIRSPEED INDICATOR CAN BE A VITAL AID. DURING REJOINS, COMPARE YOUR SPEED WITH THE PREBRIEFED OR ANNOUNCED AIRSPEED. IF YOU ARE DIRECTLY IN TRAIL, MOVE LATERALLY TO GAIN GREATER PERSPECTIVE OF CLOSURE RATE AND PROVIDE A SAFE MARGIN FOR BREAKOUT OR OVER-SHOOT. USE POWER AS NECESSARY.

FAILURE TO MAINTAIN LATERAL OR VERTICAL SEPARATION. THIS GENERALLY APPLIES TO TURNING OR STRAIGHT AHEAD REJOINS. ALWAYS MAINTAIN LATERAL OR VERTICAL SEPARATION UNTIL CLOSURE RATES ARE UNDER CONTROL AND YOU REACH ROUTE POSITION.

FAILURE TO MANEUVER IN THE SAFEST DIRECTION WHEN VISUAL CONTACT IS LOST. IF YOU LOSE SIGHT OF LEAD FOR ANY REASON, BREAK OUT OF FORMATION. DO NOT DELAY YOUR BREAKOUT ATTEMPTING TO REGAIN VISUAL CONTACT. BREAK IN A SAFE DIRECTION (AWAY AND DOWN FROM THE LAST KNOWN POSITION OR FLIGHTPATH OF LEAD) TO GAIN IMMEDIATE SEPARATION. CALL YOUR BREAKOUT OVER THE RADIO. DO NOT ATTEMPT TO REJOIN UNTIL YOU RECEIVE PERMISSION FROM THE LEADER.

FAILURE TO CONSIDER THE EFFECTS OF WING VORTICES OR PROP WASH. WINGMAN USUALLY FLY INTO THEM WHEN THEY GET TOO CLOSE DURING FINGERTIP MANEUVERING OR WHILE PASSING THROUGH LEADS FLIGHTPATH IN CHASE OR TRAIL. THE RESULTING CONTROL DIFFICULTIES ARE VERY DANGEROUS. IF YOU FLY INTO THESE AREAS ATTEMPT TO UNLOAD THE G IF YOU ARE DEMANDING ANY, CONTROL YOUR AIRCRAFT AND MOVE BACK OUT. BREAK OUT IF NECESSARY.

AS A WINGMAN YOUR PRIMARY ATTENTION IS DEVOTED TO MAINTAINING PROPER POSITION. HOWEVER, THIS DOES NOT MEAN YOU CANNOT HELP CLEAR FOR THE FORMATION. WHILE REFERENCING LEAD, YOU CAN CLEAR THROUGH THE LEADER AND BEYOND. DO THIS BY USING ALL OF LEAD'S AIRCRAFT AS A REFERENCE. DON'T FIXATE ON ANY ONE SPOT.

IF YOU NEED TO TELL LEAD ABOUT A CONFLICT, DON'T HESITATE TO COME ON THE RADIO WITH CALL SIGN, TARGET POSITION AND ELEVATION.

FORMATION POSITION ASSIGNMENT

IN THIS MANUAL WE WILL DISCUSS TWO- SHIP AND FOUR SHIP- FORMATION PROCEDURES. THE FLIGHT LEAD SHOULD BE A LEAD QUALIFIED INDIVIDUAL. THE FLIGHT LEAD IS COMMANDER OF THE UNIT WHETHER TWO OR FOUR SHIP FORMATION. GENERALLY THE LEADER SHOULD SELECT FROM HIS GROUP IF IN FOUR-SHIP FORMATION, AN INDIVIDUAL TO ACT AS DEPUTY FLIGHT COMMANDER AND FLY AS NUMBER 3. NUMBER 3 WOULD ASSUME COMMAND OF THE FORMATION (RETAIN LEAD'S CALL SIGN) IF LEAD ABORTS OR FALLS OUT OF THE FORMATION. THEREFORE NUMBER 3 SHOULD BE SELECTED BASED ON EXPERIENCE. NUMBERS 2 AND 4 ARE GENERALLY THE LEAST EXPERIENCED IN THE GROUP.

LEADER

FLIGHT LEAD IS A SERIOUS RESPONSIBILITY. THE LEADER IS RESPONSIBLE FOR ALL ASPECTS OF THE FORMATION, FROM BEGINNING TO END. THE LEADER SHOULD BRIEF EACH MISSION USING A BRIEFING GUIDE OR CARD. THOSE NOT ATTENDING THE BRIEFING SHOULD NOT BE ALLOWED TO FLY . THE FLIGHT LEAD IS THE ONLY INDIVIDUAL THAT COMMUNICATES FOR THE FLIGHT. THE LEADER IS ALSO THE ONLY MEMBER OF THE FORMATION TO USE THE TRANSPONDER. CLEARING AND PLANNING ARE IMPORTANT ASPECTS OF LEADING FIGHTER FORMATION. THE LEADER MUST MONITOR THE WINGMAN, CLEAR THE AREA, AND PLAN EACH MANEUVER. THE LEADER MUST EXECUTE EACH MANEUVER SMOOTHLY WITH SKILL AND PRECISION.

ABRUPT ROLL RATES OR MANEUVERS ARE TABOO WHILE IN LEAD. THIS WILL ALLOW THE WINGMAN TO MAINTAIN POSITION WITHOUT DIFFICULTY. THE LEADER SHOULD NEVER BECOME SO OVERLY CONSCIOUS WITH SMOOTHNESS, HOWEVER, THAT SAFETY AND PRECISION ARE COMPROMISED. IT IS FAR MORE IMPORTANT TO FLY YOUR AIRCRAFT SAFELY WITH MINOR EXCURSIONS FROM PERFECT PERFORMANCE THAN TO FLY SUPER SMOOTH AND BE A LIABILITY TO THE FLIGHT. PLAN ALL MANEUVERS TO KEEP THE FLIGHT WELL WITHIN THE ASSIGNED WORKING AREA. AS THE LEADER, SELECT A POWER SETTING THAT WILL ALLOW YOU TO WORK THROUGH THE ALLOWABLE AIRSPEED AND ALTITUDE RANGE.

THE LEADER MUST ALSO MONITOR THE WINGMAN. THIS IS TO ENSURE THAT THE WINGMAN IS IN POSITION BEFORE THE NEXT MANEUVER. ALSO, YOU WOULD NOT WANT TO MISS A HEFOE EMERGENCY SIGNAL. MAKE THE WINGMAN PART OF YOUR CROSS-CHECK AS YOU ARE CLEARING AND NAVIGATING.

WINGMAN

WINGMAN DUTIES REINFORCE THE PURPOSE OF FORMATION: MUTUAL SUPPORT. INITIALLY, YOU WILL SPEND MOST OF YOUR TIME LEARNING TO MAINTAIN POSITION; HOWEVER, YOU SHOULD DEVELOP THE OTHER SKILLS THAT ARE AN INTEGRAL PART OF BEING A FORMATION WINGMAN. THE FOLLOWING ARE BASIC WINGMAN RESPONSIBILITIES:

KEEP THE LEADER IN SIGHT AT ALL TIMES.

FLY ONLY AS DIRECTED, CONTINUALLY STRIVE FOR PERFECT FORMATION POSITION, AND BE FLEXIBLE (NO UNAUTHORIZED OR UNBRIEFED MANEUVERING).

BE AWARE OF THE DEPARTURE, RECOVERY, AND ENROUTE ALTITUDES AND ROUTING SO YOU CAN ASSUME THE LEAD AT ANY TIME.

MONITOR THE LEAD AND OTHER FLIGHT MEMBERS FOR SYSTEMS MALFUNCTIONS AND PROPER CONFIGURATIONS. ASSIST AS YOU CAN DURING EMERGENCIES.

MONITOR THE RADIOS, HOWEVER, MAINTAIN RADIO SILENCE WITH THE EXCEPTION OF RADIO FREQUENCY CHECK-IN, TRAFFIC CALL-OUTS, AND EMERGENCY ANNOUNCEMENTS.

MAINTAIN A CONSTANT AWARENESS OF THE COLLISION POTENTIAL.

FOLLOW THE FLIGHT LEAD'S DIRECTIONS. IF YOU ARE UNCOMFORTABLE WITH THE FLIGHT LEAD FOR ANY REASON DO NOT HESITATE TO LEAVE THE FORMATION AND ADVISE LEAD OF YOUR INTENTIONS.

THE ABOVE RESPONSIBILITIES SUPPORT THE THREE BASIC ASPECTS OF BEING A WINGMAN: MAINTAINING POSITION, MUTUAL SUPPORT, AND FORMATION INTEGRITY.

FORMATION COMMUNICATION DISCIPLINE

RADIO DISCIPLINE REQUIRES NOT ONLY CLARITY AND BREVITY IN THE MESSAGE ITSELF, BUT LIMITING UNNECESSARY TRANSMISSIONS AS WELL. THE FIRST PART OF ANY RADIO CALL SHOULD BE ALWAYS "CALL SIGN". THIS STEP SERVES TO BOTH ALERT LISTENERS (WINGMAN) THAT A MESSAGE IS COMING (ATTENTION STEP) AND TO SPECIFY WHO IS MAKING THE CALL OR TO WHOM IT IS DIRECTED. RELYING ON VOICE RECOGNITION OR TONE/INFLECTION TO IDENTIFY ANOTHER AIRCRAFT IS NOT ADEQUATE. THIS UNPROFESSIONAL PRACTICE TENDS TO BECOME HABIT, AND HAS COST MORE FIGHTERS OVER THE YEARS THAN WE LIKE TO REMEMBER. COMMENTS SHOULD BE BRIEF, SHARP, AND PROFESSIONAL. CONVERSATIONAL CHIT-CHAT HAS NO PLACE IN A FIGHTER COCKPIT.

PREBRIEF A FORMATION CALL SIGN. EXAMPLE: MUSTANG FLIGHT, RED FLIGHT, BLUE FLIGHT ETC. USE THIS CALL SIGN FOR ALL FORMATION COMMUNICATION. CHANGE RADIO FREQUENCIES ONLY WHEN DIRECTED TO DO SO. AS THE LEADER, WHEN YOU CALL FOR A FREQUENCY CHANGE, GIVE YOUR FLIGHT A CHANCE TO ACCOMPLISH IT. NORMALLY WHEN A RADIO FREQUENCY CHANGE IS GIVEN IN FLIGHT, THE WINGMAN WILL AUTOMATICALLY MOVE TO ROUTE POSITION, CHANGE FREQUENCIES, AND MOVE BACK INTO FINGERTIP. THE THINKING WINGMAN WILL GIVE A HEAD NOD WHEN HE HAS CHANGED FREQUENCIES. THIS HELPS PRECLUDE THE BOTCHED CHECK IN BECAUSE EVERYONE WASN'T READY. **THE LEADER INITIATES ALL FREQUENCY CHANGES AND CHECK INS.** EXAMPLE: "MUSTANGS, 122.7, GO". ACKNOWLEDGMENTS "2, 3, 4". AFTER THE CHANGE THE LEADER WILL CHECK THE FLIGHT BACK IN. EXAMPLE: "MUSTANGS CHECK" ACKNOWLEDGMENTS "2, 3, 4". NUMBER 2 SHOULD BE ESPECIALLY COGNIZANT OF THE CHECK IN. IF NUMBER 2 IS LATE ON THE CHECK IN, NUMBER 3 MAY HAVE TO CHECK IN OUT OF SEQUENCE, THUS NECESSITATING ANOTHER COMPLETE CHECK IN SEQUENCE. POOR RADIO DISCIPLINE CAN DO MORE TO DEGRADE A FORMATION PERFORMANCE THAN MOST ANY OTHER MISTAKE.

STANDARD VISUAL SIGNALS

A. SIGNAL OF EXECUTION: NOD HEAD. THIS SIGNAL IS GIVEN ONE OR TWO SECONDS FOLLOWING A PREPARATORY SIGNAL.

B. TIGHTEN / REJOIN FORMATION: SHALLOW WING ROCK

C. CHANGE LEAD: MAKE SEVERAL FORWARD POINTING MOTIONS, THEN HOLD UP NUMBER OF FINGERS TO INDICATE PRESENT POSITION OF THE PILOT WHO IS TO ASSUME THE LEAD. WINGMAN ACKNOWLEDGMENT WILL BE A HEAD NOD. THE CHANGE OF LEAD IS EFFECTIVE UPON ACKNOWLEDGMENT. IN A FLIGHT OF FOUR, THE DEPUTY FLIGHT LEAD, NORMALLY NO. 3, IS DESIGNATED DURING THE FLIGHT BRIEFING.

D. ECHELON/CROSSUNDER TO OPPOSITE SIDE: DIP WING RIGHT OR LEFT **OR** FIST AT TOP OF CANOPY (NAVY SIGNAL). THE WING DIP IS THE STANDARD SIGNAL - THE FIST SHOULD BE PREBRIEFED.

E. FUEL CHECK: CLOSE FIST WITH THE THUMB EXTENDED AND PERFORM DRINKING MOTION WITH THUMB TOUCHING MOUTH OR OXYGEN MASK.

F. FUEL REMAINING: EXTEND ONE FINGER FOR EACH 100 GALLONS OF FUEL ON BOARD. AFTER SIGNALING 100 GALLON INCREMENTS, CLOSE FIST AND SIGNAL 10 GALLON INCREMENTS IN THE SAME MANNER.

G. GEAR DOWN: MAKE A DOWNWARD MOTION WITH A CLOSED FIST, THUMB EXTENDED DOWNWARD. DO NOT CONFUSE THIS SIGNAL WITH THE LAND IMMEDIATELY SIGNAL.

H. GEAR UP: MAKE AN UPWARD MOTION WITH CLOSED FIST, THUMB EXTENDED UPWARD. EXCEPTION- DURING A FORMATION TAKEOFF, A HEAD NOD MAY BE BRIEFED FOR EXECUTION.

I. LEVEL OFF: MAKE A HORIZONTAL MOTION WITH THE OPEN HAND, PALM DOWN. THIS SIGNAL IS NOT NORMALLY USED FOR EACH LEVEL OFF.

J. LOOSEN FORMATION: FISHTAIL THE AIRCRAFT

K. ENGINE START/RUN-UP: MAKE A CIRCULAR MOTION WITH VERTICALLY EXTENDED INDEX FINGER ABOVE THE WINDSHIELD.

L. PITCHOUT: SAME AS ENGINE START/RUN-UP WHILE AIRBORNE

M. RADIO FREQUENCY CHANGE: TAP HEADSET, HOLD UP CLENCHED FIST NEXT TO HELMET AND THEN EXTEND NUMBER OF FINGERS FOR EACH DIGIT OF THE FREQUENCY OF ORDER, PULLING HAND OUT OF VIEW BETWEEN EACH DIGIT. EXTEND FINGERS VERTICALLY FOR DIGITS 1 THROUGH 5 AND HORIZONTALLY FOR DIGITS 6 THROUGH 9.

N. START TAKEOFF ROLL: LEADER PLACES HEAD BACK TOWARD HEADREST AND THEN NODS HEAD FULL FORWARD TO RELEASE BRAKES.

O. TRAIL/CHASE: MAKE A SERIES OF PORPOISE MANEUVERS. TAKE SPACING AS BRIEFED.

P. POWER INCREASE: FIST MOVED FORWARD

Q. POWER DECREASE: FIST MOVED AFT

INFLIGHT DISTRESS SIGNALS (RADIO INOPERATIVE)

EMERGENCY SITUATIONS IN VINTAGE FIGHTER AIRCRAFT ARE NOT UNCOMMON. YOU SHOULD TERMINATE ANY MANEUVERING IMMEDIATELY AND FLY THE AIRPLANE ABOVE ALL ELSE. WHEN IN FORMATION THE OTHER PILOT CAN BE A VALUABLE TOOL IN HELPING HANDLE THE EMERGENCY. USE THE RADIO TO COMMUNICATE IMMEDIATELY WITH YOUR FORMATION PARTNER. ANOTHER SET OF EYES OUTSIDE YOUR AIRPLANE MAY REVEAL MUCH ABOUT THE STATE OF YOUR EMERGENCY. THE LIKLIHOOD THAT AN EMERGENCY MIGHT BE EXPERIENCED WITH A RADIO FAILURE IS MINIMAL, HOWEVER, IF IT WERE TO OCCUR THE FOLLOWING SIGNALS WILL HELP KEEP YOUR FORMATION PARTNER IN THE LOOP SO HE/SHE CAN HELP AS REQUIRED:

A. **HEFOE** SYSTEM- CLENCH FIST AND HOLD IT AT TOP OF CANOPY, THEN HOLD UP THE REQUIRED NUMBER OF FINGERS TO DENOTE WHICH SYSTEM IS INVOLVED. THE RECEIVING PILOT ACKNOWLEDGES THE

SIGNAL BY REPEATING IT:

1. HYDRAULIC - ONE FINGER
2. ELECTRICAL - TWO FINGERS
3. FUEL - THREE FINGERS
4. OXYGEN - FOUR FINGERS
5. ENGINE - FIVE FINGERS

B. LAND IMMEDIATELY: CLOSE FIST AND HOLD IT AT TOP OF CANOPY WITH THUMB EXTENDED DOWNWARD, THEN MOVE ARM UP AND DOWN RAPIDLY. (DO NOT CONFUSE THIS SIGNAL WITH "GEAR DOWN" SIGNAL, WHICH IS NOT USED AT ALTITUDE.).

C. RECEIVER FAILURE: WITH PALM OF HAND OVER EAR POSITION, MOVE HAND FORWARD AND BACKWARD.

D. TRANSMITTER FAILURE: WITH PALM OF HAND TOWARD, AND IN FRONT OF FACE, MOVE HAND UP AND DOWN.

YOU MUST BECOME COMPLETELY FAMILIAR WITH THESE SIGNALS BEFORE FLYING FORMATION. WHEN THE LEADER GIVES A SIGNAL, ACKNOWLEDGE IT BY NODDING YOUR HEAD. IF YOU DO NOT UNDERSTAND THE SIGNAL SHAKE YOUR HEAD TO INDICATE THIS TO LEAD. BY ALL MEANS USE THE RADIO TRAFFIC PERMITTING IF THERE IS CONFUSION. DO NOT ACT UNTIL YOU ARE SURE OF THE SIGNAL OR COMMAND.

INFLIGHT CHECKS

THE LEADER WILL INITIATE INFLIGHT CHECKS AND RADIO CHANNEL CHANGES. WHEN THIS OCCURS, MOVE TO THE ROUTE POSITION, AND GLANCE AT THE ITEMS TO BE CHECKED I.E. FUEL. YOU ARE STILL RESPONSIBLE FOR MAINTAINING POSITION AND TO CLEAR. NEVER FIXATE INSIDE THE COCKPIT WHILE CHANGING RADIO FREQUENCIES OR PERFORMING CHECKS.

FORMATION

ENGINE START AND TAXI

IF THE AIRCRAFT ARE PARKED TOGETHER, START ENGINES ON A VISUAL SIGNAL; IF PARKED SEPARATELY, USE A PREBRIEFED START TIME OR USE THE RADIO. IF YOU ARE LATE ARRIVING AT THE AIRPLANE, DO NOT OMIT ITEMS ON YOUR PREFLIGHT. INFORM THE LEAD BY RADIO AND ESTABLISH A NEW START TIME. AFTER ENGINE START, THE LEADER WILL CHECK THE FLIGHT IN ON THE BRIEFED RADIO FREQUENCY. ACKNOWLEDGE WITH YOUR FORMATION POSITION ONLY. CHECK IN, IN ORDER. IF YOU ARE NO. 3 OR 4 GIVE THE PILOT BEFORE YOU TIME TO CHECK IN. IF YOU DO NOT HEAR ANYTHING AFTER SEVERAL SECONDS CHECK IN YOUR POSITION ANYWAY.

TAXI OUT IN SEQUENCE. KNOW AHEAD OF TIME WHO YOU WILL FOLLOW BY AIRPLANE PAINT SCHEME, ETC. USE YOUR HEAD AND DO NOT CUT SOMEONE OFF FROM GETTING INTO PROPER SEQUENCE IN FRONT OF YOU. THIS SEEMS SIMPLE, BUT IT IS ILL-PERFORMED MORE OFTEN THAN NOT.

PRIOR TO TAKING THE RUNWAY ALL FORMATION MEMBERS SHOULD ACCOMPLISH THE RUN-UP AND ALL PRETAKEOFF CHECKS. ATTEMPT TO PARK IN ECHELON WITH PILOT'S HEADS ALIGNED SO THAT LEAD CAN SEE ALL SIGNALS. THE LEADER MAY INITIATE THE RUN-UP BY THE RUN-UP SIGNAL OR OVER THE RADIO. EACH WINGMAN WILL VERTICALLY EXTEND A THUMBS UP AT THE COMPLETION OF PRETAKEOFF CHECKS. IF LEAD IS NOT IN DIRECT VIEW OF ALL CREWMEMBERS THEN EACH PILOT WILL PASS THE THUMBS UP TO LEAD (FROM 4 TO 3 TO 2 TO LEAD).

RUNWAY LINEUP

LEAD SHOULD TAXI A SUFFICIENT DISTANCE DOWN THE RUNWAY TO ALLOW THE WINGMAN ROOM TO MANEUVER INTO POSITION FOR THE FORMATION TAKEOFF. THE WINGMAN SHOULD LINE UP ON THE FINGERTIP LINE WITH APPROXIMATELY 10 FEET LATERAL CLEARANCE OR THE CENTER OF HIS HALF OF THE RUNWAY. LEAD SHOULD CONSIDER SUCH FACTORS AS WIND, WEATHER, AND DIRECTION OF TURN OUT OF TRAFFIC WHEN DETERMINING THE PROPER SIDE TO PLACE THE WINGMAN. PLACE YOUR WINGMAN ON YOUR UPWIND SIDE WHEN THE CROSSWIND COMPONENT EXCEEDS 5 KNOTS. IF WIND IS NO FACTOR, PLACE YOUR WINGMAN ON THE RIGHT SIDE FOR TORQUE CONCERNS.

IF RUNWAY WIDTH PERMITS AND 4-SHIP LINEUPS ARE UTILIZED, LEAD SHOULD TAXI TO THE FAR DOWNWIND SIDE OF THE RUNWAY. TWO SHOULD LINE UP IN FINGERTIP APPROXIMATELY ON THE CENTER LINE. THREE SHOULD LINE UP 1-2 SHIP LENGTHS BEHIND AND BETWEEN LEAD AND TWO. FOUR SHOULD LINE UP IN FINGERTIP WITH THREE AND TO THE RIGHT OF TWO.

IT IS PERMISSIBLE AND ENCOURAGED FOR AIRCREWS IN TWO- SHIP AND FOUR- SHIP FORMATIONS DEPARTING SEPARATELY TO LINE UP AT AN ANGLE TO THE RUNWAY CENTERLINE IN ORDER TO MAINTAIN VISUAL CONTACT WITH THE PRECEDING DEPARTING FIGHTER.

RUN UP FOR TAKEOFF

THE LEADER WILL CALL FOR ENGINE RUN-UP TO 30" MP OVER THE RADIO OR BY HAND SIGNAL. THE LEADER WHEN READY LOOKS TO THE WINGMAN INDICATING THE LEAD AIRCRAFT IS READY FOR TAKEOFF. THE WINGMAN SHOULD ACKNOWLEDGE HE IS READY BY AN EXAGGERATED HEAD NOD.

TAKEOFF (SINGLE SHIP - SHOTGUN)

LEAD INITIATES ROLL BY A LARGE HEAD NOD AND RELEASES BRAKES. WINGMAN SHOULD TIME 8 SECONDS AND THEN RELEASE BRAKES. AFTER BECOMING SAFELY AIRBORNE RETRACT THE GEAR AND ATTEMPT TO FLY OUT OF THE PATH OF THE PRECEDING FIGHTERS PROP WASH.

IF THE LEAD PILOT SHOULD NEED TO ABORT AND DIRECTIONAL CONTROL CAN BE MAINTAINED, IMMEDIATELY ANNOUNCE: "LEAD'S ABORTING-APPROPRIATE SIDE OF RUNWAY". (EXAMPLE: "LEAD'S ABORTING-RIGHT SIDE). IN THIS CASE THE WINGMAN SHOULD SELECT NORMAL TAKEOFF POWER AND CONTINUE THE TAKEOFF. IF LEAD EXPERIENCES DIRECTIONAL CONTROL AND CAN NOT MAINTAIN HIS SIDE OF THE RUNWAY, HE SHOULD IMMEDIATELY ANNOUNCE: "FLIGHT ABORT, FLIGHT ABORT, FLIGHT ABORT". WINGMAN SHOULD IMMEDIATELY PULL THE THROTTLE TO IDLE AND ABORT. THE WINGMAN SHOULD LEAVE THE RUNWAY RATHER THAN COLLIDE WITH THE LEAD AIRCRAFT. IF RUNWAY DEPARTURE IS IMMINENT, REMEMBER TO RELEASE BRAKES PRIOR TO CONTACTING UPPREPARED SURFACE TO PRECLUDE THE POSSIBILITY OF FLIP-OVER (CONVENTIONAL GEAR AIRCRAFT).

TAKEOFF (2-SHIP)

TWO SHIP TAKEOFFS REQUIRE A MINIMUM RUNWAY WIDTH OF 100 FT. RUNWAY LINEUP AND RUNUP ARE THE SAME AS FOR SHOTGUN TAKEOFFS. AFTER ENGINES ARE STABILIZED AT 30" MP AND THE WINGMAN HAS ACKNOWLEDGED THAT HE IS READY, THE LEAD PILOT WILL ROTATE HIS HEAD AFT AND THEN FORWARD IN A PRONOUNCED HEAD NOD. THE LEAD PILOT WILL RELEASE BRAKES AT THE COMPLETION OF THE HEAD NOD AND SMOOTHLY ADVANCE POWER TO 50" MP. THE WINGMAN WILL USE POWER AND RUDDER TO MAINTAIN POSITION. USE PERIPHERAL VISION TO HELP DETECT ANY LATERAL MOVEMENT ON THE RUNWAY. MATCH THE LEADERS PITCH ATTITUDE AND STACK LEVEL UNTIL THE GEAR IS RETRACTED. WHEN THE LEADER MONITORS THE WINGMAN AND BOTH AIRCRAFT ARE SAFELY AIRBORNE, THE LEADER SHOULD RETRACT THE GEAR. WINGMAN RETRACT THE GEAR AT FIRST INDICATION OF LEAD GEAR MOVEMENT. NO SIGNAL IS REQUIRED. IF YOU ARE OVERRUNNING THE LEADER, YOU MAY DELAY RETRACTING THE GEAR; NEVER RAISE YOUR GEAR PRIOR TO THE LEADER.

IF THE LEADER ABORTS THE TAKEOFF AFTER BRAKE RELEASE AND DIRECTIONAL CONTROL CAN BE MAINTAINED, HE SHOULD ANNOUNCE: "LEAD'S ABORTING". THE WINGMAN SHOULD ADVANCE THROTTLE TO NORMAL TAKEOFF POWER AND CONTINUE THE TAKEOFF. HOWEVER, IF THE LEADER MUST ABORT AND DIRECTIONAL CONTROL IS NOT POSSIBLE, HE SHOULD IMMEDIATELY ANNOUNCE: "FLIGHT ABORT, FLIGHT ABORT, FLIGHT ABORT!" THE WINGMAN SHOULD IMMEDIATELY PULL THE THROTTLE TO IDLE, ABORT THE TAKEOFF AND AVOID CONTACTING THE LEADER AT ALL COST. THE WINGMAN SHOULD LEAVE THE RUNWAY RATHER THAN COLLIDE WITH THE LEAD AIRCRAFT. REMEMBER IF THIS BECOMES NECESSARY ATTEMPT TO SLOW AS MUCH AS POSSIBLE PRIOR TO LEAVING THE PREPARED SURFACE AND RELEASE BRAKES PRIOR TO CONTACTING EARTH OF ANY KIND TO AVOID THE POSSIBILITY OF FLIP-OVER. REAPLY BRAKES CAUTIOUSLY.

THE LEADER SHOULD MAINTAIN THE TAKEOFF ATTITUDE , ALLOWING AIRSPEED TO INCREASE. THE LEADER SHOULD DELAY THE FIRST TURN OUT OF TRAFFIC UNTIL AT LEAST 130 KIAS AND A SAFE ALTITUDE. AFTER THE FORMATION IS AIRBORNE, IT MAY BECOME DIFFICULT FOR THE WINGMAN TO DETERMINE THAT THE LEADER IS EXPERIENCING AN INFLIGHT EMERGENCY (LOSS OF POWER, ETC.). IF YOU, AS THE WINGMAN, DETERMINE THAT A REDUCED POWER SETTING IS REQUIRED TO MAINTAIN THE PROPER SPACING, INCREASE THE LATERAL DISTANCE FROM LEAD, INCREASE POWER, CONTINUE THE TAKEOFF, AND INFORM YOUR LEADER. DO NOT ATTEMPT TO FLY FORMATION AFTER YOU HAVE PASSED THE LEADER. WHEN THE LEADER OBSERVES YOU OVERRUNNING, HE SHOULD MAKE AN INDIVIDUAL TAKEOFF MAINTAINING SPACING ON YOU. THE LEADER WILL DIRECT A REJOIN AFTER ALL AIRCREWS HAVE REACHED A SAFE ALTITUDE AND AIRSPEED.

IN THE EVENT THAT YOU DROP BACK ON TAKEOFF, YOU MAY NOT HAVE SUFFICIENT AIRSPEED TO ROTATE WITH THE LEADER. IN THIS EVENT, CROSSCHECK YOUR AIRSPEED INDICATOR AND MAKE YOUR OWN TAKEOFF. REJOIN ON THE LEADER AFTER BECOMING SAFELY AIRBORNE.

MAXIMUM CROSSWIND COMPONENT FOR A TWO-SHIP TAKEOFF IS 10 KNOTS. USE CAUTION DURING GUSTY WIND CONDITIONS FOR RAPIDLY CHANGING WIND DIRECTION AND VELOCITY. USE TIMELY CORRECTIONS TO MAINTAIN DIRECTIONAL CONTROL AND ENSURE AIRCRAFT SEPARATION. THE SHOTGUN TAKEOFF IS PREFERABLE IN CONDITIONS SUCH AS THESE.

JOINUP AFTER TAKEOFF

IF THE AIRCRAFT TAKEOFF SEPARATELY, MANY VARIABLES WILL DICTATE THE TYPE OF JOINUP USED. SPECIFIC JOINUP PROCEDURES WILL BE DISCUSSED IN THE PITCHOUT AND REJOIN SECTION. AFTER THE LEADER IS AIRBORNE AND WITH A MINIMUM OF 150 KIAS REDUCE POWER TO APPROXIMATELY 35" MP AND 2300 RPM. ACCELERATE TO 174 KIAS (200 MPH) AND HOLD THIS AIRSPEED UNTIL THE REJOIN IS COMPLETE. IN A FOUR-SHIP DEPARTURE AND JOINUP TWO WILL ALWAYS JOIN TO THE INSIDE OF THE TURN OUT OF TRAFFIC WHILE THREE AND FOUR WILL JOIN TO THE OUTSIDE OF THE TURN. OBVIOUSLY THIS IS A STANDARD ONLY WHEN SPECIFIC POSITIONS ARE NOT MANDATORY. IN SITUATIONS WHERE SPECIFIC POSITIONS ARE REQUIRED THE LEADER SHOULD BRIEF THE SEQUENCE OF JOINUP. ON A STRAIGHT AHEAD REJOIN, JOIN TO YOUR ASSIGNED SIDE.

FINGERTIP FORMATION

THIS TYPE OF FORMATION WILL FORM THE BASIS FOR YOUR FORMATION FLYING. THE LEAD PILOT IS THE "BOSS". THE LEADER MANAGES THE FORMATION FROM ENGINE START TO ENGINE SHUTDOWN. THE LEAD POSITION IS THE MOST DIFFICULT TO FLY. IT REQUIRES PLANNING AND THINKING WELL AHEAD OF THE FORMATION. THE LEADER SHOULD STRIVE FOR PRECISION AND SMOOTHNESS IN MANEUVERS. KEEP THE AIRCRAFT PERFECTLY TRIMMED AT ALL TIMES. FLY COORDINATED AND AS THOUGH YOU WERE FLYING ON INSTRUMENTS. MAKE AS FEW THROTTLE CHANGES AS NECESSARY. THE FOLLOWING P-51POWER SETTINGS ARE USEFUL FOR PLANNING PURPOSES:

TAKEOFF:	50" MP / 3000 RPM
CLIMB:	35" MP / 2300 RPM
LEVEL:	31" MP / 2300 RPM
DESCENT:	27" MP / 2300 RPM

AVOID ABRUPT ROLL RATES. IF A FASTER ROLL IS REQUIRED THE WINGMAN CAN STAY IN POSITION IF THE LEADER "TELEGRAPHS" HIS INTENTION BY INITIALLY ROLLING SLOWLY AND THEN SPEEDING UP THE ROLL RATE. IN ALL PHASES OF FORMATION YOU WILL MAKE THE WINGMAN'S JOB EASIER IF YOU INITIALLY START INTO THE MANEUVER SLOWLY AND THEN SPEED IT UP IF NECESSARY.

AVOID PUTTING YOUR WINGMAN ON THE DOWN-SUN SIDE. STARING INTO THE SUN WHILE FLYING FORMATION IS NO FUN AND CAN BE DANGEROUS IF THE WINGMAN LOSES SIGHT OF THE LEADER. IN GENERAL, CONSIDER YOUR WINGMAN IN WHAT YOU DO. HOWEVER, DO NOT BE SO OVERLY CONCERNED, THAT YOU COMPROMISE THE PERFORMANCE OF THE GROUP. IT IS THE WINGMAN'S RESPONSIBILITY TO "BE THERE".

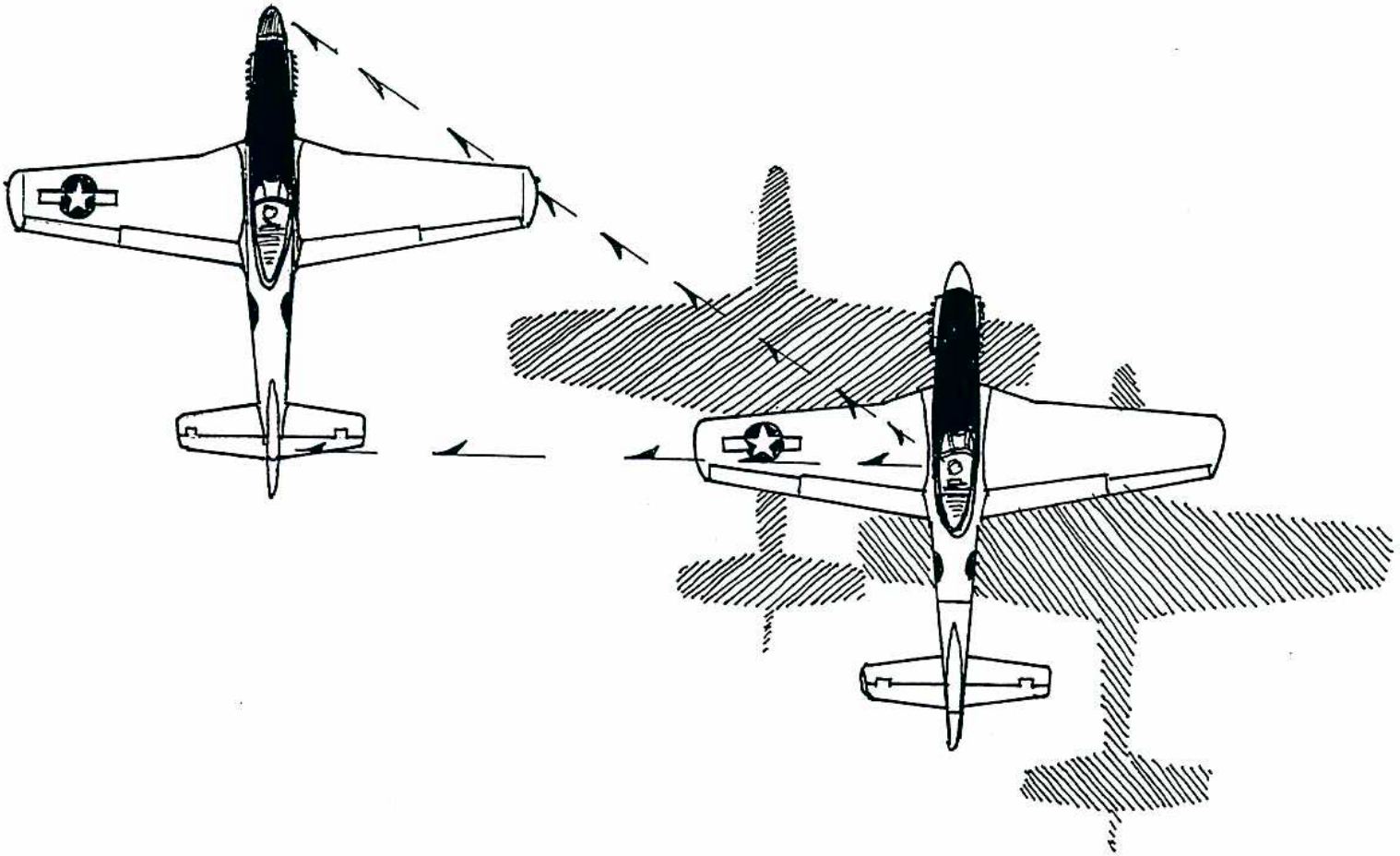
WINGMAN POSITION

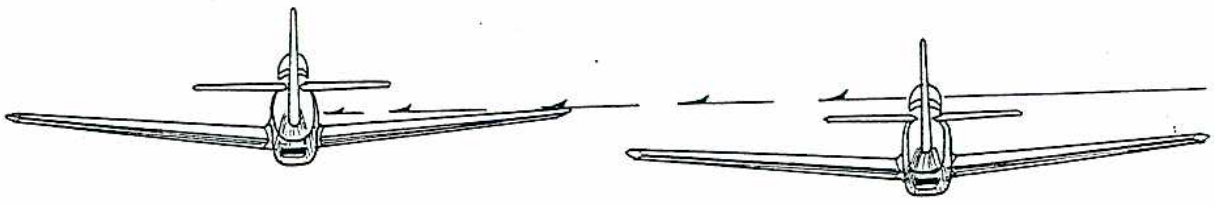
THE FINGERTIP POSITION IS FLOWN ON AN ANGLE APPROXIMATELY 30 DEGREES BACK FROM THE LEADER WITH APPROXIMATELY 11 FEET WINGTIP CLEARANCE. ONE REFERENCE IS TO ALIGN THE LEADER'S SPINNER WITH HIS WINGTIP. FOR PRECISION, ATTEMPT TO LINE UP THE LEADER'S FRONT TIP OF THE SPINNER WITH THE WING TIP NAV LIGHT. THIS POSITION PUTS YOU IN PROPER SWEEP BACK FORE AND AFT AND STEP-DOWN. HORIZONTAL SEPARATION IS DETERMINED BY LINING YOURSELF UP WITH THE LEADER'S RUDDER HINGE LINE. THIS SEPARATION MAY BE INCREASED TO ALLOW MORE AGGRESSIVE MANEUVERING OR AS AN AID IN CLEARING FOR TRAFFIC IN CONGESTED AIRSPACE. SEPARATION MAY ALSO BE INCREASED TO QUICKLY SCAN INSTRUMENTS. ONLY 4 ARE IMPORTANT WHILE IN WING POSITION: OIL PRESSURE, OIL TEMPERATURE, COOLANT TEMPERATURE, AND NEEDLE & BALL FOR TRIM.

TECHNIQUE

GOOD FORMATION IS THE RESULT OF ANTICIPATION, PLANNING, AND APPLICATION OF SMALL CORRECTIONS. DETECT SHIFTS IN POSITION PROMPTLY AND STAY IN FORMATION. ALWAYS KEEP THE AIRCRAFT TRIMMED AND COORDINATED. ATTEMPT TO HAVE THE AIRCRAFT PERFECTLY TRIMMED BY THE TIME YOU JOIN UP IF SHOTGUN TAKEOFFS WERE PERFORMED. FLY RELAXED- PROPER TRIM WILL ENABLE YOU TO FLY WITH LITTLE IF ANY PRESSURE ON THE STICK. THESE ARE SOME OF THE MOST IMPORTANT FUNDAMENTALS OF GOOD FORMATION FLYING.

BASIC FINGERTIP POSITION





IN TURNS, THE WINGMAN MAINTAINS THE SAME RELATIVE POSITION AS IN LEVEL FLIGHT WITH RESPECT TO THE LEADER. WHEN THE LEADER TURNS AWAY FROM YOU, INCREASE BACK PRESSURE SLIGHTLY TO MAINTAIN YOUR VERTICAL POSITION. THIS WILL REQUIRE AN INCREASE IN POWER TO MAINTAIN YOUR AIRSPEED AND POSITION ON THE 30 DEG LINE. WHEN THE LEADER STOPS THE ROLL IN, YOU HAVE TO PULL OFF SOME OF THE POWER YOU ADDED. WHEN THE LEADER TURNS TOWARD YOU, ADD SLIGHT FORWARD PRESSURE TO MAINTAIN VERTICAL POSITION AND REDUCE POWER TO STAY ON THE 30 DEG LINE.

THE WINGMAN SHOULD BE AWARE OF COLLISION POTENTIAL AT ALL TIMES. IN TURBULENCE, WHILE FLYING MAXIMUM PERFORMANCE MANEUVERS OR MANEUVERS WHICH ARE NOT FREQUENTLY FLOWN SUCH AS PUSHOVERS AT LESS THAN 1 G, THE COLLISION POTENTIAL INCREASES. ATTEMPT TO MINIMIZE THESE MANEUVERS IN TURBULENT CONDITIONS. BREAKOUT IF NECESSARY.

FOUR-SHIP FORMATION POSITION

IN FINGER FOUR TWO AND THREE WILL SEE EACH OTHER'S HEADS ON THE HORIZON RIGHT BELOW THEIR LEADER'S RUDDER HINGE LINE ACROSS THE FORMATION. TWO WILL SET THE PACE FOR THIS POSITION AND THREE SHOULD ATTEMPT TO MATCH THIS POSITION IN ORDER FOR THE FORMATION TO LOOK WELL FORMED. ALL THAT FOUR HAS TO DO IS LINE UP THREE'S HEAD WITH THE LEADER'S HEAD AND BE EVEN WITH THREE'S RUDDER HINGE LINE. IF THREE IS IN PROPER POSITION, FOUR WILL FIND THAT THREE'S WINGTIP AND SPINNER ARE IN LINE.

CROSSUNDER

THE PURPOSE OF PERFORMING A CROSSUNDER IS TO EFFICIENTLY AND SAFELY MOVE FROM ONE WING FINGERTIP POSITION TO THE OPPOSITE WING FINGERTIP POSITION. THE LEADER SIGNALS FOR A CROSSUNDER BY DIPPING A WING IN THE DESIRED DIRECTION OF CHANGE. USE THE FOLLOWING PROCEDURES:

1. REDUCE POWER SLIGHTLY, AND AS AIRSPEED IS REDUCED, MOVE A FEW FEET LOWER THAN NORMAL POSITION.

2. MOVE AFT TO OBTAIN NOSE TAIL CLEARANCE, THEN INCREASE POWER SLIGHTLY TO MAINTAIN SPACING. ANTICIPATE THE POWER INCREASE TO PREVENT FALLING TOO FAR BEHIND.

3. BANK SLIGHTLY TOWARD THE NEW POSITION TO CHANGE THE AIRCRAFT HEADING A FEW DEGREES. ROLL WINGS LEVEL AND FLY TO THE OPPOSITE SIDE. A HEADING CHANGE OF ONLY 1 OR 2 DEGREES WILL CAUSE THE AIRCRAFT TO FLY SMOOTHLY FROM ONE SIDE TO THE OTHER. KEEP PROPER NOSE-TAIL CLEARANCE WITH POWER; A POWER INCREASE WILL NOW BE NECESSARY TO MAINTAIN THIS CLEARANCE. DO NOT CROSS DIRECTLY UNDER ANY PART OF THE LEADER'S AIRCRAFT! WITH PROPER CLEARANCE FROM LEAD, YOUR PROP TIP ARC SHOULD PASS AFT OF THE LEADER'S TAIL LIGHT.

4. WHEN YOU HAVE WINGTIP CLEARANCE, RETURN TO THE LEADER'S HEADING. ADD POWER, AND AS YOU MOVE FORWARD, MOVE UP TO ATTAIN PROPER PITCH REFERENCES. AS YOU APPROACH THE FINGERTIP POSITION, REDUCE POWER TO STOP IN POSITION.

TO FLY GOOD CROSSUNDERS, YOU MUST ANTICIPATE EACH POWER CHANGE AND MAKE THE SMALLEST POSSIBLE CHANGES IN PITCH AND BANK. CROSSUNDERS MAY BE COMPLETED DURING TURNS WHEN YOU ARE PROFICIENT. DO NOT UNDER ANY CIRCUMSTANCES PASS DIRECTLY UNDER THE LEADER.

ROUTE FORMATION

ROUTE FORMATION PROVIDES FLEXIBILITY AND ALLOWS THE WINGMAN TO CHECK AIRCRAFT SYSTEMS AND PERSONAL EQUIPMENT, TO LOOK AROUND, OR SIMPLY TO RELAX. WITH THE FORMATION IN ROUTE, THE LEADER SHOULD RESTRICT MANEUVERING TO MODERATE TURNS AND PITCH CHANGES. MAXIMUM BANK ANGLE IN ROUTE IS 60 DEG.

THE ROUTE POSITION IS FLUID COMPARED TO FINGERTIP. FLY TWO TO FOUR SHIP WIDTHS LATERALLY, NO FARTHER AFT THAN THE NORMAL FINGERTIP LINE, NO FARTHER FORWARD THAN LINE ABREAST. THE VERTICAL POSITION IS APPROXIMATELY THE SAME AS NORMAL FINGERTIP. EXCEPT DURING TURNS AWAY, THE WINGMAN MAINTAINS THIS FLUID POSITION. THE WINGMAN FLIES A ROUTE ECHELON POSITION DURING TURNS AWAY. ATTEMPT TO LIMIT TURNS INTO THE WINGMAN IF POSSIBLE.

ECHELON

ECHELON IS A VARIATION OF FINGERTIP. THE LEADER WILL DIRECT THE FORMATION TO ENTER ECHELON TURNS BY RADIO OR VISUAL SIGNAL. ECHELON TURNS ARE ALWAYS MADE AWAY FROM THE WINGMAN. THE LEADER SHOULD ROLL IN SMOOTHLY AND MAINTAIN BACK PRESSURE COMMENSURATE WITH BANK ANGLE. AS THE WINGMAN, YOU SHOULD MATCH THE LEADER'S ROLL RATE. FOR A LEVEL TURN, POSITION YOURSELF SO THE THE HORIZON BISECTS LEAD'S FUSELAGE.

DISTANCE BETWEEN AIRCRAFT (MEASURED FUSELAGE TO FUSELAGE) SHOULD BE THE SAME AS BEFORE TURN ENTRY. IF OUT OF POSITION, USE POWER TO MAKE CORRECTIONS FORE AND AFT, BACK PRESSURE TO MAINTAIN HORIZONTAL SPACING, AND BANK TO MAKE CORRECTIONS UP OR DOWN.

DURING ROLL OUT, THE LEADER SHOULD USE A SLOWER SMOOTH ROLL RATE AND GRADUALLY REDUCE BACK PRESSURE. THE WINGMAN SHOULD MATCH THE LEADER'S ROLL RATE AND MAINTAIN RELATIVE POSITION. THE MAXIMUM BANK ANGLE IN ECHELON IS 60 DEG.

ECHELON IN FOUR-SHIP FORMATION IS IDENTICAL. THREE AND FOUR DO THE SAME AS TWO. ATTEMPT TO LINE UP HELMETS AND BE EVEN WITH THE RUDDER HINGE LINE OF THE SHIP YOUR NEXT TO. REMEMBER YOUR IN ECHELON WHEN A TURN COMMENCES AND FLY AN ECHELON TURN AND NOT A FINGERTIP TYPE TURN. THIS IS A VERY COMMON MISTAKE.

DO NOT TURN INTO AN ECHELON OR ELEMENT UNLESS IT'S UNAVOIDABLE. DRIFTS OF UP TO 5 DEG OF BANK TO GET LINED UP ON INITIAL, OR TO GET BEHIND ANOTHER FORMATION, CAN BE HANDLED. IF YOU HAVE TO BANK MORE, TRY TO PUT YOUR ELEMENT OR ECHELON ON THE OTHER SIDE OR OPEN UP YOUR FORMATION UNTIL YOU GET BACK ON COURSE.

WHEN YOU SIGNAL A FREQUENCY CHANGE, GIVE YOUR FLIGHT A CHANCE TO ACCOMPLISH IT. A THINKING WINGMAN WILL GIVE A HEAD NOD WHEN HE HAS SWITCHED FREQUENCIES.

FORMING THE FOUR-SHIP ECHELON FROM FINGERTIP

1. LEADER- SIGNAL THE FLIGHT INTO ECHELON BY VISUAL SIGNAL OR RADIO CALL.

2. TWO- IF ECHELON IS TO BE FORMED ON YOUR SIDE, REMAIN IN POSITION. IF IT IS TO BE FORMED ON THE OPPOSITE SIDE, SLOWLY DROP DOWN, CROSSUNDER LEAD, AND ASSUME THE TWO POSITION WHEN THREE MOVES OUT. REMEMBER, NO MATTER WHICH SIDE THE ECHELON HAS BEEN FORMED ON, YOU NOW HAVE THREE AND FOUR FLYING ON YOU.

3. THREE- IF THE ECHELON IS TO FORMED ON YOUR SIDE, MOVE SLOWLY OUT TO ALLOW TWO TO TAKE HIS POSITION BETWEEN YOU AND THE FLIGHT LEAD. IF THE ECHELON IS TO BE FORMED ON THE SIDE OPPOSITE YOU, SLOWLY DROP DOWN, CROSSUNDER TWO, AND MAKING SURE THAT FOUR HAS SWITCHED TO YOUR OTHER WING, COME UP ON TWO'S WING OUTBOARD FROM THE LEADER.

4. FOUR- IF THE ECHELON IS TO BE FORMED ON YOUR SIDE, REMAIN IN POSITION ON THREE'S WING. IF IT IS TO BE FORMED ON THE OPPOSITE SIDE, SLOWLY DROP DOWN WITH THREE, AND, AS HE CROSSES BENEATH LEAD AND TWO, CROSSUNDER SLOWLY BELOW THREE AND COME UP ON HIS OPPOSITE WING.

CHASE FORMATION

THE CHASE OR TRAIL POSITION IS USED TO ENHANCE MANEUVERABILITY. THE POSITION IS APPROXIMATELY 200 TO 500 FEET BEHIND AND SLIGHTLY TO THE SIDE OF LEAD, USING A SMALL CONE. KEEP IN MIND THAT THIS IS NOT A STATIC POSITION; IT IS FLUID TO ALLOW FOR FLEXIBILITY AND CLEARING. TRAIL FORMATION IS SIMILAR TO CHASE USING A LARGER CONE AND 500 TO 1000 FEET SPACING. TRAIL IS USED FOR MORE EXTREME MANEUVERING AND IS FLOWN IN A FLUID CONE. TO INITIATE CHASE OR TRAIL THE LEADER MAKES A SERIES OF PORPOISING MANEUVERS. THE LEADER CALLS OR SIGNALS FOR THE REJOIN.

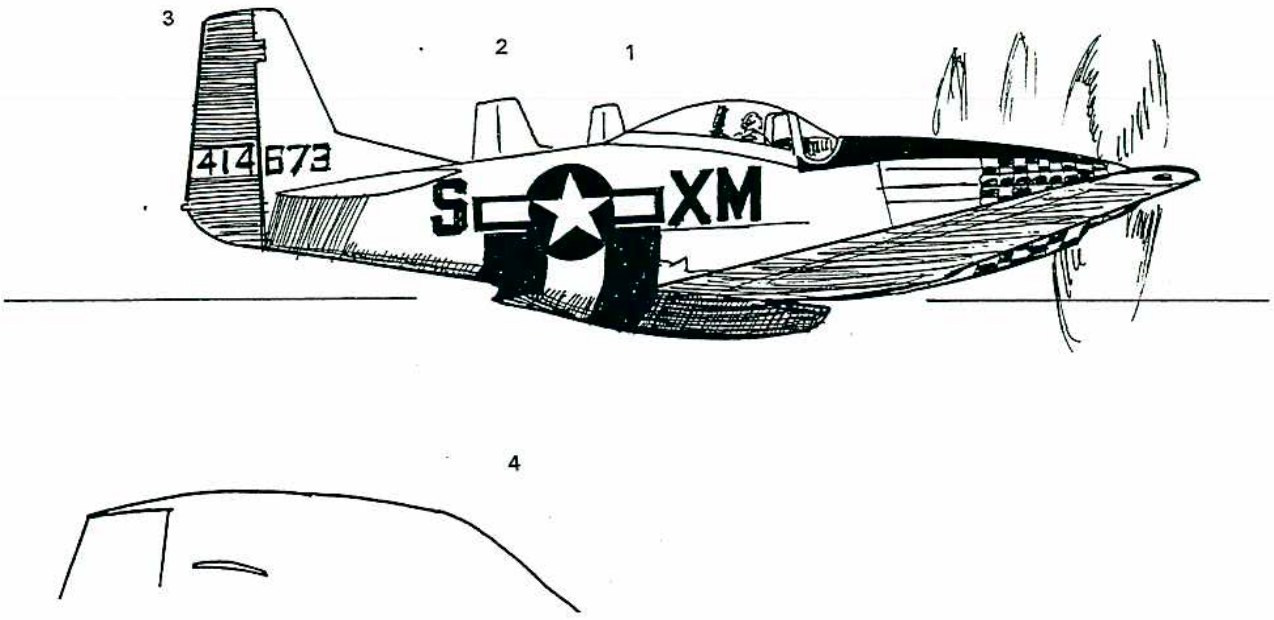
PITCHOUTS

THE PURPOSE OF THE PITCHOUT IS TO PROVIDE SPACING FOR THE OVERHEAD PATTERN, SPACING FOR TRAIL FORMATION OR FOR REJOIN PRACTICE. THE INITIAL APPROACH AND PITCHOUT FOR LANDING WILL BE DISCUSSED LATER.

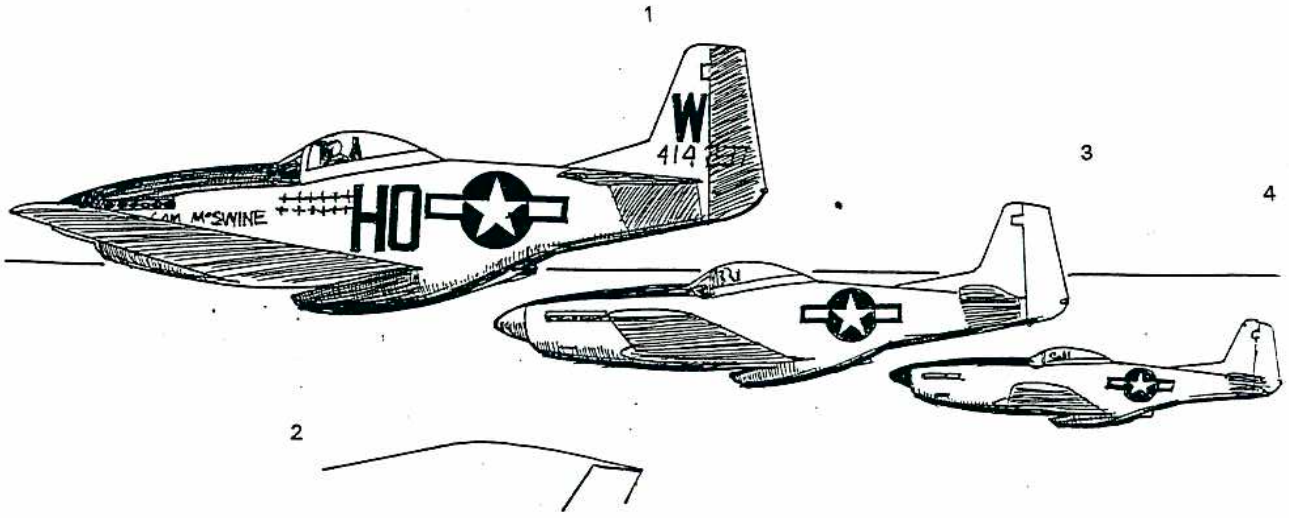
LEAD

THE PITCHOUT SIGNAL IS THE SAME AS FOR RUNUP. CLEAR IN THE DIRECTION OF THE DESIRED TURN AND BEGIN A LEVEL TURN AWAY FROM THE WINGMAN USING APPROXIMATELY 60 DEG OF BANK. CONTINUE THE

FOUR-SHIP PERSPECTIVE



FOUR'S VIEW IN A LEVEL RIGHT ECHELON



TWO'S VIEW IN A LEVEL RIGHT FINGER FOUR

TURN FOR APPROXIMATELY 180 DEG OF TURN. ALTHOUGH A LEVEL PITCHOUT IS DESIRED, DO NOT SACRIFICE CLEARING IN ORDER TO MAINTAIN PRECISE ALTITUDE CONTROL.

WINGMAN

DELAY UP TO 5 SECONDS, THEN BEGIN A TURN TO DUPLICATE THE LEADER'S ROLL RATE, BANK, AND GENERAL FLIGHTPATH. AFTER TURNING APPROXIMATELY 90 DEG, PLAY THE TURN BY VARYING BANK AND BACK PRESSURE TO ROLL OUT BEHIND AND SLIGHTLY BELOW THE LEADER.

REJOINS

REJOINS ARE USED TO GET AIRCRAFT INTO FINGERTIP AS SAFELY AND EXPEDITIOUSLY AS POSSIBLE.

LEAD

AFTER ROLLING OUT OF THE PITCHOUT, WAIT LONG ENOUGH FOR YOUR WINGMAN TO ROLL OUT IN TRAIL. SIGNAL FOR REJOIN BY ROCKING THE WINGS. ESTABLISH A TURN, USING APPROXIMATELY 30 DEG OF BANK, AND ADJUST POWER AND PITCH AS NECESSARY TO MAINTAIN 174 KIAS (200 MPH). IF YOU WANT TO CHANGE THE PREBRIEFED AIRSPEED, CALL THE AIRSPEED YOU WILL HOLD. HOLD BANK AND PITCH STABLE TO ASSIST THE WINGMAN. DURING THE REJOIN, MONITOR THE WINGMAN AND CLEAR THE AREA.

WINGMAN

WHEN THE LEADER GIVES THE REJOIN SIGNAL AND ENTERS A TURN, START A TURN IN THE SAME DIRECTION. USE APPROXIMATELY THE SAME ANGLE OF BANK AS THE LEADER UNTIL YOU APPROACH THE 30 DEGREE CUTOFF ANGLE. STAY SLIGHTLY BENEATH THE LEADER'S ALTITUDE AT ALL TIMES SO BOTH PILOTS CAN KEEP LEAD IN SIGHT. A POWER INCREASE MAY BE USED TO EXPEDITE THE REJOIN HOWEVER, USE IT CAUTIOUSLY. THE P-51 IS CAPABLE OF RELATIVELY HIGH MOMENTUM WITH LOW DRAG. OVERSHOOTS ARE EASILY ENCOUNTERED IF AIRSPEED AND CLOSURE RATES ARE NOT PROPERLY MONITORED.

AS YOU MOVE INSIDE THE LEADER'S TURN, YOU WILL NOTICE THE LEADER'S VERTICAL STABILIZER APPEARS TO MOVE TOWARD THE OUTSIDE WINGTIP AS THE CUTOFF ANGLE INCREASES. WHEN THE VERTICAL STABILIZER APPROXIMATELY BISECTS THE OUTSIDE WING, REDUCE YOUR ANGLE OF BANK TO MAINTAIN THIS REFERENCE. IF THE VERTICAL STABILIZER APPEARS TO MOVE TOWARD THE WINGTIP, YOUR CUTOFF ANGLE IS INCREASING; TO CORRECT, SHALLOW YOUR BANK. IF THE VERTICAL STABILIZER APPEARS TO MOVE TOWARD THE WING ROOT, YOUR CUTOFF ANGLE IS DECREASING; TO CORRECT, INCREASE YOUR BANK. THIS REFERENCE WILL PROVIDE A REASONABLE CUTOFF DURING THE INITIAL PHASE OF THE REJOIN. AS YOU GET CLOSER TO LEAD, THE REFERENCE WILL CHANGE AND THE VERTICAL STABILIZER WILL APPEAR TO MOVE TOWARD THE OUTSIDE WINGTIP. WHEN YOU ARE APPROXIMATELY 500 FEET FROM THE JOINUP AND SLIGHTLY BEHIND THE 30 DEG LINE. THIS IS THE MOST CRITICAL STAGE OF THE REJOIN. MOVE UP TOWARD THE LEADER BY MAKING SMALL BANK CORRECTIONS. BEGIN DECREASING THE OVERTAKE AIRSPEED WITH A POWER REDUCTION. MONITOR BANK AND OVERTAKE CLOSELY DURING THE LAST FEW HUNDRED FEET BEFORE JOINUP TO ENSURE YOUR MOVEMENT IS CONTROLLABLE. PLAN TO ARRIVE IN THE ROUTE POSITION WITH AIRSPEED THE SAME AS THE LEADER'S. STABILIZE IN THIS POSITION, THEN MOVE INTO FINGERTIP AT A CONTROLLED RATE.

TO REJOIN ON THE OUTSIDE OF THE TURN (THREE POSITION) PLAN TO PASS BEHIND (AT LEAST TWO SHIP LENGTHS) AND BELOW THE LEADER. STABILIZE TWO TO FOUR SHIP WIDTHS OUT IN THE ROUTE ECHELON POSITION. THEN MOVE INTO FINGERTIP AT A CONTROLLED RATE.

STRAIGHT AHEAD REJOINS

LEAD

AFTER THE PITCHOUT, CALL FOR A STRAIGHT AHEAD REJOIN AND SPECIFY THE SIDE TO WHICH THE WINGMAN REJOINS. THE LEADER WILL ANNOUNCE THE AIRSPEED IF IT DIFFERS MORE THAN 10 KIAS FROM THE PREBRIEFED AIRSPEED.

WINGMAN

INITIALLY THE WINGMAN WILL USE POWER AS NECESSARY AND MOVE BELOW AND SLIGHTLY TO THE SIDE DESIGNATED BY THE LEADER. CONTINUE TO CLOSE UNTIL YOU ARE APPROXIMATELY 1500 FEET TO THE REAR OF THE LEADER. FROM THIS POINT, BEGIN DECREASING THE OVERTAKE SPEED WITH A POWER

REDUCTION, PLANNING TO ARRIVE IN THE ROUTE POSITION WITH AIRSPEED THE SAME AS THE LEADER'S. AFTER MATCHING SPEED IN THE ROUTE POSITION, MOVE INTO THE FINGERTIP POSITION. IF LEAD MUST TURN DURING A STRAIGHT AHEAD REJOIN, TRANSITION TO A TURNING REJOIN AND BE ALERT FOR OVERSHOOT SITUATIONS SINCE YOU MAY HAVE BOTH A CUTOFF AND AIRSPEED ADVANTAGE.

OVERSHOOTS

TURNING

IF, DESPITE REDUCED POWER AND DECREASED CUTOFF, AN OVERSHOOT DEVELOPS, STAY LOW ENOUGH TO KEEP THE LEADER IN SIGHT AND MOVE TO THE OUTSIDE OF THE TURN WITH AT LEAST TWO SHIP LENGTHS OF NOSE-TAIL SEPARATION. THE GREATER YOUR CLOSURE RATE, THE WIDER YOU MUST GO TO PREVENT MOVING FORWARD OF LEAD'S POSITION. AVOID EXCESSIVE BACK PRESSURE SINCE THIS WILL CAUSE YOU TO CLOSE ON THE LEADER; GO NO HIGHER THAN LEAD. AFTER MOMENTARILY STABILIZING, RETURN TO THE INSIDE OF THE TURN WITH A MINIMUM OF TWO SHIP LENGTHS NOSE-TAIL SEPARATION ON THE LEAD AIRCRAFT AND COMPLETE A NORMAL REJOIN. **NOTE: NEVER RAISE YOUR WING UP WHILE REJOINING ON THE INSIDE OF THE TURN IN AN EFFORT TO SALVAGE A POOR REJOIN. THIS RESULTS IN LOST SIGHT OF THE LEADER AND A POTENTIALLY CATASTROPHIC SITUATION.**

STRAIGHT AHEAD

IF YOUR CLOSURE RATE IS EXCESSIVE DURING THE STRAIGHT AHEAD REJOIN, REDUCE POWER AS REQUIRED TO ESTABLISH A SAFE CLOSURE RATE. IF YOU ARE GOING TO OVERSHOOT, MAINTAIN VERTICAL SEPARATION AND TURN AWAY SLIGHTLY FROM THE LEADER, KEEPING LEAD IN SIGHT. RESUME THE REJOIN WHEN THE LEADER BEGINS TO MOVE AHEAD. IF AT ANY TIME YOU LOSE SIGHT OF LEAD, BREAKOUT IMMEDIATELY.

WHEN OVERSHOOTING STRAIGHT AHEAD, THERE IS A TENDENCY TO MOVE THE CONTROL STICK IN THE DIRECTION YOU ARE LOOKING; THAT IS, TOWARD LEAD. THIS WILL CAUSE YOUR AIRCRAFT TO PASS IN FRONT OF LEAD, WHICH WILL RESULT IN A BREAKOUT.

BREAKOUTS

AS THE WINGMAN, YOU MUST LEAVE THE FORMATION:

1. WHEN YOU LOSE SIGHT OF THE LEADER.
2. WHEN YOU ARE UNABLE TO REJOIN OR TO STAY IN FORMATION WITHOUT CROSSING DIRECTLY UNDER OR IN FRONT OF THE LEADER.
3. ANY TIME YOU FEEL THAT YOUR PRESENCE IN THE FORMATION CONSTITUTES A HAZARD.
4. WHEN YOU ARE DIRECTED BY THE LEADER TO BREAK OUT.

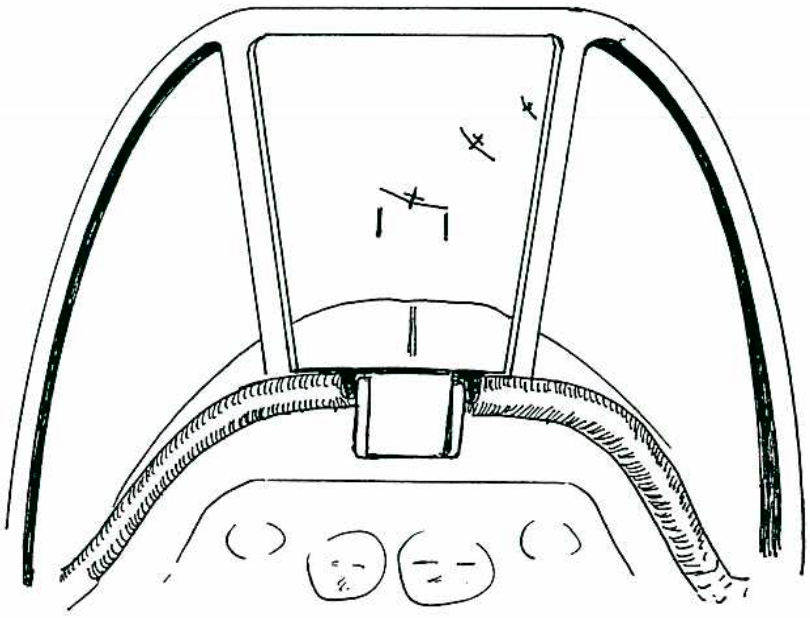
WHEN YOU LEAVE THE FORMATION, NOTIFY THE LEADER.

IF YOU HAVE LOST SIGHT OF THE LEADER, CLEAR AND BREAK OUT AWAY FROM THE DIRECTION LEAD WAS LAST SEEN OR IN A DIRECTION THAT WILL ENSURE IMMEDIATE SEPARATION. USE POWER AS NECESSARY TO EXPEDITE SEPARATION. A WINGMAN BREAKING OUT MUST NOT REJOIN THE FORMATION UNTIL GRANTED PERMISSION BY THE LEADER.

COMBAT MODES FOR SHOWS

GENERAL

THE FOLLOWING MODES INVOLVE SPACING THAT IS NECESSARY TO ACHIEVE THE CORRECT LOOK FOR THE CROWD AND SAFELY ACCOMPLISH THE MANEUVERS. SINCE MOST OF OUR AIRCRAFT NO LONGER HAVE OPERATIONAL GUN SIGHTS AN IMPROVISATION IS REQUIRED. PRIOR TO THE SHOW, IN CRUISE LEVEL FLIGHT, PLACE A GREASE PENCIL "PIPPER" ON THE CENTER OF YOUR WINDSHIELD WHERE THE HORIZON BISECTS THE WINDSCREEN. WHEN BACK ON THE GROUND, DRAW A CIRCLE AROUND THE PIPPER TWO INCHES IN DIAMETER. THE SLOPING WINDSHIELD WILL DISTORT THE CIRCLE INTO AN OVAL WHICH CAN BE USED TO ESTIMATE DISTANCES BASE ON TARGET WINGSPAN. THESE REFERENCES ARE DESCRIBED IN THE FOLLOWING COMBAT MODES.



FOUR'S VIEW THROUGH 2 INCH SIGHT IN TRAIL

TRAIL

SOMETIMES CALLED THE SNAKE DANCE, THREE OR MORE FIGHTERS IN STRING OR TRAIL FOLLOW THE LEADER IN A SERIES OF LAZY EIGHTS BEFORE THE CROWD. A POWER SETTING OF APPROXIMATELY 33" AND 2300 RPM WORKS WELL. EACH FIGHTER STAYS EIGHT TO TEN SHIP LENGTHS BEHIND THE AIRPLANE IN FRONT OF HIM. THE SHIP IN FRONT WILL APPEAR TO BE ABOUT 2.5 TO 3 INCHES IN WINGSPAN ON YOUR WINDSHIELD. IF HE BEGINS TO GET A LITTLE LARGER, SWING YOUR TURNS A LITTLE WIDER UNTIL HE RETURNS TO THE RIGHT SIZE. IF HE BEGINS TO GET SMALLER, CUT HIM OFF A LITTLE IN THE TURNS.

DOGFIGHT

THE DOGFIGHT MAY BE SIMULATED TO THE CROWD BY A LITTLE PLANNING. GENERALLY THE BANDIT WILL BE A SLOWER AIRCRAFT FIGHTER REPLICA SUCH AS A T-6 (ZERO) OR A ME-108, 208, OR EVEN 109. FOR THIS REASON PLAN TO BE 500 TO 100 FEET BEHIND YOUR TARGET IN FRONT OF THE CROWD. THE FIGHTER/TRAINER WILL APPEAR TO BE .75 TO 1.5 INCHES ON YOUR WINDSHIELD. A BOMBER OR TRANSPORT WILL BE 1.5 TO 3 INCHES ON YOUR WINDSHIELD.

DUE TO THE SPEED ADVANTAGE, A POWER SETTING OF 27" AND 2300 RPM WOULD BE APPROPRIATE. YOU CAN USE GEOMETRY TO STAY IN POSITION WITH CUT OFF AND WIDER TURN CIRCLES OR THE VERTICAL. WINGMAN SHOULD FLY A LOOSE POSITION SLIGHTLY TRAILING LEAD TO ALLOW LEAD TO MANEUVER AS REQUIRED.

GROUND ATTACK

THIS MODE IS THE MOST COMMON AT AIRSHOWS. IT CAN BE USED TO SIMULATE STRAFING AND BOMBING. PREBRIEF THE PLANNED POWER SETTINGS FOR THE ATTACK (35" AND 2300 RPM WORK WELL). GENERALLY YOU SHOULD NOT NEED TO CHANGE THIS SETTING THROUGHOUT THE ATTACK. YOUR GOAL IS TO FLY THE AIRPLANE SAFELY AND STAY IN RELATIVE POSITION TO THE OTHER MEMBERS OF THE ATTACK. IN THIS

PROFILE YOU WILL BE THE CLOSEST TO THE GROUND OF ANY OF THE AIRSHOW MODES. AS WE SAID IN THE MILITARY: THE PK (PROBABILITY OF KILL) OF THE GROUND IS ALWAYS ONE. THE INTENT IS NOT TO SEE WHO CAN MAKE THE STEEPEST DIVE, LOWEST PASS, OR HIGHEST PULL UP OFF THE TARGET. SOONER OR LATER THESE PRACTICES WILL BITE YOU.

IF NOT OTHERWIZE BRIEFED BY THE AIRBOSS, FLY THE PATTERN AS A RACETRACK. THE NORMAL TRAFFIC PATTERN WORKS WELL. FLY TO YOUR COMFORT LEVEL. THE LEAD FIGHTER SHOULD SET THE PACE FOR THE ATTACK. THE FLIGHT LEAD SHOULD CONSIDER HIS PILOTS' EXPERIENCE LEVELS IN PLANNING DIVE ANGLES AND PULL UPS. GENERALLY DIVE ANGLES SHOULD NOT EXCEED 30 DEGRESS. ROLL IN FOR THE PASS SHOULD INCLUDE A DIVE ANGLE THAT ALLOWS A COMFORTABLE LEVEL OFF FOR THE PASS. PLAN TO FLY BY SHOW CENTER LEVEL AT 200 TO 300 FEET AGL.. DO NOT FIXATE ON A TARGET OR POINT ON THE GROUND. BE PARTICULARLY COGNIZANT OF YOUR AIRSPEED PRIOR TO THE PULL UP OFF TARGET. MONITOR THIS SPEED THROUGHOUT THE CLIMBING TURN BACK TO THE RACETRACK. IN THE EVENT SOMEONE OUT CLIMBS YOU, DO NOT ATTEMPT TO FOLLOW WITHOUT THE NECESSARY AIRSPEED. YOU CAN MAKE UP THE DISTANCE WITH CUTOFF IN THE RACETRACK. BY USING CUTOFF AND GEOMETRY YOU CAN MAINTAIN SPACING SUCH THAT EACH FIGHTER ROLLS IN ABOUT THE TIME THE PRECEEDING FIGHTER IS BEGINNING HIS PULL UP . ATTEMPT TO FLY TO ONE SIDE OR ANOTHER OF THE PRECEEDING ATTACKER TO AVOID PYRO BLASTS AND LINGERING PROP WASH.

OF GREAT CONCERN DURING THESE MANEUVERS IS THE RELATIONSHIP OF AIRSPEED VERSUS G. KNOW THE VG DIAGRAM FOR YOUR AIRPLANE AND MAKE CERTAIN YOU HAVE THE AIRSPEED NECESSARY TO PULL THROUGH ANY TURN WHETHER ROLL IN OR PULL UP OFF THE TARGET. OCCASIONALLY YOU WILL BE ASKED TO PERFORM A CLIMBING 180 DEGREE TURN TO FLY BACK DOWN SHOW CENTER IN THE OPPOSITE DIRECTION (DUSTER TURN). THIS MANEUVER IS NOT DANGEROUS UNLESS YOU ARE NOT ON TOP OF YOUR AIRSPEED. INSURE THAT YOU HAVE THE NECESSARY AIRSPEED PRIOR TO ROLLING IN THE OPPOSITE DIRECTION. IF NOT, SIMPLY SHALLOW THE CLIMB AND EXTEND THE TURN UNTIL YOU DO. YOU MAY ALSO WIDEN THE TURN RADIUS TO PRECLUDE A TIGHT TURN BACK TO THE RUNWAY. IF YOU ARE EVER UNSURE OF YOUR LOADING AND ANY QUESTION EXISTS AS TO YOUR ABILITY TO CONTINUE A TURN, UNLOAD THE G, ROLL WINGS LEVEL, AND LEAVE THE ATTACK PATTERN. **THIS CAN NOT BE OVEREMPHASIZED**! ANNOUNCE YOUR INTENTIONS. THERE IS NO STIGMA ATTACHED TO ANYONE THAT LEAVES THE FIGHT. A THINKING PILOT WHO ABANDONS A QUESTIONABLE MANEUVER LIVES TO FIGHT ANOTHER DAY!.

BOMBER ESCORT FOR SHOW

THIS IS BY FAR THE MOST COMPLICATED AND LEAST ACCOMPLISHED FORMATION DRILL. TWO FIGHTERS, ELEMENTS, OR FLIGHTS OF FOUR "S" ABOVE BOMBERS IN A TRAIL RACETRACK. THIS MANEUVER IS ALSO KNOWN AS A WEAVE OR SCISSORS. WITH POWER SET AT 30" AND 2300 RPM, THE FIGHTERS WEAVE BACK AND FORTH TO MAINTAIN RELATIVE POSITION TO THE BOMBERS. IF TWO FLIGHTS OF FIGHTERS ARE INVOLVED AN ALTITUDE SEPARATION OF 300 TO 500 FEET IS ESTABLISHED AND THE TWO FORMATIONS ATTEMPT TO WEAVE ACROSS EACH OTHER AT SHOW CENTER AT THE SAME TIME.

WEAVING WITH SINGLE AIRPLANES IS RELATIVELY SIMPLE. IT CAN BE DONE CLOSER ABOVE THE BOMBERS THAN MULTIPLLE SHIP WEAVES. THE UPPER FIGHTER "LEADS", LEAVING SUFFICIENT ROOM BETWEEN HIM AND THE BOMBERS FOR THE LOWER SHIP TO COUNTERFLY THE PATTERN.

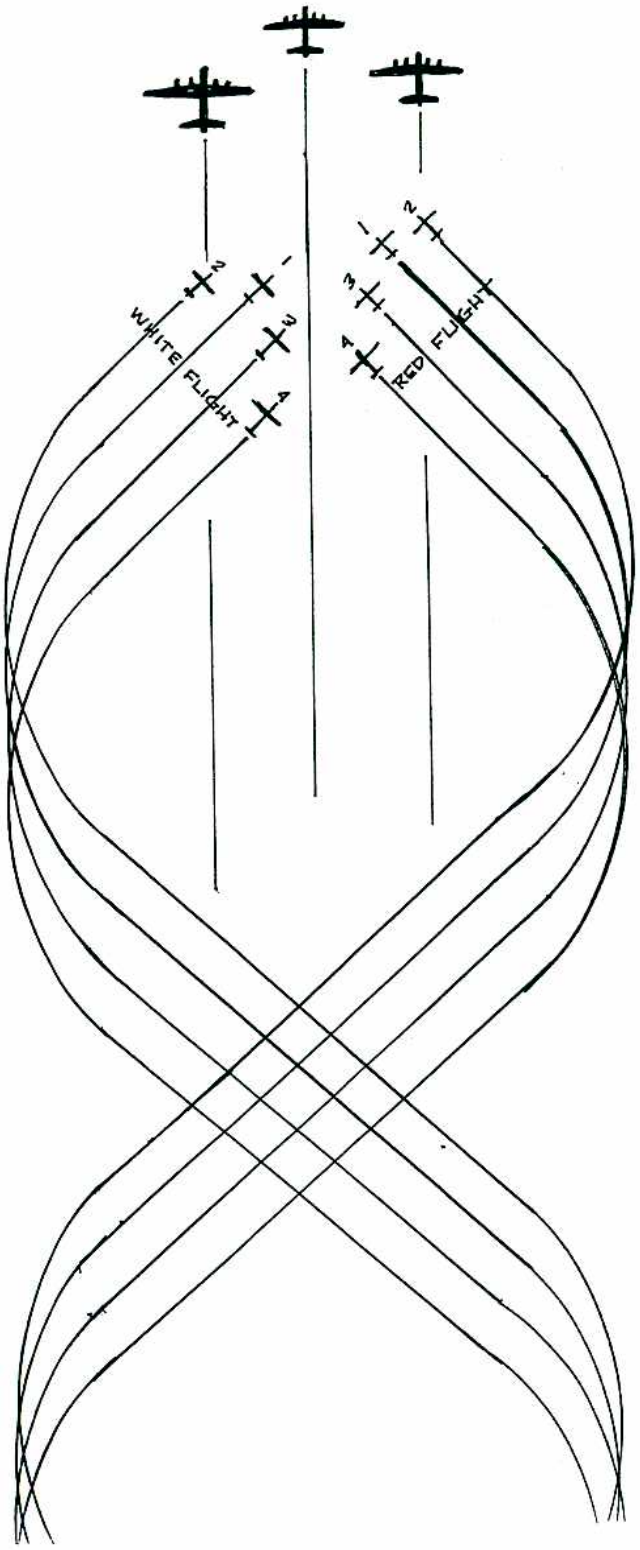
IN WEAVING ELEMENTS, WINGMAN SHOULD REMAIN ABOUT THREE WINGSPANS OUT, AN AIRPLANE LENGTH BACK, AND AT LEAST TWENTY FEET BELOW THEIR LEADERS. THEY PLAY THEIR LEADERS' TURNS, HOLDING 30" AND 2300 RPM; FINDING THEMSELVES ON ONE SIDE OF THE FORMATION ON ONE PASS OVER THE BOMBERS AND THE OTHER SIDE ON THE NEXT PASS. THE UPPER, OR "LEAD" ELEMENT LEADER, MUST ALLOW SUFFICIENT MANEUVERING ALTITUDE BETWEEN HIMSELF AND THE BOMBERS FOR THE OTHER THREE AIRPLANES TO CROSS BETEATH HIM, AND BENEATH EACH OTHER.

TWO FLIGHTS FLYING THE WEAVE DO IT LIKE TWO ELEMENTS. THE MAIN DIFFERENCE IS THAT THE UPPER, OR "LEAD" FLIGHT LEADER MUST LEAVE SUFFICIENT ALTITUDE BETWEEN HIMSELF AND THE BOMBER STREAM FOR 7 AIRPLANES TO CROSS BENEATH HIM AND ABOVE THE BOMBERS.

THE SECOND, OR LOWER, FLIGHT LEADER COUNTERFLIES THE FIRST LEADER'S PATTERN, CROSSING BENEATH HIM OVER THE BOMBER STREAM, SWINGING OUT TO THE OPPOSITE SIDE, AND STARTING BACK IN TO CROSS AGAIN WHEN THE FIRST FLIGHT LEADER DOES. THE SECOND ELEMENT LEADER IN EACH FLIGHT "PLAYS" HIS FLIGHT LEADER'S TURNS; FINDING HIMSELF ON FIRST ONE SIDE WHEN CROSSING THE BOMBERS AND THEN ON THE OTHER SIDE DURING THE NEXT CROSSING. WINGMEN "PLAY" THEIR ELEMENT LEADER'S TURNS TO BE IN THE PROPER "LOOSE FINGER FOUR" POSITION ON EACH PASS OVER THE BOMBERS, A RIGHT FINGER FOUR, FOLLOWED BY A LEFT FINGER FOUR, FOLLOWED BY A RIGHT, ETC.

THE END RESULT IS A BEAUTIFUL SIGHT, BUT CONSIDER YOUR FLIGHT MEMBERS EXPERIENCE LEVELS PRIOR TO ATTEMPTING SUCH A TASK.

BOMBER ESCORT WEAVE



RECOVERY

IN COMBAT THE OBJECTIVE IS TO RECOVER A LARGE VOLUME OF FIGHTERS IN MINIMUM TIME AND TO LIMIT THEIR EXPOSURE TO ENEMY GROUND FIRE. THUS THE OVERHEAD APPROACH. THE OVERHEAD USED TODAY DIFFERS SOMEWHAT FROM THAT USED DURING COMBAT IN 1944. THE MODERN OVERHEAD, HOWEVER, IS GENERALLY ACCEPTED BY THE FAA AND CAN BE ACCOMPLISHED WITH IMPUNITY AT TOWER OR NON-TOWER CONTROLLED AIRFIELDS.

360 DEGREE OVERHEAD APPROACH

INITIAL

REJOIN THE FORMATION TO ECHELON PRIOR TO TURNING TO THE INITIAL LEG OR ON INITIAL IF SUFFICEINT DISTANCE TO THE RUNWAY EXIST. LEFT ECHELON FOR RIGHT BREAK AND RIGHT ECHELON FOR LEFT BREAK.

1. REDUCE POWER TO APPROXIMATELY 27" MP AND 2300 RPM OR AS REQUIRED TO APPROACH THE PITCH POINT AT 200 TO 225 MPH (174 TO 200 KIAS).
2. INITIAL APPROACH ALTITUDE IS 1000 FEET AGL.
3. ENTER INITIAL AT LEAST ONE MILE FROM THE PITCH POINT.
4. PLAN TO BE OVER THE PITCH POINT (USUALLY THE NUMBERS) WHEN THE LAST SHIP OF THE PRECEDING FLIGHT IS TOUCHING DOWN.
5. SIGNAL FOR THE BREAK GENERALLY FROM THE NUMBERS TO MIDFIELD OR AS REQUIRED.

BREAK/PITCHOUT

SIGNAL THE BREAK WITH A PITCHOUT SIGNAL AND ROLL RAPIDLY AWAY FROM THE WINGMAN USING APPROXIMATELY 60 DEG OF BANK AND REDUCE POWER. ROLL OUT PARALLEL TO THE RUNWAY. STAY LEVEL WITH THE HORIZON. EACH SUCCEEDING WINGMAN TAKE 5 SECOND SPACING AND THEN DUPLICATE THE LEADER'S PATTERN. PLAN TO ARRIVE AT THE PERCH POINT (APPROACH END OF RUNWAY) AT 150 KIAS AND LOWER THE GEAR. MAKE A NORMAL FINAL TURN AND LANDING. SPACING MAY BE ALTERED IF PREBRIEFED.

WHEN THE RUNWAY WIDTH IS 100 FEET OR GREATER, LEAD LANDS ON THE LEFT, TWO ON THE RIGHT, THREE ON THE LEFT, AND FOUR ON THE RIGHT. DEPENDING ON REQUIREMENTS, THE LEAD CAN LAND ON WHICHEVER SIDE HE NEEDS TO, TO FACILITATE EXPEDITIOUS TURNOFF, ETC. AND WINGMEN LAND ACCORDINGLY ON ALTERNATING OPPOSITE SIDES.

IN NO EVENT LAND CLOSER THAN 3000 FEET BEHIND THE AIRCRAFT DIRECTLY IN FRONT OF YOU IN YOUR HALF OF THE RUNWAY. DURING THE ROLL OUT, REMAIN IN YOUR HALF OF THE RUNWAY. ON RUNWAYS LESS THAN 100 FEET WIDE, LAND IN THE CENTER AND TAKE APPROPRIATE SPACING.

DURING WAIVERED AIRSHOW ACTIVITIES A LOWER INITIAL ALTITUDE MAY BE BRIEFED. IN THIS EVENT USE THE SAME PROCEDURES PREVIOUSLY DISCUSSED HOWEVER EACH AIRCRAFT WILL EXECUTE A CLIMBING 180 DEGREE TURN TO PARALLEL THE RUNWAY. THE SAME 5 SECOND SPACING IS USED AND LANDING PROCEDURES ARE IDENTICAL.

ANOTHER TYPE OF PITCHOUT IS THE **FAN** BREAK. INITIAL APPROACH IS THE SAME AS PREVIOUSLY DISCUSSED. ALL BREAK SIMULTANEOUSLY OVER THE PITCH POINT IN A "FAN" OPPOSITE THE TOUCHDOWN POINT. SPACING IS ACHIEVED BY EACH MEMBER VARYING HIS BANK ANGLE. (E.G.; NO. 1 BANKS 90 DEGREES, NO. 2 BANKS 75 DEGREES, NO. 3 BANKS 45 DEGREES, NO. 4 BANKS 30 DEGREES.) THE LEADER'S IS THE TIGHTEST CIRCLE, REMAINING AS CLOSE IN AS CAN BE SAFELY NEGOTIATED. EACH SUCCEEDING AIRPLANE'S CIRCLE IS SUFFICIENTLY LARGER THAN THE PRECEEDING ONE TO SECURE SPACING FOR LANDING. THIS BREAK MAY ALSO BE PERFORMED AT LOW ALTITUDE ON INITIAL. IN THIS CASE , INSURE AIRSPEED IS SUFFICIENT TO INITIATE A FAN BREAK OF CHANDELLES TO THE DOWNWIND ALTITUDE. THIS BREAK IS GENERALLY PERFORMED DURING AIRSHOWS, HOWEVER, PROVIDING INITIAL APPROACH ALTITUDE IS LEGAL, IT MAY BE PERFORMED ANYWHERE IN PLACE OF THE STANDARD BREAK.

APPENDIX

FORMATION STANDARDS
FOR THE P-51 AND SIMILAR PERFORMANCE FIGHTER AIRCRAFT

ENGINE START

LEAD CHECK FLIGHT IN ON BRIEFED FREQUENCY.
LEAD SEND FLIGHT TO APPROPRIATE GROUND & TOWER FREQUENCIES AS REQD.

RUNUP FOR ENGINE CHECKS

LEAD CALL FOR RUNUP BY VISUAL SIGNAL (CIRCULAR MOTION WITH VERTICALLY EXTENDED INDEX FINGER) OR BY RADIO CALL.

WINGMAN ACKNOWLEDGE **COMPLETION** OF SUCCESSFUL RUNUP AND PRETAKEOFF CHECKS BY VERTICALLY EXTENDED THUMBS UP.

TAKEOFF SINGLE- SHIP (SHOTGUN)

LEAD COMMENCES TAKEOFF AND REMAINS ON HIS SIDE OF RUNWAY DURING ROLL.

WINGMAN COMMENCES TAKEOFF USING OPPOSITE SIDE OF RUNWAY AFTER 8 SECOND SPACING. IF PREBRIEFED EACH FORMATION MEMBER MAY CALL "TAILS" TO INCREASE SITUATIONAL AWARENESS.

IF LEAD REQUIRES ABORT AND DIRECTIONAL CONTROL CAN BE MAINTAINED: LEADER SHOULD IMMEDIATELY ANNOUNCE: "LEAD'S ABORTING & APPROPRIATE SIDE OF RUNWAY" (I.E. "LEAD'S ABORTING-RIGHT SIDE"), PULL THROTTLE TO IDLE AND STOP ON HIS SIDE OF RUNWAY. WINGMAN SHOULD SELECT NORMAL TAKEOFF POWER AND CONTINUE THE TAKEOFF.

IF LEAD REQUIRES ABORT & DIRECTIONAL CONTROL CAN NOT BE MAINTAINED, IMMEDIATELY ANNOUNCE: "FLIGHT ABORT, FLIGHT ABORT, FLIGHT ABORT". WINGMAN WILL IMMEDIATELY ABORT ALSO AND LEAVE THE RUNWAY RATHER THAN COLLIDE WITH THE LEADER.

TAKEOFF (FORMATION)

LEAD ASSUMES POSITION ON DOWNWIND SIDE OF RUNWAY IF CROSSWIND COMPONENT 5 KNOTS OR GREATER. IF WIND IS NO FACTOR LINEUP TO PLACE WINGMAN ON RIGHT.

WHEN BOTH AIRCRAFT ARE IN POSITION LEAD SIGNALS FOR RUNUP TO 30" MP (OR PREBRIEFED MP) BY VISUAL SIGNAL.

WHEN LEAD IS READY, HE WILL LOOK TOWARD TWO. WINGMAN ACKNOWLEDGE READY WITH LARGE HEAD NOD.

LEAD SIGNALS FOR BRAKE RELEASE BY LARGE DELIBERATE HEAD NOD & SMOOTHLY PUSH POWER TO NO MORE THAN 50" MP AT A SLIGHTLY SLOWER RATE OF THROTTLE MOVEMENT THAN NORMAL.

AFTER AIRBORNE LEAD WILL LOOK AT TWO TO INSURE SAFELY AIRBORNE AND THEN RETRACT GEAR (NO SIGNAL REQD, HOWEVER A HEAD NOD MAY BE PREBRIEFED).

SAME ABORT SCENARIO AS DESCRIBED IN SHOTGUN TAKEOFF

JOINUP AND REJOIN SPEEDS/POWER SETTINGS

FOR SHOTGUN TAKEOFF JOINUPS, LEAD USE 35" MP / 2300 RPM AND 174 KIAS (200 MPH)

REJOINS FROM ALL SEPARATIONS, LEAD FLY 30 DEG BANK AND 174 KIAS (200 MPH). IF AIRSPEED DIFFERS BY 10 KNOTS OR MORE CALL THE AIRSPEED ON THE RADIO.

CLIMB

AFTER THE GEAR IS UP AND AT A SAFE ALTITUDE LEAD WILL REDUCE POWER TO 35" MP / 2300 RPM FOR THE CLIMB SEGENT. THIS SETTING IS SUGGESTED AND MAY BE PUSHED UP IF NECESSARY.

CRUISE

NORMAL SUGGESTED CRUISE POWER IS 31" MP / 2300 RPM.

DESCENT

NORMAL SUGGESTED DESCENT POWER IS 27" MP/ 2300 RPM.

APPROACH AND LANDING

LEAD WILL ASSEMBLE FLIGHT IN ECHELON PRIOR TO 2 MILE INITIAL IF POSSIBLE.

NORMAL SUGGESTED POWER ON INITIAL IS 27" MP / 2300 RPM OR AS REQUIRED TO ARRIVE OVER THE NUMBERS AT 200 TO 225 MPH (174 TO 200 KIAS).

SIGNAL FOR THE BREAK FROM THE NUMBERS TO MIDFIELD. (PLAN SO THAT EACH AIRCRAFT CAN ARRIVE AT THE PERCH AT GEAR SPEED (170 MPH / 147 KIAS).

IF RUNWAY WIDTH 100 FT OR GREATER, LEAD LAND ON LEFT, TWO ON RIGHT, THREE ON LEFT, FOUR ON RIGHT. LEAD HAS DISCRETION TO LAND ON TURN OFF SIDE TO EXPEDITE RECOVERY. IN THIS CASE IF LANDING IS DIFFERENT THAN DESCRIBED, WINGMAN LAND ON ALTERNATING OPPOSITE SIDES.

IF RUNWAY IS LESS THAN 100 FT WIDE PLAN 3000 FT SPACING BETWEEN LANDING AIRCRAFT.

FORMATION LANDINGS ARE NOT AUTHORIZED DUE TO CONTROL AND VISIBILITY LIMITATIONS.

MUSTANG/FIGHTER
GENERAL BRIEFING GUIDE

MISSION DATA

1. TIME HACK
2. MISSION OVERVIEW
3. MISSION DATA CARD
   - A. CALL SIGN
   - B. WEATHER
   - C. ALTIMETER
   - D. FORMATION POSITION ASSIGNMENTS
   - E. FREQUENCIES - AIRSHOW PRIMARY _____ SEC _____
     - ATIS _____
     - CHECK IN _____
     - TAXI/GRND _____
     - T/O _____
     - DEPARTURE _____
     - AIR TO AIR _____
     - RECOVERY _____
4. TIMES
   - A. START
   - B. TAXI
   - C. TAKEOFF
   - D. OTHER

GROUND PROCEDURES

1. PREFLIGHT
2. RADIO OPS
3. CHECK IN
4. ENGINE START/TAXI

DEPARTURE PROCEDURES

1. TAKEOFF
   - A. RUNWAY LINEUP
   - B. SHOTGUN (SINGLE SHIP)
   - C. FORMATION TAKOFF
   - D. TAKEOFF EMERGENCIES/ABORTS
2. DEPARTURE/JOIN-UP
3. FORMATION POSITION

ENROUTE

1. AIRWORK & FORMATION PROCEDURES
2. RADIO CHANNEL CHANGES

RECOVERY

1. REJOIN
2. TYPE RECOVERY
3. PATTERN AND LANDING
4. AFTER LANDING
5. ENGINE SHUTDOWN

ABNORMAL PROCEDURES

1. DEPUTY FLIGHT LEAD DESIGNATION
2. BREAKOUTS
3. RADIO INOP
4. SARCAP
5. EMERGENCY (HEFOE)
6. EMERGENCY AIRFIELDS/DIVERT

SPECIAL SUBJECTS

1. AIRSHOW OPERATIONS
   - A. VISUAL SEARCH RESPONSIBILITIES
   - B. FLIGHT PATH DECONFLICTION
   - C. FUEL AWARENESS
   - D. CHANNELIZED ATTENTION
   - E. AIRSPEED/G RECOGNITION
   - F. VISUAL ILLUSIONS
   - G. DISSIMILAR FORMATIONS

FIGHTER FORMATION BRIEFING CARD

FLT CALL SIGN: _____
WEATHER: _____
ALTIMETER: _____
FLT LEAD: _____
#2: _____
#3: _____
#4: _____
OTHER: _____
AIRSHOW FREQ: _____
ATIS: _____ ATIS: _____
GRND: _____ APPR: _____
TWR: _____ TWR: _____
DEP: _____ GRND: _____
START ENGINE: _____ CHECK IN: _____
TAXI: _____ T/O: _____
TAKEOFF/LINEUP: _____
DEPARTURE: _____

MISSION DATA:

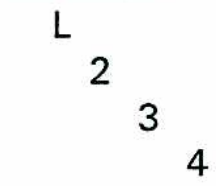
RECOVERY: _____
_____
EMERGENCY AIRFIELDS: _____
_____

FORMATION POSITION

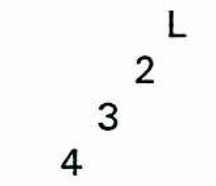
FINGERTIP-RT

FINGERTIP-LT

ECHELON-RT

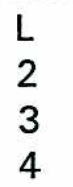


ECHELON-LT



DIAMOND

TRAIL



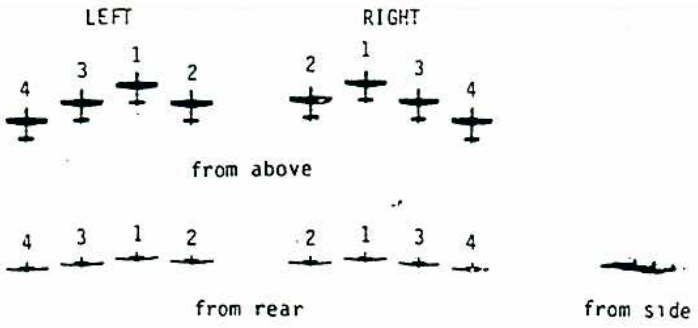
NOTES

#2 ALWAYS JOINS TO INSIDE OF TURN
#3 & #4 ALWAYS JOIN TO OUTSIDE OF TURN
ALL REJOINS ARE TO STANDARD FINGERTIP FORMATION (FINGERTIP LEFT OR RIGHT BASED ON TURN OUT OF TRAFFIC OR PREBRIEFED SPECIFIC SIDES)

BASIC FORMATIONS

FINGER FOUR

FLIGHT



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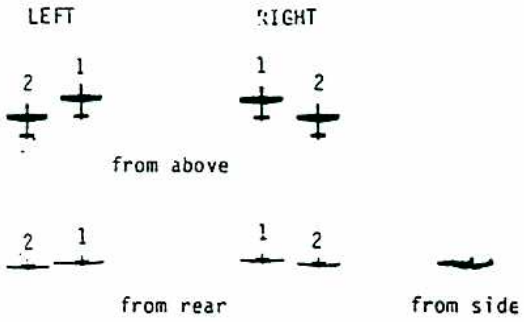

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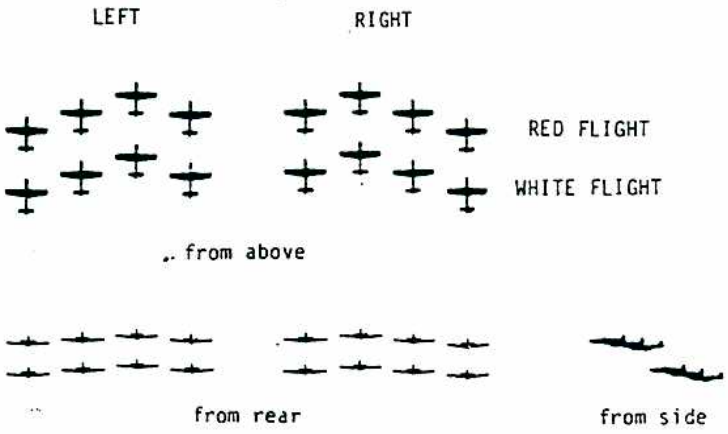
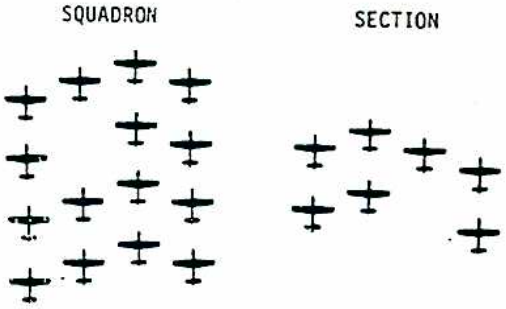
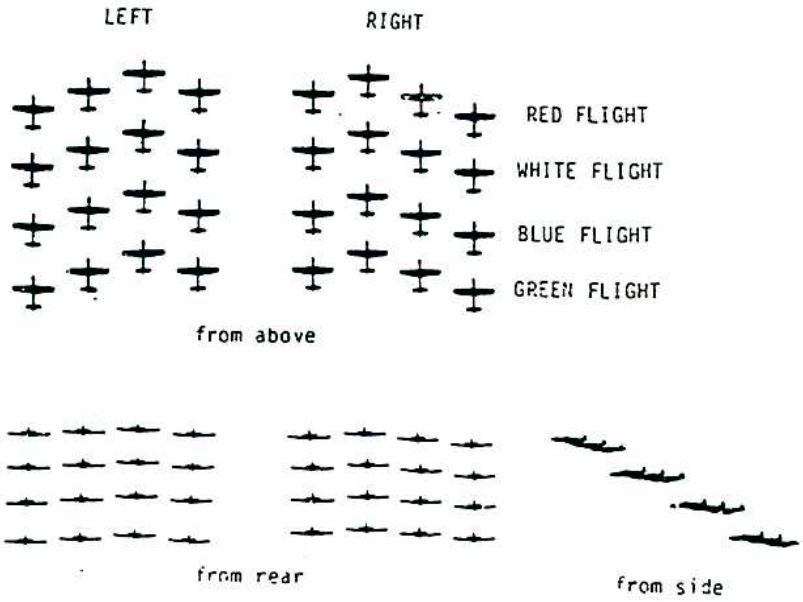


MISSING MAN

NOTE - in any formation larger than a flight, the man is always missing; there is no "pullout"



SQUADRON



ECHELON