



Flight Manual

Jaeger Software



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FIGHTER DUEL PRO 2
by JAEGER SOFTWARE

Fighter Duel Pro 2

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SYSTEM REQUIREMENTS

Fighter Duel Pro 2 has been programmed for the entire Amiga line including the 1200 and 4000 models, and on Amigas with accelerator boards with processors through the 68040. Memory requirements are 2 megabytes of chip RAM, or 2 megabytes of fast RAM plus 512K of chip RAM. Machines with 4 megabytes of fast RAM have the additional feature of in-flight switching among the 25 enemy aircraft. (If your computer contains 4 megabytes of fast RAM and you are not able to switch among the 25 enemy aircraft, or if the program simply will not run, it is possible that programs have been launched during boot-up and are running concurrently and are reducing the amount of memory available to *FDPro2*. Either quit the programs, remove them from the start-up, or install more memory, and try again.) The Kickstart in use must be version 1.2 or later, and there is complete compatibility with version 2.0 and 3.0. With the 68040 microprocessor, the 2.0 or 3.0 version must be used.

Ethernet network software should be disabled before running *FDPro2*.

On Amiga 1200 and 4000 models, *FDPro2* will operate in either the "NTSC:640x400 Interlaced" screen mode or the new "DBLNTSC:High Res No Flicker" enhanced AGA mode. You must set the Workbench screen to one of these modes using the Preferences program "ScreenMode" before running *FDPro2*. The "DBLNTSC:High Res No Flicker" enhanced AGA mode has superior performance and should be used if possible.

FDPro2 requires both a mouse and a joystick; hardware requirements for "Two-Player" and "Rear-View" modes are described in their respective sections. *FDPro2* supports both digital and analog joysticks, including analog sticks with "hat" switches, and analog rudder pedals. Analog sticks are superior over digital sticks in providing faster, smoother, and more realistic control of the aircraft. Analog controls will require an adapter; we recommend the *AMIGA Smart Port* from IDD (Interactive Digital Devices, 2238 Nantuckett Court, Marietta, GA 30066, 404-516-0248) which, among the other features it provides, will allow you to use IBM-compatible analog joysticks and rudder pedals, and the analog stick "hat" switch. We recommend the

Flight Stick Pro analog stick from CH Products, and as for analog rudder pedals, we recommend the *Rudder Control System* from ThrustMaster, and the *PC Pedals* from IDD.

HARD-DRIVE INSTALLATION

To begin the installation of *Fighter Duel Pro 2* on your hard drive, boot the computer from the hard drive, insert a copy of *Fighter Duel Pro 2* Disk 1 in DF0:, and double-click the disk icon that appears on the Workbench screen. Start the program by double-clicking the FIGHTERDUELPRO2 icon that appears in the disk window. The title screen will appear followed by the main menu screen. In the main menu screen, press the <I> key and the INSTALL window will appear.

You can abort the installation at this point by clicking the CANCEL button. If *Fighter Duel Pro 1* or *Flight Recorder* is installed on the hard-drive then click the INSTALL UPDATE button. You will need Disk1 and Disk4 that are included in the upgrade package. Otherwise, click the INSTALL ALL button; you will need Disk1, Disk2, Disk3, and Disk4.

INSTALL will then ask you to supply a valid AmigaDos path for *Fighter Duel Pro 2*. Make sure to select a location that is accessible from Workbench. The installer will check that the location has enough free space available. If enough free space is not available then you must clear space (by deleting files) and rerun the installer.

COPY PROTECTION

Fighter Duel Pro 2 is not copy protected. Therefore, YOU are the only copy protection. Illegal distribution of this product will inhibit development of future projects of this type and erode the viability of the Amiga software market.

RUNNING THE PROGRAM

First, make back-up copies of the four disks included in the *Fighter Duel Pro 2* package; upgrade packages will contain two disks.

There are three methods for running the *FDPro2* program:

(1) Insert *FDPro2* Disk1 in DF0: at the Workbench disk prompt. This method will not use the enhanced AGA screen display.

(2) Boot the computer from the Workbench disk and if you wish to use the enhanced AGA screen display, set the ScreenMode to "DBLNTSC:High Res No Flicker" using the Prefs ScreenMode program. Insert *FDPro2* Disk1 in DF0:, and double-click the DISK1 icon that appears on the Workbench screen. Start the program by double-clicking the FIGHTERDUELPRO2 icon that appears in the disk window.

(3) The last method, which requires hard-drive installation, is to display and double-click the FIGHTERDUELPRO2 icon. Again, if you wish to use the enhanced AGA screen display, set the ScreenMode to "DBLNTSC:High Res No Flicker" using the Prefs ScreenMode program before running *FDPro2*.

CUSTOMER SUPPORT

Jaeger Software maintains a Support CATegory, CATegory 24, in the Amiga Starship Roundtable on GENie, the General Electric Information Exchange. Topics of discussion cover all aspects of *FDPro2*, including aircraft performance, dogfighting tactics, control hardware, and tournament activity. Jaeger Software personnel check the messages regularly and will answer questions. You may also send direct electronic mail to Jaeger representative Matt Shaw at GENie mail address: M.SHAW15, Internet mail address M.SHAW15@genie.geis.com, or call Jaeger Software, Inc. at 301-948-6862. Letters can be sent to Jaeger Software Inc., 7800 White Cliff Terr., Rockville, MD 20855. Customer support for *FDPro2* can only be given to registered owners, please make sure to send in your registration card as soon as possible.

INTRODUCTION

Fighter Duel Pro 2 was built from the ground-up to recreate the excitement and challenge of the World War II dogfight. You'll catch all the action with a lightning-fast frame rate that redraws the screen and reacts to your inputs at over 24 frames per second. *FDPro2* is a true flight simulator with accurate and complete aerodynamic modelling. The flight performances of all aircraft are realistic whether you pilot the aircraft or fly against them.

The *FDPro2* graphics display is the high-resolution 640x400 mode, either AGA flicker-free or interlaced, that affords the finest possible detail. Aircraft are rendered precisely, pixel-by-pixel, so that even at great distances it is possible to tell, for example, the bank angle of the bandit and where it's headed. The scenery objects are massive and meant to provide positional reference when travelling at typical dogfight airspeeds.



The combination of Theatre, Locale, and Start menu items determine the beginning position of your flight; positions may be limited by the PlayerMode setting. If you select SEA for Theatre then your flight will be over water and the carrier will be the base of operations. For LAND, the flight will be over land and the landing strip will be the base. For both theatres, the outlying combat locales are the arch, towers, and isles. You can start your flight at one of the locales by selecting that option from the Locale menu item. If you select BASE for Locale then your flight will begin at either the carrier or landing strip. With the TRAINING option, the outlying locales are the basic and advanced gunnery ranges and training areas. Finally, the Start item determines whether the flight will begin airborne or on the deck. For example, With ARCH selected for Locale and DECK selected for Start, the flight will begin with your aircraft sitting on the arch with engines idling.

In the Joystick item, ANALOG NO HAT refers to an analog joystick without the "hat" switch feature; THRUSTMSTR/SP is the *ThrustMaster* analog stick with the "hat" feature used in conjunction with the *Amiga Smart Port*; FLTSTK PRO is the *Flight Stick Pro* analog stick with the "hat" feature used with a customized adapter; and FLTSTK PRO/SP is the *Flight Stick Pro* analog stick with the "hat" feature used in conjunction with the *Amiga Smart Port*. Digital "EZ" is a digital stick with many of the realism features removed from the program.

If Gun Realism is checked then the trajectory of the bullets and tracers will reflect the movement of the aircraft; otherwise, the bullets will travel to the center of the gunsight. The Starting Altitude setting of a Standard mode flight, in thousands of feet, can be set from one to 26. In all other modes, the starting altitude of your aircraft and that of the computer-controlled aircraft must be at least five thousand feet, in order to avoid collisions with the scenery objects. Surface dots are dots on the land and sea in the area of the carrier and landing strip.

In the Rudder item, PC PEDALS refers to Interactive Digital Design's *PC Pedals*; RCS PEDALS refers to ThrustMaster's *Rudder Control System*; MAXX PEDALS refers to Maxx's *Maxx Pedals*.

3. AIRCRAFT SCREEN

The Aircraft screen is used to select the type of aircraft that you will pilot, and the types and skill levels for the computer-controlled foes. Click the Aircraft roll-over gadget to YOUR AIRCRAFT and highlight the type you wish to fly. With the TWO-SEATER player mode, the selection is limited to the P-61 and ME-110 aircraft. Click again to FOE1 and highlight the type and click the Skill Level gadget for the Foe1 skill level; continue with FOE2, FOE3, and FOE4. If you select MACHINE GUNNER as your aircraft, you will be controlling a stationary anti-aircraft gun at either the arch or the towers locale. As an extra and otherwise undocumented feature, the foes will be assigned to two F-16 and two F-18 jets by pressing <Shift-J> while in the Aircraft screen; there is no silhouette screen for the jets and the skill levels will remain as set.

4. HOOK-UP SCREEN

Instruction for use of the Hook-Up screen is given in Section VI: "Two-Player Modes". The Hook-Up screen button is only enabled if a two-player mode is selected in the PlayerOptions screen.

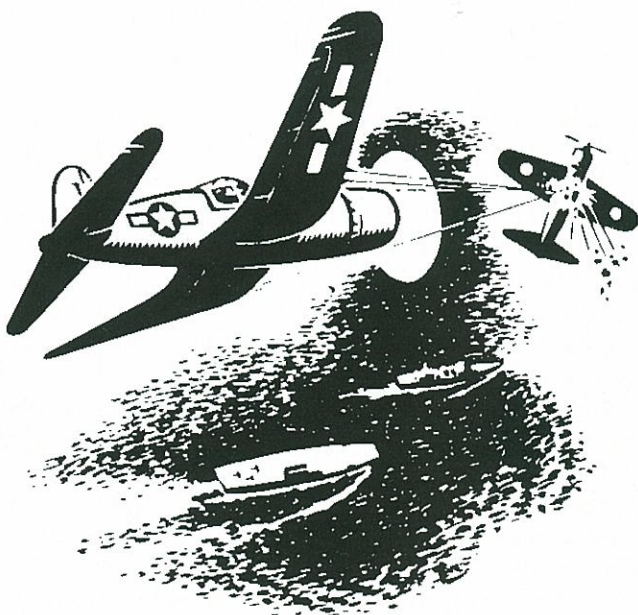
5. CHAT SCREEN

The Chat screen is used to assign a set of keystrokes to the <F2> through <F10> function keys that are used in all two-player modes to send comments between players. Four separate sets of comments, named Chat1, Chat2, Chat3, and Chat4, can be saved to disk and recalled for later flights. The set that is selected when exiting the Chat screen is used for the current flight; clicking the Save button in the main menu screen will cause that set to be automatically selected for future flights.

6. COLORS SCREEN

The Colors screen is used to fine tune many of the screen colors used in the actual flight part of the program. To help in the selections, the top two-thirds of the COLORS screen is a combination of various scenes from *FDPPro2*. The lower third contains eight color squares representing the eight alterable colors. The shades can be cycled by clicking the mouse pointer on the square or on a part of the scene where the color appears. Labels above the squares refer to objects of that color in the scene; only a portion of the brown carrier deck (black landing strip in land theater) can be seen in the lower left-hand corner of the scene. Changing the color of the sky from the default color may reduce flicker on your monitor.

The default shades can be restored by clicking the DEFAULT button. When the shade selections are completed, click on the USE button to use these shades in the pending flight and return to the main menu. Click the CANCEL button at any time to return the main menu screen without affecting the color selections. To save a set of colors to disk for use the next time the program is run, exit the Colors screen and click the SAVE button in the main menu screen.



SECTION II ONE-PLAYER MODES

1. STANDARD

This mode affords the broadest flexibility in selecting the beginning position for the flight and the type of activity during the flight. Flights can start airborne at any altitude or stationary on the deck, at a combat locale or at the carrier base or landing-strip base. This mode is also used for the training regimen; the combat locales are replaced with training locales when TRAINING is selected from the Locale item in either the Pre-Flight or In-Flight Menus. The TRAINING option is only available in Standard mode. Another feature of Standard mode is that when you enter a combat locale, the enemy aircraft formations will approach from random altitudes and positions. These formations of four aircraft include diamond, abreast, finger-and-four, and split pairs.

2. TOURNEY

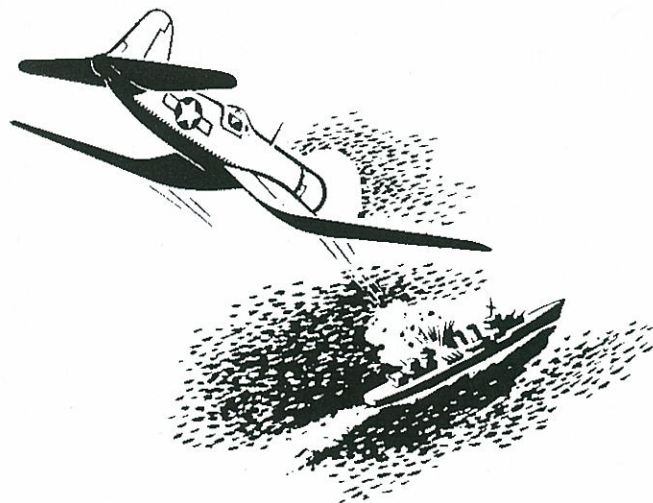
This mode immediately places the pilot in a combat situation with a fly-by of an abreast formation of four enemy aircraft. The pilot is able to set the starting altitude of the engagement from anywhere between five and twenty-six thousand feet, and the action begins over the center of the combat locale. The Locale menu item is restricted to one of the combat locales, either arch, towers, or isles, and the type of start will be forced to airborne. After crashing or exploding, or clicking the RESTART FLIGHT button, the fly-by start is repeated with a fresh set of enemy aircraft.

3. WINGMAN

This mode features three computer-controlled aircraft, one of which is friendly, known as the "lead" aircraft, and two enemy aircraft. At the beginning of the flight, your lead is positioned ahead and to your left; the enemy aircraft, also in a lead and wing formation, approach with a fly-by. The two lead aircraft have been instructed to engage one another, and the enemy wing aircraft will attempt to seek and destroy your aircraft. For identification purposes, pressing the right mouse button or the <I> key will cause your lead's aircraft to blink.

The pilot is able to set the starting altitude of the engagement from anywhere between five and twenty-six thousand feet, and the

action begins over the center of the combat locale. The Locale menu item is restricted to one of the combat locales, either arch, towers, or isles, and the type of start will be forced to airborne. After crashing or exploding, or clicking the RESTART FLIGHT button, the fly-by start is repeated with a fresh set of enemy aircraft.



SECTION III BASIC TRAINING

1. GENERAL

Training is necessary in order to develop fundamental flying and gunnery skills, without which the student will not develop into a feared fighter pilot, and will never know the satisfaction of a hard fought victory. To access the training area, set the Locale option to TRAINING, and the PlayerMode to ONE-PLAYER STANDARD in the Pre-Flight Menu; the flight will originate at either the carrier or landing strip depending on the setting of the THEATRE option.

The Training Program is divided into Basic and Advanced sections. A map positioning the training area localities in relationship to the carrier (or landing strip) is shown in Figure I. Headings are provided for flying to each locality from the carrier (or landing strip) and from locality to locality. The carrier (and landing strip) is situated in the center of the area with basic gunnery located 12 nautical miles to the north, maneuvers located the same distance to the southeast, and advanced gunnery the same distance to the southwest. The training gunsight displays your gunnery score on the right side of the cross hair and an elapsed time clock on the left. The clock is started with the first firing of the guns and can be reset by rearming. Rearming will also clear the score.

2. CARRIER TAKEOFF

Takeoffs can be made with any flaps setting, however a flap setting of 30 is recommended for the student pilot. A low-drag flaps-up takeoff is the fastest way to get from the carrier out to a locality. This will, however, decrease the available lift and make turning difficult. After setting the flaps, add right aileron trim to counteract engine torque by holding down the left mouse button while applying right stick for about a second. Without aileron trim, the aircraft will roll to the left after leaving the deck. The reaction of the aircraft to engine torque is greatest at high rpm and low airspeeds, and will cause the aircraft to yaw left and roll left. The amount of trim necessary to counter the torque also depends on the horsepower of the engine. For example, the F4U takeoff rudder trim is 6° nose right and the aileron trim is 6° right wing down. The P38 exhibits no torque roll because the two engines are counter-rotating. There is no trim indicator.

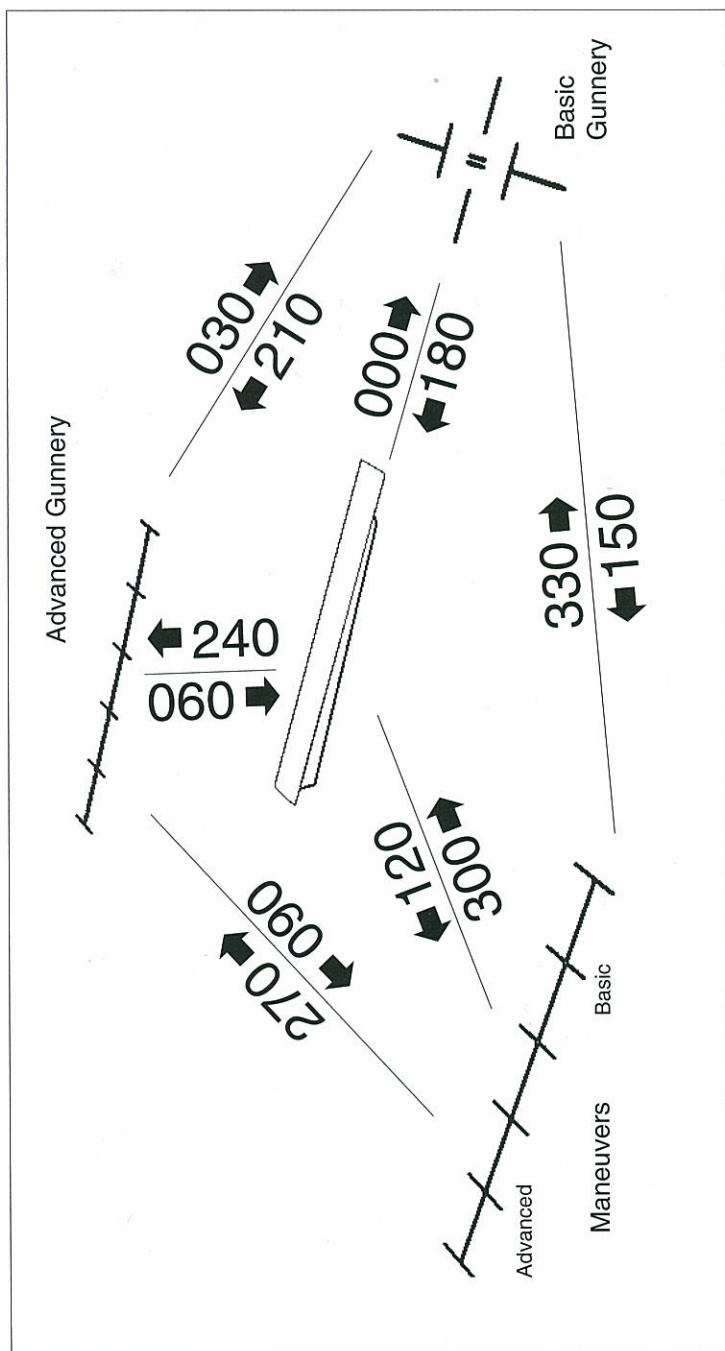


Figure I. Map of Training Area.

Begin the takeoff roll out by applying maximum throttle. Keep the aircraft rolling down the centerline with rudder adjustment. At an airspeed of 90 knots gently bring the nose up by applying back stick until the angle-of-attack indicator in the center of the panel increases to 10 degrees. When airborne, trim ailerons and elevator for 135 knot climb out and retract the gear and flaps at a safe altitude. Retracting flaps will cause the aircraft to settle temporarily. With increasing airspeed, the aircraft will have a tendency to roll right because of the takeoff trim settings.

To make a catapult launch, lower the flaps, apply full throttle and press the <L> key. After leaving the end of the deck, a high angle of attack is necessary to keep the airplane flying since the airspeed will be just above stall. This may take some practice.

3. MANEUVERS

The maneuvers area is located (see Figure I) 12 nautical miles to the southeast of the carrier. There is a 16 mile-long centerline with crossing buoy lines laid out on the ocean surface at approximately three-mile intervals. Basic maneuvers are performed in the northern half of the area. The pattern flown by the lead aircraft is diagrammed in Figure II. Notice that the perspective is from the east while you will probably approach the area from the west. Spot and fall in behind the lead aircraft, performing the series of maneuvers at full throttle in tandem with the lead. The lower level of the pattern is flown at an altitude of 2000 feet and the upper level at 4000 feet. Banked turns will require back stick to maintain altitude. To begin the loop, enter a shallow dive, level the wings, then pull back gradually to an angle of attack of 10 degrees and hold it. It is instructive to experiment with the angle of attack in the loop.

4. GUNNERY

Basic continues with a flight to the basic gunnery range. Drawing aim on a stationary target is meant to simulate a head-on or tail attack. Here is the procedure. Approach the target from the west in a shallow dive at 180 knots. When the target fills the gunsight, squeeze off a short burst and pull up to avoid knocking the target off its sled. Continue down range. Make a flat turn back toward the target for a run from the east to complete the pattern. Repeat the pattern for a total of four gunnery passes at the target. Chart

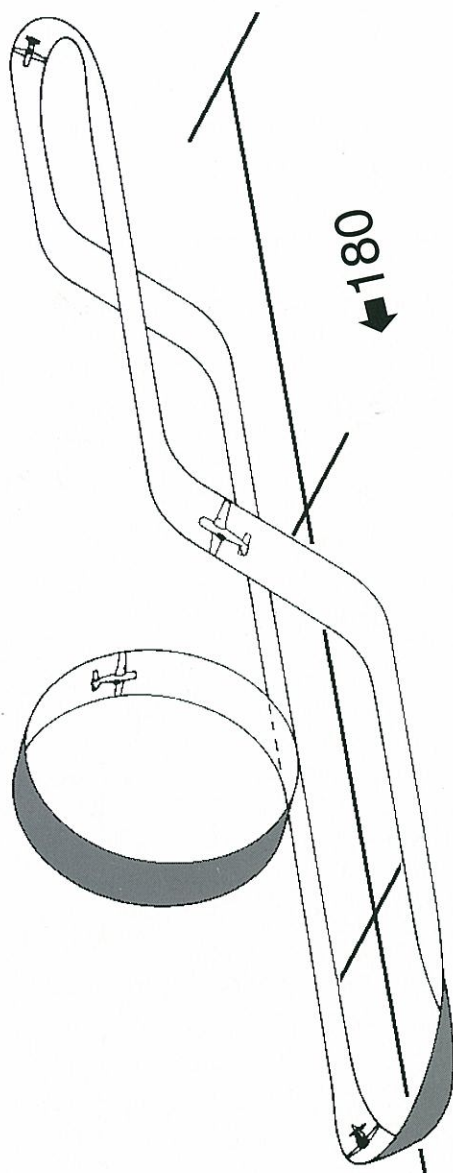


Figure II. Basic Maneuvers Pattern.

performance by recording the total score and elapsed time. As your skill level improves, increase the pattern airspeed and tighten turns to lower the elapsed time. You may also experiment with different maneuvers, such as a three-quarter loop with roll out, or a wing-over, to reverse directions after a pass.

5. CARRIER LANDING

The last requirement of Basic is the carrier landing. If you are out in the training area press the left mouse button to display (over the fuel quantity gauge) the heading back to the carrier. Make an approach from the south, fly over the carrier at an altitude of 1000 feet, and when past make a hard left turn. If you are on the carrier deck, begin the exercise with a 30 degree-flaps take off then a climbing 45 degree banked left turn, maintaining approximately 110 knots in the climb to 1000 feet. With either approach, level out on a heading of 180 and cut power to maintain an altitude of 1000 feet and an airspeed of 110 knots. Lower the hook if the aircraft is fitted with one. Illuminate the cross hair and ranging circle by pressing the <A> key. In the vicinity of the carrier, these function as a glide-slope indicator by targeting where the aircraft is *headed*, as opposed (in the normal gunsight mode) to where the aircraft is *pointed*. Now pan to the left to pick up the carrier.

When past the carrier, begin the 45 degree banked left turn to final. Ideally the aircraft will level out on final at 110 knots, altitude about 700 feet and the glide-slope indicator centered on the deck just past the aft number. During the approach, rapidly scan the airspeed, line up, and glide-slope. Keep the angle of attack around 8 degrees and use the throttle to control the descent and the glide-slope. Cut the throttle over the numbers and let it stall in. On the Bunker Hill, arresting wires are strung from the numbers to forward of the "x" marking the elevator. If you miss, apply full throttle and go around again. If the aircraft does not have a hook then make the slowest approach possible and apply brakes after touching down.

If the approach is low, high, or off line, then take a wave off, open the throttle and go around again. Don't waste your time trying to salvage a poor approach; in the fleet it would be your last. They never work anyway. A crash into the stern or a dive for the deck is the more likely outcome. A touchdown with too much nose-down attitude or a high sink rate is another invitation to crash and burn. If you do decide to open the throttle and go around again, then be prepared for the aircraft to roll left-wing down in reaction to the increased engine torque.

SECTION IV ADVANCED TRAINING

1. GENERAL

Congratulations on completion of the Basic Training section and welcome to Advanced. The purpose of Advanced is to teach the pilot the flying and gunnery skills needed to survive in a tactical combat situation.

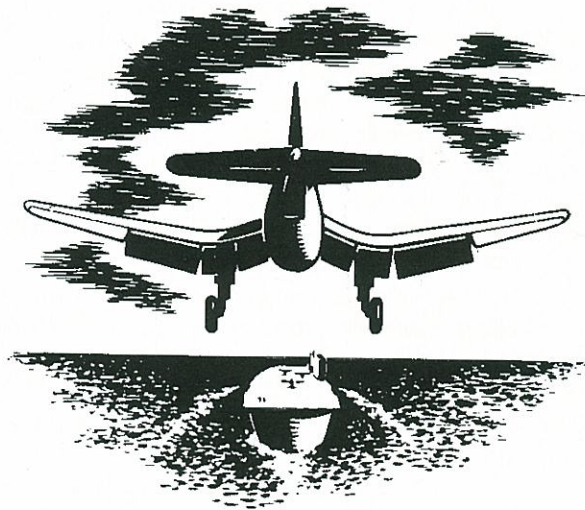
2. MANEUVERS

Several maneuvers in this section of the training program involve changes in attitude in both the vertical and horizontal planes. The disorientation that can result from the improper execution of these maneuvers may prevent a timely response on the part of the pilot. These situations are called unusual attitudes and invariably occur in extreme nose-up or nose-down attitudes. The procedure for recovering from any unusual attitude and returning the aircraft to straight and level flight follows.

- (1) Let go of stick.
- (2) Cut the throttle.
- (3) Center the rudder.
- (4) Wait for airspeed.
- (5) Minimize angle of attack if digital stick.
- (6) Level wings- use Gyro Horizon if necessary.
- (7) Pull out without stalling.

The most lethal unusual attitude is the spin. This maneuver should be started at an altitude of at least 5000 feet. Close the throttle and put the aircraft into a 30° climb- the horizon will just be visible at the bottom of the view. As the airspeed bleeds off, it will be necessary to increase the angle of attack in order to maintain the climb angle. When the airspeed drops to about 100 knots and the aircraft begins to buffet, throw the rudder to full right to initiate a right spin or full left for a left spin. The nose of the aircraft will drop off violently in the direction chosen and begin to rotate in a nose-down attitude about a point on the ocean. To stop the rotation, return the rudder to its neutral position and apply forward stick to decrease the angle of attack.

Advanced maneuvers are performed in the southern half of the maneuvers locality as indicated on the training map in Figure I. The pattern flown by the lead aircraft is diagrammed in Figure III.



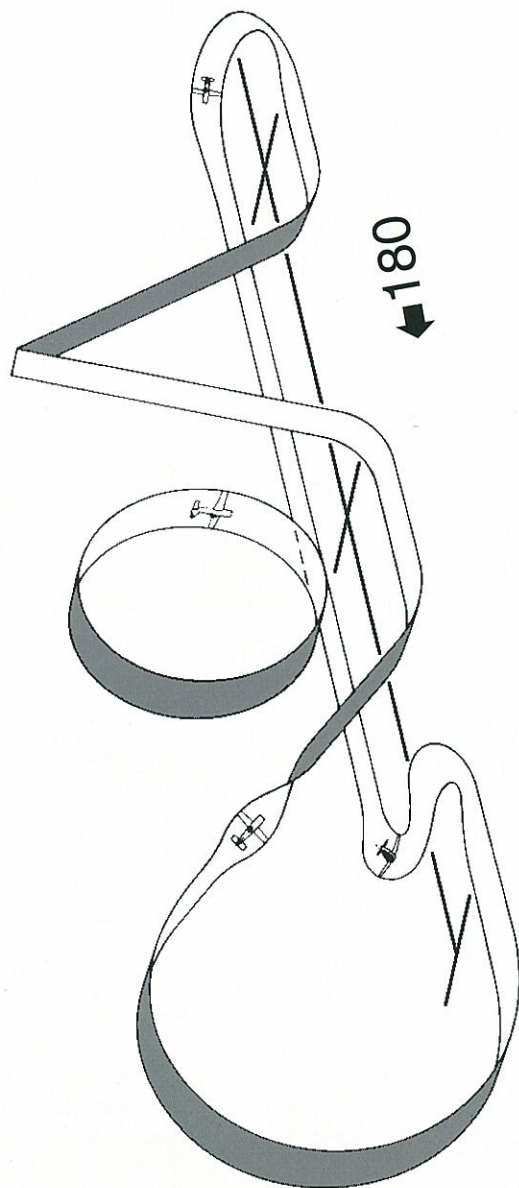


Figure III. Advanced Maneuvers Pattern.

As was the case with the Basic pattern, the perspective is from the east while you will probably approach from the west. The maneuvers pattern begins at an altitude of 2000 feet with a loop, followed by a hard left turn and a hard right turn, then a three-quarters loop with a roll out, followed by a climb and a stall, and finally a hard left turn to complete the pattern. Again, the lead is flying these maneuvers at full throttle.

3. GUNNERY

In Basic, the student learned to control the aircraft so as to aim at and hit a stationary target. In advanced gunnery, the situation is a great deal more complicated with the target moving at 130 knots. Locate the Advanced Gunnery locality on the training map. At an altitude of 2000 feet, the tow aircraft tows the target back and forth along the centerline between the northern and southern ends of the 50 mile-long area. The northern end is the most likely place to find the target.

The purpose of the moving target is to become proficient at the deflection shot, which is drawing aim on a target moving across your field of view. The degree of difficulty is obviously dependent on the rate at which the target is moving across the field of view. This is determined by the deflection angle, the angle between your heading and the target heading. Two examples are used to explain the deflection shot, one with a zero degree angle and one with a 90 degree angle.

Picture the target travelling from north to south. A zero degree angle is a northerly approach from behind the target. The target does not move across the field of view, and there is no difficulty in drawing aim and no need to lead the target. In contrast, the 90 degree angle is a broadside approach from the east or west. The target is moving at 130 knots across your field of view. You must fly to a point ahead of the target so that you will be able to draw aim when the target comes into range. Finally, you must again lead the target for the time it takes the bullets to reach the target.

A rectangular flight pattern has been devised to help the pilot practice the deflection shot. The example used is again the target flying from the north to the south. To enter the pattern, approach the target from behind and when even with the target begin a climb to 4000 feet, maintaining the southerly heading. Level off and

continue on course, checking the position of the target. When you have a sufficient lead on the target, and this is something you must learn by trial, turn sharply to your left to a heading of 270 degrees. Continue on this heading for about 5 seconds; this time will determine the length of the final approach. Turn sharply again to your left to a heading of 180 degrees. From this perch, the target should be visible below and to the left side as a red dot. For reference, note the relative position of the target to the cross hair or to the edge of the display and begin a descending left turn that will bring the target into view. Place the cross hair ahead of the target and fire. Pull up sharply and begin a climbing left turn and repeat the pattern.

After a few passes, you will begin to understand the challenge of this exercise. But the skills acquired should serve you well. In a combat situation, the hit-and-run deflection pass will ring up a lot of kills and guarantee a long life.

SECTION V

COMBAT AIR PATROL

1. COMBAT LOCALES

Your mission as a *FDP*2 pilot is to fly Combat Air Patrol (CAP). The map of the combat locales (Figure IV) shows three contested localities named arch, towers, and isles. Headings are provided for flying to the locale from the carrier (or landing strip) and from locale to locale. The carrier (or landing strip) is situated in the center of the area. The arch is located 12 nautical miles due north of the carrier. The isles are located the same distance to the southeast of the carrier and the towers are the same distance to the southwest. Your mission is to patrol these areas and to intercept and to destroy enemy aircraft. Enemy aircraft will not pursue beyond the inner rectangular border lines drawn on the surface; and because their mission is to defend the structure, if you approach and remain at high altitude it will be some time before they are able to climb and intercept.

The combat gunsight displays the number of hits on the enemy aircraft on the right side of the cross hair and the number of hits to your aircraft on the left. The number of hits delivered to each of the enemy aircraft are kept individually, but only the score on the most recent bogey to take hits is displayed. To display the score of all aircraft, press the <S> key. If your opponent crashes or is shot down, the blinking message "kill" will appear in place of your gunnery score for about 15 seconds, then the downed bogey is replaced. Returning to the carrier or landing strip (by flying or clicking RESTART in the In-Flight Menus) will clear the number of hits on your aircraft, and replenish fuel and ammo stores.

2. TACTICS

The initial stage of a successful CAP mission is a relentless search of the sky for enemy aircraft. The first pilot to see the other will be more likely to gain the superior position at the point of interception. If you're daydreaming, the enemy will be more than happy to roll in on your tail and subdivide your aircraft. The second stage of the mission is the ability to maneuver for the superior position behind the enemy and make out his attitude and match his maneuvers. The next level are more maneuverable and will even spin their aircraft and quickly lose altitude to throw off

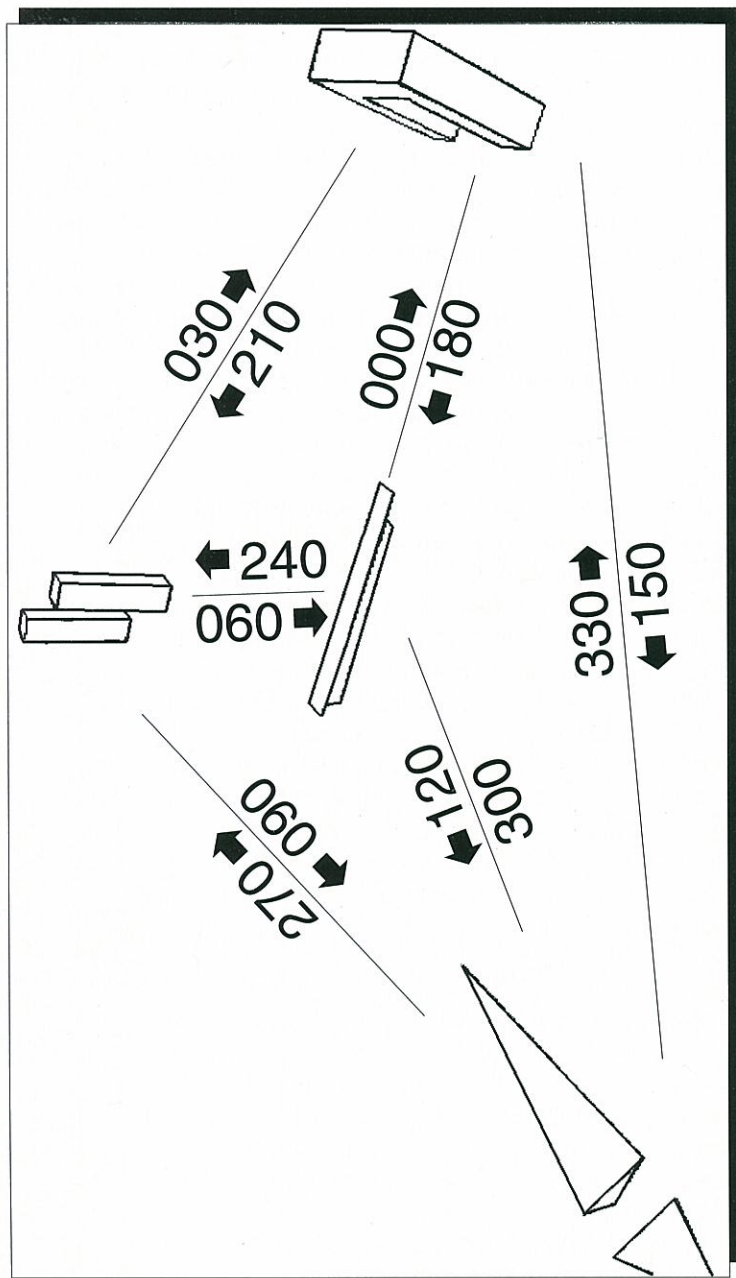


Figure IV. Map of Combat Area.

your aim. Expert bogey pilots are proficient at turning dives that will eventually take the battle dangerously close to the deck.

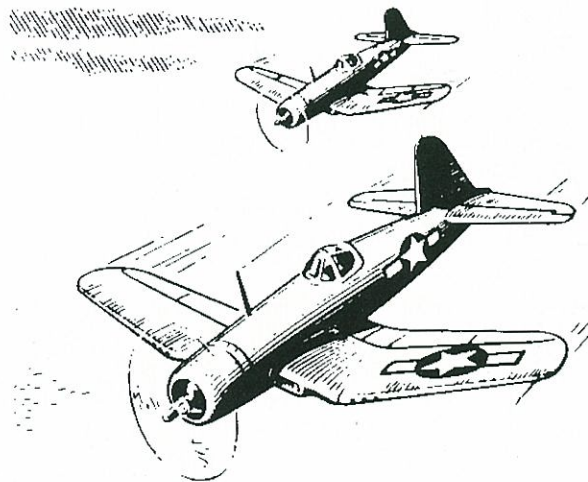
The P-61 aircraft is equipped with a turret gun containing four 0.50 caliber machine guns and capable of a 360 degree arc of fire. If you are piloting the P-61 in a one-player mode, the turret gun is aimed forward and is fired on a digital joystick along with the cannons with the first firebutton. With an analog stick, the turret gun can be fired independently with the second fire button. If you engage this aircraft as a computer-controlled enemy, especially at the "ace" skill level, a belly attack is recommended.

The ME-110 aircraft is equipped with two rear-firing 7.9mm machine guns that are capable of a 120 degree arc of fire; it cannot be fired in a one-player mode. As an enemy aircraft, the ME-110 is not nearly as deadly as the P-61, but may still cause damage if you sit on its tail.

Be aware that when the bogey fires its guns, the gun audio will be heard on the right channel if the bogey is to the right of the aircraft, and on the left channel if the bogey is to the left. Also, the volume of the audio increases as the distance between your aircraft and the bogey decreases. You are also able to tell what type of armament the bogey is firing by the rate of fire.

3. COMBAT DAMAGE

A list of the types of malfunctions as a result of combat damage includes altimeter, airspeed indicator, flaps mechanism, flight controls, armament, engine, landing gear, and fuel leak. Loss of flight controls will result in an unrecoverable spin. Engine damage is indicated by a smoke trail. A preponderance of damage will result in an explosion.



SECTION VI TWO-PLAYER MODES

(Note: *Fighter Duel Pro 2* is two-player incompatible with earlier programs in the *Fighter Duel* series.)

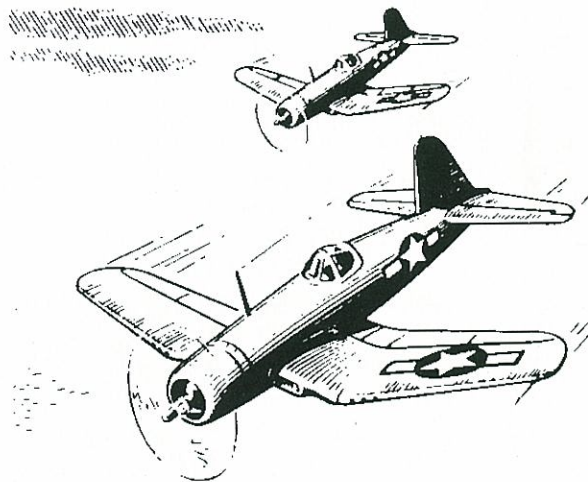
1. HARDWARE

FDPro2 requires external, Hayes-compatible, 1200 baud to 9600 baud modems, or a null-modem cable. Null-modem cables are available from your local computer hardware retailer. Make sure that the null-modem cable is of the correct gender for the serial port connection on your computer; the serial port connection on the Amiga 1000 is of opposite gender to that on other Amiga models. Always turn off the power to the computer when inserting or removing connectors.

2. PRE-FLIGHT MENU SELECTIONS

In all two-player modes, many PlayerOptions and Aircraft menu selections made by the player making the call will override the current selections of the player answering the call. These include "Theatre", "Locale", "Unlimited Ammo", "Gun Realism", and the types and skill levels of the computer-controlled aircraft. In Tourney and Wingman mode, "Start Altitude" is also overridden; also in Tourney mode, if the caller selects RANDOM for YOUR AIRCRAFT both players will fly the same randomly-selected aircraft. The caller will also automatically be positioned to the north of the locale in standard and tourney modes, and will be the lead aircraft in wingman mode. The flights will always begin with an airborne start and the surface dots option is disabled. The locales are limited to the arch, towers and isles.

The PlayerMode selector on the PlayerOptions screen lists 5 two-player options: Standard, Tourney, Wingman, Two-Seater Pilot, and Two-Seater Gunner. In standard and tourney modes, the action is head-to-head between you and your opponent; the two aircraft are positioned at opposite ends of the locale in standard mode, and over the center of the locale with a fly-by start in tourney mode. In wingman mode, the two players form a lead and wing formation and battle two computer-controlled enemy aircraft. The two-seater mode has one player as the pilot and the other manning the turret gun against up to four enemy aircraft.



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3. HOOK-UP

After making their selections, both players will hang-up the telephone line (it is assumed that a voice link was used by the players to confer on selections) and go to the Hook-Up screen. Both players should set the agreed-upon baud rate using the Connection Type roll-over gadget at the top of the screen, and the caller-designate selects a phonebook entry, which will appear in the string gadget below the message box. The phonebook entry format is <Number_BaudRate_Comments>; the caller's phonebook entry baud rate will override the number set in the Connection Type gadget.

Now the caller-designate clicks CALL and other player clicks ANSWER when the telephone rings. If a null-modem cable is being used, the NULL-MODEM CABLE option should be selected instead of a baud rate; the phonebook entry is ignored in this case, and both CALL and ANSWER can be clicked at any time.

The Modem Settings button at the bottom of the Hook-Up screen will bring up the Modem Settings screen that is used to customize the program's commands to the modem. The Modem Init command is used to disable error correction and data compression, modem features that will affect the performance of the program during flight. With Supra modems, set Modem Init to "AT&F0"; with U.S.Robotics modems use "AT&K0&M0"; and with *LineLink 14.4* modems use "AT&M0&Q0&R0". If the modem's user manual does not contain this information then contact the modem manufacturer. Running a communications program or modem power-up will reset the modem to its original configuration. Click the Save button at the bottom of the screen if you wish to use the settings in subsequent flights.

When the modems establish a connection, a message will appear in the message box along with the baud rate of the connection. Both players are now able to communicate by typing messages followed by <Return> in the string gadget below the message box. The settings to be used in the flight are also displayed. If any of the displayed settings need to be changed at this point, the caller-designate exits the hook-up screen, which will hang up the line, makes the change, re-enters the Hook-Up screen and clicks CALL again. Any time after the connection, the Begin Duel button will begin blinking and can be clicked to start the program. If you click Begin Duel, this information is relayed to the other player.

4. BEGIN FLIGHT

Pause mode is disabled in two-player mode, and the turbo feature is disabled in Tourney mode. To score a win in Standard or Tourney modes, your opponent must crash or explode and you must survive until the automatic reset to the next round (15 seconds); if both players crash before the automatic reset, the score will not change.

In Wingman mode, the lead enemy aircraft tracks your lead aircraft, and the wingman enemy aircraft tracks your wingman. The starting altitude is set in the Pre-Flight Menu. For identification purposes, pressing the right mouse button or the <I> key will cause your wingman's aircraft to blink. Also, pressing the left mouse button will display over the fuel gauge the heading to fly your aircraft toward your wingman. When enemy aircraft are shot down or crash, they will restart at the original start position and altitude.

In Two-Seater mode, the pilot and gunner will hear each other's guns firing, but will not see each other's tracers. The gun turret in the P-61 has an arc of fire of 360 degrees, while the ME-110 has an arc of 120 degrees.

5. CHAT MODE

Chat mode allows in-flight communication between pilots in two-player and between pilot and gunner in two-seater modes. The complete ASCII character set is supported from the main keyboard; entries from the numeric keypad are ignored. With the chat mode activated, the send and receive prompts and text are displayed at the bottom of the view display. In chat mode, the keyboard aircraft controls must be combined with a <Ctrl> or <Alt> key, otherwise they will be interpreted as text input.

The chat mode is activated automatically when a message is received; pressing the <F1> key will also activate the mode. The <Esc> key will clear the send line, the <Return>, <Del>, and <CapsLock> keys are ignored. The automatic activation feature can be alternately disabled and enabled by pressing the <Ctrl-F1> keys. This is intended particularly for the tournament situation in order to prevent the distraction of the opponent sending text and automatically activating the chat mode. The <F2> through <F10> keys can be pre-programmed in the Pre-Flight Menu to send comments with a single keystroke.

6. RESTART

In Standard, Tourney, and Two-Seater modes, if you crash or suffer a mid-air explosion, the screen will go blank for a moment, then the last frame will reappear with either a crash or explosion message on the instrument panel along with the number of hits taken by your aircraft. After a delay of 15 seconds, the program will restart. In Wingman mode, if you crash or explode the action will continue and only your aircraft's position is reset.

If your opponent or wingman crashes or is shot down, the blinking message "KILL" will appear in place of your gunnery score. In Standard and Tourney modes, the flight will continue for 15 seconds, after which time the screen will go blank and the program will automatically reset. In Standard mode, flight will begin at a new starting point; your opponent will again start at some point on the opposite end of the locale. In tourney mode the starting points are unchanged. Both players must reboot and reconnect in order to change locales.

7. TOURNAMENTS

Nationwide tournaments are coordinated and directed by Drew Dorman. You can reach him on GENie at Email address GHOST.RIDER, Internet Email address GHOST.RIDER@genie.geis.com, or write/call him at 5560 Pershing, Apt. 505, St. Louis, MO 63112 (314-367-3916). He can also supply a list of duelers in your area. Duelers can also be found on local BBS systems, at user group meetings, and through Amiga retailers.

SECTION VII

REAR VIEW MODE

1. GENERAL

The "rear view" feature allows continuous display of the view to the rear of the aircraft on a second computer, or an alternate view with the use of the view keys. The rear view can be displayed in all configurations, including two-player, two-seater, and review mode, and without degrading the performance of the simulation.

2. HARDWARE

The hardware requirements to operate the rear-view feature are two Amiga computers capable of running *FDPro2*, two standard parallel (invariably Centronics-type) printer cables, and the *FDPro Parallel Adapter*. (The adapter is available from Jaeger Software by sending a \$15 cashier's check or money order to Jaeger Software, Inc. Direct Sales Dept., 7800 White Cliff Terr., Rockville MD 20855.) Before making any connections, turn off the power to both computers. After making sure the cables are of the correct gender for their intended computers, connect one cable to one computer's parallel port and the other cable to the second computer's parallel port. There should be no confusion as to which end of the cable connects to the computer since one end is a Centronics-type connector that will only mate with a printer. Now connect the two Centronics-type ends together with the adapter. This concludes the hardware installation.

3. SOFTWARE CONFIGURATION

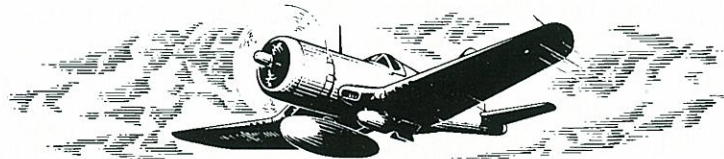
On each computer, load and run the program in the normal fashion and stop at the Pre-Flight Menu. If one computer exhibits better performance (with fast RAM or upgraded processor) then this computer should be assigned as the "control" computer by selecting a PlayerMode other than REAR VIEW MACHINE and check-marking SEND REAR in the PLAYER OPTIONS menu. The other computer becomes the "rear view" by selecting REAR VIEW MACHINE for the PlayerMode in the PlayerOptions screen.

Other than selecting SEND REAR in the PlayerOptions screen, the menu selections for the control computer are unaffected by the presence of the rear view computer. Most of the rear-view computer's selections, however, are ghosted. You are able to click

COLORS and SAVE from the main menu screen, and can set SURFACE DOTS in the Player Options menu. On rear-view machines with stock processors, the rendering of surface dots will slow the rate at which the rear-view screen display is updated.

With most machines there is no need to coordinate the power-up, program loading, and the pressing of the BEGIN FLIGHT button on the two computers; either can be started first. It is our experience though that pressing the rear-view BEGIN FLIGHT button first will ensure reliable operation. After BEGIN FLIGHT is pressed, the lead computer will do a short disk load and then wait for the second computer. The computers will synchronize again just before the flight begins so that if one program is loading from a hard drive and the other from floppy, the lead computer will wait and display a blank screen during the floppy load. If the computers do not successfully advance to the flight display, it is recommended that both computers be powered-off, the parallel connections checked, and the procedure retried.

The rear-view display, which does not have an instrument panel, will continue to operate after resets from the In-Flight Menu of the control computer and also after control computer system reboots (the display will freeze in this case and there may be artifacts on the display after restart but it can be cleaned up by clicking the RESTART FLIGHT button). Changes to the bogey types when the program is reloaded, however, will not be updated in the rear view. Other changes, such as theater and locale type, can be instituted by clicking the RESTART FLIGHT button in the In-Flight Menu of the control computer.



SECTION VIII

AIRCRAFT CONTROLS

1. DIGITAL STICK

The stick action can be set to either slow, medium, or fast in the Pre-Flight Menu. Aileron control with the digital stick is left stick for left roll and right stick for right roll. Continuous stick pressure will cause the aircraft to roll with increasing rate until the stick is brought back to the center position, which stops the roll and maintains the angle of bank.

Elevator control is back stick for increased pitch or nose-up attitude, and forward stick for decreased pitch or nose-down attitude. The angle of attack indicator on the instrument panel will show a positive value for nose-up and a negative angle for nose-down attitudes. Returning the stick to the center position will stop the change and maintain the elevator and the angle of attack of the aircraft in the airstream at their current angles. This will also keep the aircraft at its current angle of pitch.

Trim tabs are used to stabilize excess roll and pitch that would otherwise require constant stick movements to keep the aircraft straight and level. Trim with the digital stick is accomplished by holding the left mouse button down while moving the stick in the direction trim is required. The effect is cumulative so that the longer the stick is held in a direction the greater the amount of trim. There is no trim indicator.

If the "EZ" digital stick mode is selected in the Pre-Flight Menu, the performance of the digital stick and of the flight model are tamed in order to help the novice learn to fly. The most obvious difference is that when the stick is in the center position, the angle of attack of the aircraft returns to zero. This makes maneuvering difficult, but eliminates the need for a positive response from the pilot to stabilize the aircraft. In addition, the overall response of the stick is deadened, the angle of attack is limited to prevent stalls, the rudder is disabled, and there is no torque roll.

2. ANALOG STICK

The stick action can be set to either slow, medium, or fast in the Pre-Flight Menu. Aileron control with the analog stick is left stick for left roll and right stick for right roll. The further from center the stick is moved, the greater the rate of roll. Returning the stick to the center position stops the roll and maintains the angle of bank.

Elevator control is back stick for increased pitch or nose-up attitude, and forward stick for decreased pitch or nose-down attitude. The angle of attack indicator on the instrument panel will show a positive value for nose-up and a negative angle for nose-down attitudes. The further from center the stick is moved, the greater the angle of attack of the aircraft in the airstream. Returning the stick to the center position will return the elevator to its center position and cause the angle of attack to return to zero.

The operation of the analog stick is identical to that of the control stick in an actual aircraft; the desired roll rate and pitch can be set instantaneously. Also, most analog sticks will have fine-adjustment wheels for trimming the aircraft.

3. CENTER ANALOG CONTROLS

The analog stick and rudder pedals can be centered at any time and in any player mode by pressing the <Zero> key.

4. THROTTLE

The aircraft throttle can be controlled with either the mouse or the keyboard. Holding down the left mouse button and moving the mouse forward and back will increase and decrease the throttle. On the keyboard, the <Z> key will increase and the <X> key will decrease the throttle position.

5. ENGINE POWER BOOST

The aircraft equipped with power boost are the F4U and F2G Corsairs, the F6F Hellcat, the P-61 Black Widow, the Bf109-G, and the TA-152H. Pressing the key will enable the feature, which is indicated by the letter "B" appearing to the right of the tail hook icon on the instrument panel. The boost mechanism will only function with full throttle; when boost is present the "B" indicator will blink.

6. RUDDER

Keyboard control of the aircraft rudder is <C> key for left rudder, <V> key for right rudder, and <F> key for center rudder. The rudder can also be controlled with either the mouse or rudder pedals, depending on which method is selected in the Pre-Flight Menu. With the mouse, hold down the left mouse button and move the mouse left and right to move the rudder left and right.

7. WING FLAPS

The flaps are lowered with the <E> key and raised with the <W> key.

8. WHEEL BRAKES

The left and right brakes are activated by pressing the <Del> and <Help> keys, respectively, on the keyboard. To stop the aircraft, press both buttons simultaneously; to taxi, move the throttle forward to cause the aircraft to begin moving and then press the left brake button to turn left, or the right brake button to turn right.

9. VIEW KEYS

The view can be changed instantly by pressing one or a combination of cursor keys. In normal pilot modes, the left-cursor key will display the view directly to the left of the aircraft, right-cursor key to the right, and down-cursor key to the rear. Simultaneously pressing the up-cursor key will elevate the view by 45 degrees; alone this key will display the elevated forward view. The overhead view is displayed when both the left- and right-cursor keys are pressed. Releasing the keys will return the forward view to the screen. In addition, the altered view can be held by simultaneously pressing the <Help> key, and released by pressing the <Del> key.

With the rear-view and rear-gunner modes, the view keys function in the same manner as above except that the views are relative to the rear-facing position of the gunner. For the stationary machine-gunner mode, the views are unaffected by the elevation of the gun.

The view can also be changed using the "hat" switch available on some analog sticks. In normal pilot modes, forward switch will elevate the forward view by 45 degrees, right switch will display the overhead view, left switch will elevate the rear view by 45 degrees, and back switch will display the rear view. These have

been judged to be the most useful views in a turning battle. In rear-gunner mode, left and right switch will display left and right views. For the stationary machine-gunner mode, the switch displays the left, right, and rear views; forward switch displays the overhead view.

10. ARMAMENT

With digital joysticks, pressing the firebutton will fire both groups of guns. On analog sticks, the first firebutton will fire the first group, and the second fire button will fire the second group. With the *Flight Stick Pro* analog stick, which is equipped with a "hat" switch, the first firebutton will fire both groups and the second firebutton will only fire the second group.

11. GUNSIGHT

The guns are armed or the glideslope indicator is actuated with the <A> key. When the guns are armed and both mouse buttons are pressed, the lead-computing ranging mechanism is displayed in the gunsight as a frontal aircraft silhouette. While continuing to hold down both buttons, move the mouse forward and back to change the size of the silhouetted aircraft to correspond with the size of the target aircraft.

12. LANDING GEAR

The landing gear can be alternately raised and lowered by pressing the <G> key. The landing gear cannot be raised if the tailhook is lowered. To simplify its design, the Komet used a trolley for takeoffs and a sprung skid for landing. To jettison the trolley (and its accompanying weight and drag) after takeoff, move the landing gear control to the up position. The landing skid can now be lowered by placing the landing gear control in the down position. Attempting to land with the trolley still attached will result in a crash.

13. ARRESTING GEAR

The arresting gear, also known as the tailhook, can be alternately raised and lowered by pressing the <H> key. The tailhook cannot be lowered if the landing gear is not extended.

14. CATAPULT LAUNCH

The catapult launching mechanism is activated by pressing the <L> key. Remember to advance the throttle to 100% RPM before launching.

15. DISPLAY SCORE

The score is displayed in a box overlay on the instruments panel by pressing the <S> key. In standard and tourney two-player modes, the score is kept as wins and losses; in all other modes, only the losses are counted.

16. TURBO

Pressing the <T> key will cause the aircraft's apparent velocity to increase by a factor of sixteen, which is intended for quick movement between the locales and rapid changes in altitude. This feature is unrelated to the aircraft's turbocharger.

17. AUDIO

Pressing the <Q> key will alternately enable and disable the audio output of the program.

18. PAUSING PROGRAM AND IN-FLIGHT MENUS

Pressing the <P> key will pause the program and provide access to the In-Flight Menu.

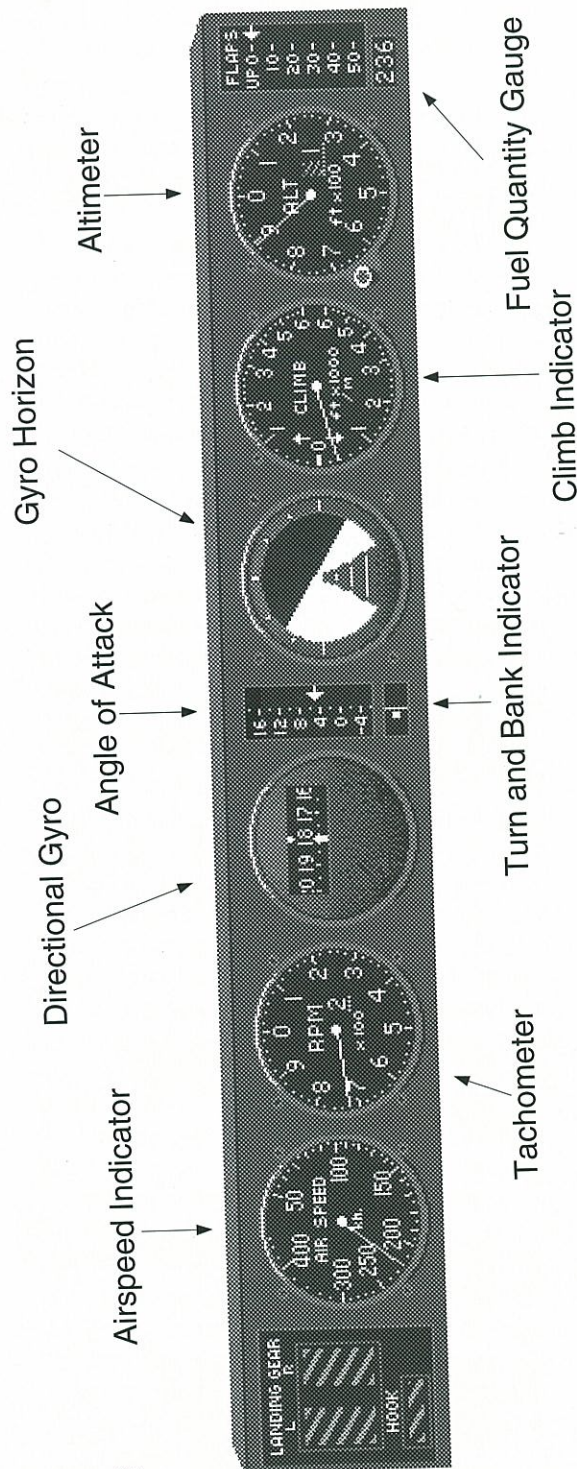


Figure V. Instrument Panel.

SECTION IX FLIGHT INSTRUMENTS

1. GENERAL

A labelled picture of the English (Japanese, German, and Russian are not shown) instrument panel is shown in Figure V. The instruments are described below in the left-to-right order that they appear on the panel.

2. AIRSPEED INDICATOR

This instrument registers the indicated airspeed in knots. The true airspeed is obtained by correcting for temperature, pressure, altitude and instrument error; but for short-distance flights, the indicated airspeed is sufficiently correct. Knots is nautical miles per hour with a nautical mile equalling 6000 ft. To convert to statute miles per hour, multiply knots by 1.14. The Japanese, German, and Russian aircraft indicators give readings in units of kilometers per hour, which should be halved to get the equivalent airspeed in knots.

3. TACHOMETER OR THRUST METER

In the case of the piston-engined and jet-engined aircraft, this instrument functions as a tachometer and registers the engine revolutions per minute (rpm). For the rocket-powered ME-163, it is a thrust meter indicating percentage of maximum thrust. The tachometer, while not a flight instrument, may be used as an approximate indication of the aircraft's attitude and throttle position. For one setting of the throttle its reading will decrease in nose-up attitudes and increase in nose-down attitudes. These changes are clearly audible yet amount to only a few hundred rpm because the aircraft rpm is controlled by a constant speed propeller.

4. DIRECTIONAL GYRO

This instrument is a gyroscopically-controlled compass that gives the aircraft heading in units of tens of degrees. The instrument is initialized to indicate a heading of 000 (magnetic north) at start-up on the carrier and a heading of 070 on the landing strip.

5. ANGLE OF ATTACK

This instrument registers the angle of attack of the wing in the airstream in units of degrees. An angle of attack greater than 16 degrees will result in a stall condition and this region of the indicator is colored red.

Fighters of World War II were not equipped with an angle of attack indicator. We have included one here in order to assist the pilot fly the aircraft in the absence of *g* forces and stick forces. While engaged in combat, the pilot will draw maximum climb and turning performance from the aircraft by pulling back hard on the stick. This will increase the angle of attack of the wing in the airstream and will result in increased lift.

At typical intercept speeds, this maneuver will cause accelerating (*g*) forces and resistive stick forces. The pilot uses these physical cues to extend the aircraft to the edge of the performance envelope. With too much force on the stick, a high-speed stall may develop or the airframe could become overstressed. In *FDPro2*, the angle of attack can be set just below stall to give maximum performance by using the angle of attack indicator. Assistance is also provided by the stall horn beeps which increase in frequency as stall approaches.

Finally, the position of the instrument panel functions as an accelerometer. With positive *g*-forces the panel rises to simulate the pilot being forced downward in the seat; negative *g*-forces lift the pilot and lower the panel. In *FDPro2*, it is not possible to overstress the airframe. Accelerating forces are not allowed to exceed positive 7.5 *g* or negative 3 *g*.

6. TURN AND BANK INDICATOR

The turn portion of this instrument refers to the vertical bar that moves away from its center position in the direction of the turning or yawing of the aircraft. The distance it moves indicates the rate of the turn or yaw.

The bank or ball portion of the instrument indicates slip/skid. If the longitudinal axis of the aircraft is aligned with the direction of flight then the ball will appear in the center of the box. For example, applying rudder in level flight will cause the aircraft axis to point away from the flight path, causing a skid condition in which the ball will move away from center and toward the flight path. The slip condition arises when the aircraft is steeply banked. The nose of the aircraft is on the horizon but the aircraft is descending. The ball will move to the low side of the bank, again in the direction of the flight path.

7. GYRO HORIZON

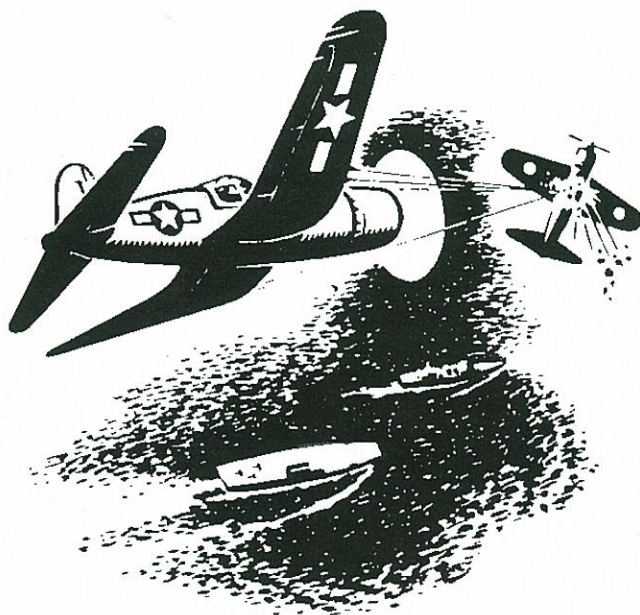
With a white sky and black land (or sea), this instrument draws the position of the horizon in relation to the orientation of the aircraft, and is used to determine the pitch and bank of the aircraft. Horizontal gradients on the lower portion of the face represent increments in pitch of 10 degrees. Tick marks around the upper edge of the instruments represent increments in bank of 30 degrees. The horizon line is visible in all attitudes, which is particularly useful in steep dives when the real horizon is not visible and the wings must be rolled level to pull out of the dive.

8. CLIMB INDICATOR

This instruments indicates the rate of climb or descent in thousands of feet per minute for the American and British aircraft and in units of hundreds of meters per minute for the Japanese, German, and Russian aircraft. It operates on the change in air pressure and is not affected by local barometric pressure. There is an appreciable lag in this instrument and it therefore should be used only for extended climbs or descents and not in the pursuit of constant-altitude flight.

9. ALTIMETER

This instrument measures altitude by means of atmospheric pressure and is affected not only by its position above sea-level, but also by barometric pressure of the locality. The altitude is given in hundreds of feet for the American and British aircraft and in hundreds of meters for the Japanese, German, and Russian aircraft. To convert from meters to feet, multiply by three.



SECTION X IN-FLIGHT MENU

1. GENERAL

The In-Flight Menu is available in one-player modes and is activated by pausing the program by pressing the <P> key; the menus and pointer are overlaid across the instrument panel. If your aircraft crashes or explodes, the program automatically pauses and the replay menu and a message box will appear. You can replay the action, but you cannot resume flight; only the RESTART FLIGHT button is available.

2. REPLAY MENU

To replay action sequences, move the pointer over the reverse button (left-facing arrow) in the replay menu and click the left mouse button. The arrow will blink and the action will replay in reverse until either the stop (square) or forward (right-facing arrow) button is clicked, or the maximum replay time is reached. The forward button will then play the action and stop when the originating frame is reached, and only at this point can flight be resumed. The program can be restarted, however, at any point in the replay by clicking the RESTART FLIGHT button.

Replay time is dependent on available memory. A two megabyte machine should have at least 14 seconds; more time can be added by selecting the same type of aircraft for more than one foe in the Pre-Flight Menu. Machines with four megabytes of fast RAM should be able to replay for 60 seconds, the program-imposed limit on replay time.

3. FOE MENU

The foe menu is used to change the skill level and type of computer-controlled aircraft. On machines with less than 4 megabytes of fast RAM, the available types of aircraft are limited to the four types chosen in the Pre-Flight Menu. The top gadget determines which of the aircraft that the settings on the skill level(middle) and type(bottom) gadgets will affect. To change the type of foe aircraft it is necessary to click the RESTART FLIGHT button. To change the number of aircraft, use the type "NONE"; selecting multiple foes will cause a reduction in the frame rate on slower machines.

4. AIRCRAFT MENU

The aircraft menu is used to change the type of aircraft that you are piloting and also to set the theater, locale, and type of start. The middle gadget selects between the latter three and the bottom gadget is the selection. Click the RESTART FLIGHT button to use the settings. Some combinations are not supported, for example, there is no stationary gunner or deck start at the isles. Also, in one-player tourney mode only an airborne start is allowed. If an unsupported selection is made, the menu will automatically switch to a supported one if the RESTART BUTTON is clicked.

If the GUNNER selection is made for the aircraft type and the RESTART FLIGHT button is clicked, the program will restart at either the arch or towers, regardless of the one-player mode. As gunner you will be operating a stationary pair of 20mm anti-aircraft cannons located on the ground.

5. CONTROL BUTTONS

The RESUME FLIGHT button will resume flight and ignore any changes in the flight settings other than the skill levels of the enemy aircraft. The RESUME FLIGHT button is disabled unless the replay feature has been played forward to the frame at which the flight was paused. The RESTART FLIGHT will restart the flight from the beginning using the current settings, if valid, of the In-Flight Menu.

6. STARTING ALTITUDE

The starting altitude of a Standard mode flight, in thousands of feet, can be set from one to 26. In Tourney and Wingman modes, the starting altitude of your aircraft and that of the computer-controlled aircraft must be at least five thousand feet, in order to avoid collisions with the scenery objects.

SECTION XI AIRCRAFT SYSTEMS

1. POWER PLANT

The throttle directly controls the thrust delivered by the rocket-engined ME-163 and jet-engined ME-262. The piston engine controls, other than the throttle, are not adjustable and have been set for maximum performance in a combat situation. These include an auto-rich mixture control and the propeller governor control set for maximum rpm. The propeller governor control sets the constant speed unit and has no direct control over propeller blade angle. Rapid changes in throttle setting will tend to cause the rpm to "overshoot the mark" momentarily before settling down. The supercharger control is set automatically to supply air to the carburetor at approximately sea level pressure when operating at altitude.

Several of the aircraft have the limited capability to increase engine horsepower with methanol-water injection and supercharger pressure boost. The aircraft so equipped are the F4U and F2G Corsairs, the F6F Hellcat, the P-61 Black Widow, the Bf109-G, and the TA-152H. The duration of boost for the American aircraft is 5 minutes, and 10 minutes for the German types.

The pilot must compensate for strong torque forces generated by the engine. The reaction of the aircraft is greatest at high rpm and low airspeeds, and will cause the aircraft to roll left and yaw left. The twin-engined P-38, P-61, and ME-110 have counter-rotating propellers that effectively cancel the engine torque; this will not be the case, however, if one engine is damaged and its rpm drops off significantly. The J7W employs a "pusher"-type propeller configuration, thus the effect of engine torque is to cause this aircraft to roll right and yaw right. The jet-engined ME-262 and rocket-engined ME-163 do not exhibit engine torque.

Inverted or negative *g* flight in piston-engined aircraft shall not exceed 10 seconds because of loss of oil pressure and possible damage to bearings, especially the thrust bearings, caused by the temporarily insufficient engine lubrication. If the engine begins to run rough, roll the aircraft wings level and pull positive *gs*. The Hurricane and Spitfire I have float-type carburetors that will not operate properly in negative *g* flight. For example, simply pushing the stick forward in level flight will cause engine interruption.

2. FUEL SYSTEM

The fuel quantity gauge is located in the bottom right corner of the instrument panel and reads in units of U.S. gallons for American fighters, in Imperial gallons for British fighters, and in liters for the Russian, Japanese, and German fighters. The gross weight of the aircraft decreases as the fuel is consumed. (Approximate weights: U.S. gallon, 6 pounds; Imperial gallon, 7.2 pounds; liter, 1.5 pounds.) The tanks are topped off when the aircraft comes to a stop on the carrier or landing strip. Fuel capacities and flight times are listed in Table 2 of Appendix II. Note that the flight time of the ME-163 Komet is only about 9 minutes.

3. LANDING GEAR

The P-38, P-61, J7W, and ME-262 employ a tricycle gear configuration and stand level, while the rest are tail-draggers, standing nose-high. The landing gear control will not operate on the deck. The positions of the left and right gear are shown by the indicators on the left edge of the instrument panel. The gear will not lock if lowered at airspeeds greater than 260 knots, but can be used in this configuration as a dive brake. The indicators will show incomplete extension until the airspeed drops to 260 knots at which time the down and locked indication will be given as the gear extend and lock. A mechanical interlock is provided between the arresting gear control and the landing gear control. The landing gear cannot be raised unless the arresting gear is raised.

To simplify its design, the Komet used a trolley for takeoffs and a sprung skid for landing. To jettison the trolley (and its accompanying weight and drag) after takeoff, move the landing gear control to the up position. The landing skid can now be lowered by placing the landing gear control in the down position. Attempting to land with the trolley still attached will result in a crash.

4. ARRESTING GEAR

The arresting gear indicator is located below the landing gear indicator and is labelled "hook". The tailhook icon is indicative of the tailhook extended condition. Lowering the tailhook on deck during roll out will create excess drag and may prevent a successful take-off. The tailhook may be retracted after a trap landing and another take-off attempted. The Corsair, Hellcat, Seafire, and Zero are fitted with tailhooks; for the other aircraft, no

icon will appear. A mechanical interlock is provided between the arresting gear control and the landing gear control. The arresting gear cannot be lowered unless the landing gear is lowered.

5. WING FLAPS

The wing flaps can be set in 10 degree steps up to full down (50 degrees) on most aircraft. The maximum flap angle on the Lightning is 40 degrees. The Spitfire, Seafire, Yak, and Hellcat variants can only be set to full-up or full-down. The Zero, Bf109, and FW190 flaps have a full-down and an intermediate setting.

The wing flap system includes a mechanism that causes the flaps to "blow-up" (back off) from the angle set by the control under excessive loads caused by airspeeds greater than normal. The flaps will return to the angle corresponding to the control setting when the airspeed is reduced. The mechanism is set so that with flaps set full down and power on for level flight in the landing condition, they begin to "blow-up" at between 90-110 knots, indicated. At lesser flap settings, the "blow-up" speeds will be greater than with flaps full down. At airspeeds greater than 250 knots, flaps are in full-up position regardless of flaps-angle setting.

The flaps are also designed for use in maneuvering the airplane in combat. With typical maneuvering flap deflections of 20 degrees or less, the airplane may be maneuvered at equivalent limiting "flaps up" accelerations up to 200 knots. The landing and maneuvering flap control shall not be placed in position for lowering flaps at speeds in excess of 200 knots even though the flaps are protected by an overload release mechanism.

6. GUNSIGHT AND ARMAMENT

Arming the guns illuminates a cross hair and ranging circle in the center of the view. At a distance of about 400 feet, a aircraft with a forty foot wingspan will just fill the ranging circle. The lead-computing ranging mechanism is displayed in the gunsight as a frontal aircraft silhouette of an aircraft with a forty foot wingspan. Adjust the size of the silhouette to match the size of the target aircraft. The distances range from 200 feet for the largest aircraft silhouette to approximately 1500 feet for the smallest. In essence, this mechanism places the center of the gunsight over the bullet stream at the ranging distance.

The number to the right of the cross hair is the number of hits on the enemy aircraft, the number to the left is the number of hits received. The number of hits delivered to each of the enemy aircraft are kept individually, but only the score on the most recent bogey to take hits is displayed. For safety purposes, the guns cannot be armed in the vicinity of the carrier or landing strip.

Armament is divided into two groups for the purpose of providing separate fire control for machine guns and cannons. This feature is only available with a two-firebutton analog stick; the primary firebutton controls the machine guns and the secondary firebutton controls the cannons. If the aircraft is equipped with just guns or just cannons then half of the armament is controlled by one button and half by the other. With the *Flight Stick Pro* analog stick, which is equipped with a "hat" switch, the first firebutton will fire both groups and the second firebutton will only fire the second group. The digital stick firebutton will fire both groups simultaneously.

The group configurations and fire durations are given in Tables 1 and 2 of Appendix III. The lethality entries in these tables are a relative measure of the damage caused by the bullet or cannon shell striking an aircraft. (Lethality-per-second is obtained by multiplying the rounds-per-second times the lethality-per-round.) Table 3 ranks the aircraft in order of total lethality-per-second when both groups of guns are fired simultaneously. The relative measure of the effect this damage has on the ability of each aircraft to continue to function is given by the combat-damage vulnerabilities listed in Appendix IV. Combat-damage vulnerability rankings are derived from aircraft surface area, weight, and anecdotal evidence of armor and fire protection. Lethality is increased when hits are made on the cockpit and engine areas.

The P-61 aircraft is equipped with a turret gun containing four 0.50 caliber machine guns and capable of a 360 degree arc of fire. If you are piloting the P-61 in a one-player mode, the turret gun is aimed forward and is fired on a digital joystick along with the cannons with the first firebutton. With an analog stick, the turret gun can be fired independently with the second fire button. The ME-110 aircraft is equipped with two rear-firing 7.9mm machine guns that are capable of a 120 degree arc of fire; it cannot be fired in a one-player mode.

The audible firing rate of the armament is generally slowest for cannons and fastest for the light machine guns. A combination of machine guns and cannons will produce a volume-modulated pattern.

For wing mounted guns, the bullet streams converge at a distance of 1000 feet. Firing should be held to short bursts else a noticeable loss of airspeed may result. In limited ammo mode, the gross weight of the aircraft decreases as the ammunition is expended. Ammo stores are replenished after clicking RESTART FLIGHT in the In-Flight Menu or after a successful carrier trap or strip landing.

7. GLIDE-SLOPE INDICATOR

The sea-based pilots were aided in their carrier landings by the landing signals officer who would stand at the end of the carrier deck and signal the pilots if their approaches were too high or too low. The glide-slope indicator in serves the same purpose and is functional in the vicinity of the carrier or if the carrier is visible on the display screen. The same applies to the landing strip. It appears as a red cross hair and ranging circle along the centerline of the display screen and is illuminated by pressing the <a> key. By moving up and down, it is able to target where the aircraft is *headed*, as opposed (in the stationary gunsight mode) to where the aircraft is *pointed*. The red glide-slope indicator will switch back and forth with the black gunsight automatically as dictated by the position and heading of the aircraft.



SECTION XII

THE FOUR BASIC FORCES OF FLIGHT

1. GENERAL

This section contains a short analysis of the basic forces that act on an aircraft in flight, namely, Weight, Lift, Thrust, and Drag. The ability to control and manipulate these forces in a wide range of flight conditions is the key to developing effective tactical-combat skills.

2. WEIGHT

Weight is the attractive force of the aircraft and planet Earth. It is equal to the weight of the aircraft and, unlike the other forces, is constant in magnitude and direction. Weight is unremitting in its desire to pull the aircraft into the ocean (or ground), especially at low airspeeds when Weight can become the dominant force. Weight can be used to advantage when at altitude by diving and rapidly increasing the airspeed.

3. LIFT

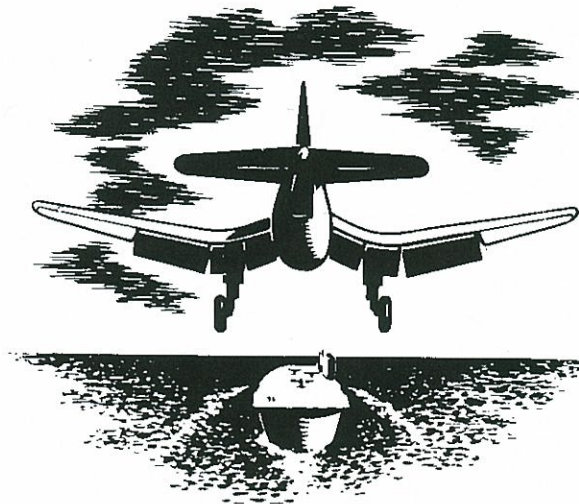
Lift is the force generated by the airfoil shape of the wing, which is rounded on top and flat on the bottom. The airstream moves faster over the top surface in order to keep up with the air moving over the bottom surface. Because a faster moving airstream exerts less pressure, the result is a pressure differential and a net force pointing up through the wing. Lift increases with airspeed and also with the angle of attack of the wing in the airstream. A combination of high airspeeds and back pressure on the stick (producing a high angle of attack) will result in a Lift force many times the weight of the aircraft. It can be used to climb, descend or turn depending on the bank angle of the aircraft. In straight and level flight the Lift is equal to the Weight.

4. THRUST

The airfoil-shaped propeller blades provide Thrust, the pulling force that increases with rpm and decreases with airspeed. Thrust is at a maximum at takeoff when it is equal to about one-half the Weight.

5. DRAG

Drag is a combination of the friction of the aircraft profile against the airstream and the induced drag associated with Lift. Drag increases with airspeed and acts in the direction opposite to the motion of the aircraft. It can be manipulated to slow the aircraft on a landing approach or during combat. If maximum airspeed is desired, the Drag should be minimized by retracting flaps, landing gear and tailhook. In level flight, Drag is counteracted by Thrust.



SECTION XIII THE CARRIERS

1. BUNKER HILL (CV-17)

The *U.S.S Bunker Hill* was launched 7 December 1942, the third Essex-class carrier to enter the war. She saw action in battles ranging from the Solomon Islands northward to Okinawa until crippled by two *kamikaze* hits on 11 May 1945. Corsair squadrons operated sporadically from the carrier until their permanent assignment in early 1945. She carried 91 aircraft, of which 36 were fighters, had a flight deck 860 feet long by 100 feet wide and a top speed of 33 knots. For carrier operations, the carrier is making 25 knots on a calm sea. Arresting wires were strung from just beyond the aft deck number forward to the aft elevator, which is marked with an "x".

2. SHOKAKU

The Imperial Japanese Navy carrier *Shokaku* was launched 1 June 1939. She survived many of the important naval battles of the Pacific theater, but on 19 June 1944, in the Battle of the Philippine Sea, was sunk by four torpedoes fired from the submarine *Cavalla*. She carried 84 aircraft, of which 18 were Zero fighters, had a flight deck 790 feet long by 95 feet wide and a top speed of 34 knots. For carrier operations, the carrier is making 25 knots on a calm sea. Arresting wires were strung from the aft elevator (marked with an "x") forward to the crossing line.

APPENDIX I

QUICK INDEX OF FLIGHT CONTROLS

Note: With chat mode on, either the <Alt> or <Ctrl> keys must also be pressed if the aircraft is to be controlled from the keyboard.

Wheel Brakes- Left: <Del> key.
Right: <Help> key.

Catapult launch- <L> key.

Center Analog Stick and Rudder- <0> key on main keyboard.

Chat Display- <F1> key.

Chat Auto Display Toggle- <Ctrl-F1> keys.

Display Score- <S> key.

Wing Flaps- Raise: <E> key.

Lower: <W> key.

Landing Gear- <G> key.

Glideslope Indicator- <A> key near the landing strip or carrier.

Gunsight- <A> key at one of the locales or in a training area.

Gunsight Range- press both mouse buttons and move mouse forward/back.

Guns- firebutton #1 and/or #2 with guns armed.

Hat Switch Views-

Forward & Up: forward switch.

Up: right switch.

Rear & Up: left switch.

Rear: back switch.

Home Heading- press left mouse button and read fuel gauge.

Hook- <H> key.

In-Flight Menu Access- Press <P> key.

Pan View- Press right mouse button and move mouse.

Pause- Press <P> key.

Rudder- Left and right movement of the mouse with left mouse button down.

Left: <C> key.

Right: <V> key.

Center: <F> key.

Throttle- Fore and back movement of the mouse with left mouse button down.

Increase: <Z> key.

Decrease: <X> key.

Trim- Press left mouse button while moving digital stick.

Turbo Flight- <T> key.

View Cursor Keys-

Left: <left> key.

Right: <right> key.

Rear: <down> key.

Forward & Up: <up> key.

Right & Up: <right & up> key.

Left & Up: <left & up> key.

Rear & Up: <down & up> key.

Up: <left and right> key.

Lock: <Help> key.

Unlock: <Del> key.

Wingman Heading- press left mouse button and look at fuel gauge.

Wingman Blink- press right mouse button or <I> key.

APPENDIX II

AIRCRAFT SPECIFICATIONS AND PERFORMANCE DATA

TABLE 1. Aircraft weight, wing area, wingspan, and length.

Aircraft	Weight (lbs)	Wing Area (sq ft)	Wing Span (ft)	Length (ft)
<i>American:</i>				
F4U-1D	11700	314	41.0	33.5
F2G	13100	314	41.0	34.5
F6F-3	12000	341	42.8	33.5
P38-L	13200	328	52.0	37.8
P47-D	12500	300	40.9	34.8
P51-D	10000	233	37.0	32.3
P61-C	29000	664	66.0	48.9
<i>British:</i>				
Hurricane II	7670	258	40.0	32.0
Spitfire I	5784	242	36.8	31.0
Spitfire IX	7300	242	36.8	31.0
Spitfire XIV	8400	242	36.8	31.3
Seafire II	6650	242	36.8	31.0
Tempest V	12500	300	40.9	33.7
<i>Russian:</i>				
Yak3	5600	185	30.2	27.9
<i>Japanese:</i>				
A6M5a	6025	229	36.1	29.9
KI84	8300	226	36.9	32.5
N1K2	8800	253	39.4	29.1
J7W	10600	221	36.5	30.8
<i>German:</i>				
Bf109-E	5875	174	32.5	30.0
Bf109-G6	6834	173	32.5	30.0
FW190-A8	9625	197	34.5	28.9
TA-152-H	10300	251	47.3	35.0
ME-262	13000	270	40.9	34.8
ME163B	9042	219	30.5	19.2
ME110-G	16000	413	53.3	39.5

TABLE 2. Maximum engine horsepower or thrust at take-off, internal fuel capacity, and flight time at military power. American aircraft fuel units are U.S. Gallons; British are Imperial Gallons; all others are Liters.

Aircraft	HP/Thrust	Fuel	Flight Time (min)
<i>American:</i>			
F4U-1D	2000	237	67
F2G	3000	237	41
F6F-3	2000	250	71
P38-L	2x 1475	260	76
P47-D	2300	370	89
P51-D	1590	245	66
P61-C	2x 2800	736	83
<i>British:</i>			
Hurricane II	1280	120	52
Spitfire I	880	85	49
Spitfire IX	1290	85	37
Spitfire XIV	2050	94	25
Seafire II	1185	85	42
Tempest V	2300	370	44
<i>Russian:</i>			
Yak-3	1650	720	42
<i>Japanese:</i>			
A6M5a	1130	524	74
KI84	1900	960	70
N1K2	2000	960	68
J7W	2130	960	64
<i>German:</i>			
Bf109-E1	1175	400	58
Bf109-G6	1475	400	35
FW190-A8	1700	640	54
TA152-H	1880	640	53
ME262	3960	1800	30
ME163-B	3750	1600	9.3
ME110-G	2x 1475	1200	60

TABLE 3. Aircraft wing loadings, power loadings, initial climb rates, maximum airspeeds at sea level, and maximum diving speeds.

Aircraft	Wing Loading (lbs/sq ft)	Power Loading (lbs/hp)	Climb (ft/min)	Max Speed (knots)	Max Dive (knots)
<i>American:</i>					
F4U-1D	37	5.9	2890	284	482
F2G	41	4.4	4800	352	482
F6F-3	35	6.0	3240	270	482
P38-L	40	4.5	2850	283	471
P47-D	42	5.4	2800	298	440
P51-D	43	6.3	3475	281	444
P61-C	43	5.2	3000	322	470
<i>British:</i>					
Hurricane II	30	6.0	2700	240	400
Spitfire I	24	6.6	2530	256	400
Spitfire IX	30	5.6	4100	281	400
Spitfire XIV	34	4.1	4580	340	440
Seafire II	27	5.6	3300	269	400
Tempest V	42	5.4	3000	305	466
<i>Russian:</i>					
Yak-3	30.3	3.4	5250	334	450
<i>Japanese:</i>					
A6M5a	26	5.3	3150	251	400
KI-84	36	4.4	3600	290	440
N1K2	35	4.4	3300	272	437
J7W	48	5.0	3300	314	450
<i>German:</i>					
Bf109-E1	34	5.0	3200	245	473
Bf109-G6	40	4.6	3300	271	473
FW190-A8	49	5.7	2350	281	482
TA152-H	41	5.5	3300	353	480
ME262	48	3.3	3940	475	572
ME163-B	41	2.4	16400	524	572
ME110-G	38	5.4	2500	278	440

TABLE 4. Sustained turning performance: time in seconds to complete maneuver at military power, no flaps, and 6000 feet.
Roll rate grading: A = fast, D = slow.

Aircraft	Horizontal	Vertical	Roll Rate
J7W Shinden	14	16	C
Spit XIV	15	15	D
N1K2 George	15	15	C
TA152-H	15	15	B
A6M5a Zero	15	16	D
Spitfire IX	16	16	D
KI84	16	16	C
Spitfire I	16	18	D
P51-D	17	16	B
F6F-3	17	16	C
Seafire II	17	17	D
P38-L	17	17	D
Yak-3	17	17	C
Hurricane II	17	18	C
F2G	17	18	B
Me109E-1	17	19	B
Fw190A-8	18	16	A
Tempest V	18	19	C
Me109G-6	18	19	C
P47-D	19	19	A
F4U-1D	20	20	B
ME262	22	20	C
P61-C	22	18	D
ME163-B	22	23	B
ME110-G	24	25	D

APPENDIX III ARMAMENT

TABLE 1. Armament controlled by secondary firebutton on analog stick, or by primary firebutton on digital joystick. Arbitrary units for lethality. MG = Machine Gun, C = Cannon.

Aircraft	Armament	Rounds (/sec)	Lethality (/rnd)/(/sec)	Duration (sec)
<i>American:</i>				
F2G	3x 0.50cal MG	45	8 360	26
F6F-3	3x 0.50cal MG	45	8 360	26
P38-L	4x 0.50cal MG	60	8 480	26
P47-D	4x 0.50cal MG	60	8 480	26
P51-D	3x 0.50cal MG	45	8 360	26
P61-C	4x 20mm C	45	33 1485	18
-rear	4x 0.50cal MG	60	8 480	37
<i>British:</i>				
Hurricane II	4x 0.30cal MG	75	2 150	18
Spitfire I	4x 0.30cal MG	75	2 150	18
Spitfire IX	2x 0.50cal MG	30	8 240	16
Spitfire XIV	2x 0.50cal MG	30	8 240	16
Seafire II	4x 0.30cal MG	75	2 150	18
Tempest V	2x 20mm C	23	33 726	11
<i>Russian:</i>				
Yak-3	2x 12.7mm MG	30	8 240	17
<i>Japanese:</i>				
A6M5a	2x 7.7mm MG	23	2 46	44
KI84	2x 20mm C	15	19 285	16
N1K2	2x 20mm C	15	19 285	16
J7W	2x 30mm C	15	33 495	9
<i>German:</i>				
Bf109-E1	2x 7.9mm MG	22	2 44	44
Bf109-G6	2x 13mm MG	30	7 210	20
FW190-A8	2x 13mm MG	30	7 210	20
TA152-H	1x 30mm C	8	27 216	12
ME262	2x 30mm C	15	27 405	13
ME163-B	2x 20mm C	12	31 372	9
ME110-G	2x 20mm C	23	31 713	16
-rear	2x 7.9mm MG	23	2 46	71

TABLE 2. Armament controlled by secondary firebutton on analog stick, or by primary firebutton on digital joystick. Arbitrary units for lethality. MG = Machine Gun, C = Cannon.

Aircraft	Armament	Rounds (/sec)	Lethality (/rnd)(/sec)		Duration (sec)
<i>American:</i>					
F2G	3x 0.50cal MG	45	8	360	26
F6F-3	3x 0.50cal MG	45	8	360	26
P38-L	1x 20mm C	11	33	363	13
P47-D	4x 0.50cal MG	60	8	480	26
P51-D	3x 0.50cal MG	45	8	360	26
P61-C(no rear)	4x 0.50cal MG	60	8	480	37
<i>British:</i>					
Hurricane II	4x 0.30cal MG	75	2	150	18
Spitfire I	4x 0.30cal MG	75	2	150	18
Spitfire IX	2x 20mm C	22	33	726	11
Spitfire XIV	2x 20mm C	22	33	726	11
Seafire II	2x 20mm C	22	33	726	11
Tempest V	2x 20mm C	22	33	726	11
<i>Russian:</i>					
Yak-3	1x 20mm C	8	19	219	16
<i>Japanese:</i>					
A6M5a	2x 20mm C	15	19	285	11
KI84	2x 20mm C	15	19	285	16
N1K2	2x 20mm C	15	19	285	16
J7W	2x 30mm C	15	33	495	9
<i>German:</i>					
Bf109-E	3x 20mm C	23	24	552	14
Bf109-G	2x 20mm C; 1x 30mm C	34	30	1020	11
FW190-A8	4x 20mm C	45	31	1395	17
TA152-H	2x 20mm C	23	31	713	16
ME262	2x 30mm C	15	27	405	13
ME163-B	1x 20mm C	12	31	372	9
ME110-G	2x 30mm C	15	27	405	18

TABLE 3. Aircraft ranked in order of maximum lethality deliverable during a one second burst with all guns firing.

Aircraft	Lethality
P61-C	1965
FW190-A8	1610
Tempest V	1460
Bf109-G	1230
ME110-G	1118
J7W	990
Spitfire IX	970
Spitfire XIV	970
P47-D	960
TA152-H	929
ME262	910
Seafire II	880
P38-L	840
ME163-B	744
F4U-1D	720
F2G	720
F6F-3	720
P51-D	720
Bf109-E1	594
KI84	580
N1K2	580
Yak-3	392
A6M5a	336
Hurricane II	300
Spitfire I	300

APPENDIX IV COMBAT DAMAGE VULNERABILITIES

TABLE 1. Combat-damage vulnerability rankings are derived from aircraft surface area, weight, and anecdotal evidence of armor and fire protection.

Aircraft	Vulnerability Factor
A6M5a Zero	41- most vulnerable
ME109E-1	41
ME163-B	38
ME109G-6	38
Spitfire I	37
ME262	36
Seafire II	33
Spitfire IX	31
Fw190A-8	27
Spitfire XIV	27
Yak-3	27
Hurricane II	26
TA152-H	25
KI84	25
P51-D	24
J7W Shinden	21
NIK2 George	21
F4U-1D	18
F2G	18
Tempest V	17
P47-D	17
F6F-3	17
P38-L	16
ME110-G	15
P61-C	12- least vulnerable

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