FIREFOX
FIREFOX
FIREFOX

Operators Manual

Atari Customer Service

If reading through this manual does not lead to solving a certain maintenance prob-
lem, call TELEHELP® at the Atari Customer Service office in your geographical area,
as shown below.

UNITED STATES

Parts and Service

Atari, Inc.
California Customer Service Office
737 Sycamore
P.O. Box 906
Milpitas, CA 95035
Telex 17-1103
(Monday–Friday, 7:30–4:00 pm Pacific Time)

☎ From California, Alaska, or Hawaii
   (408) 943-1120

☎ Service from anywhere in the area shown in white
   toll-free **(800) 538-1611**

EUROPE

Parts and Service

Atari Ireland Limited
European Customer Service Office
Tipperary Town, Ireland
Telex 28165
(Monday–Friday, 9:00–6:00 pm GMT)

☎ **062-52155**

FIREFOX FIREFOX FIREFOX

Notice Regarding Non-ATARI Parts

```
▲——— WARNING ——▲
Use of non-ATARI parts or modifications of any
ATARI® game circuitry may adversely affect the
safety of your game, and may cause injury to
you and your players.
```

You may void the game warranty (printed on the inside back cover of this manual) if you do any of the following:

- Substitute non-ATARI parts in the game.
- Modify or alter any circuits in the game by using kits or parts *not* supplied by Atari.

NOTE

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area or modification to this equipment is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference. If you suspect interference from an ATARI® game at your location, check the following:

- All green ground wires in the game are properly connected as shown in the game wiring diagram.
- The power cord is properly plugged into a grounded three-wire outlet.
- The game printed-circuit boards (PCB) are properly installed within the Electromagnetic Interference (EMI) cage.
- The EMI Shield PCB is properly installed and connected in series with the game PCB harness.
- All filter capacitors required on the EMI Shield PCB are properly soldered in place.

If you are still unable to solve the interference problem, please contact ATARI Customer Service. See the inside front cover of this manual for service in your area.

Table of Contents

NOTE

For illustrated parts lists, refer to TM-253-02.

List of Illustrations

List of Tables

Safety Summary

The following safety precautions apply to all game operators and service personnel. Specific warnings and cautions will be found throughout this manual where they apply.

⚠ WARNINGS ⚠

Properly Ground the Game. Players may receive an electrical shock if this game is not properly grounded! To avoid electrical shock, do not plug in the game until it has been inspected and properly grounded. This game should only be plugged into a grounded 3-wire outlet. If you have only a 2-wire outlet, we recommend you hire a licensed electrician to install a grounded outlet. Players may receive an electrical shock if the control panel is not properly grounded! After servicing any parts on the control panel, check that the grounding clip is firmly secured to the metal tab on the inside of the control panel. Only then should you lock up the game.

AC Power Connection. Before connecting the game to the AC power source, verify that the proper voltage-selection plug is installed on the game's power supply.

Disconnect Power During Repairs. To avoid electrical shock, disconnect the game from the AC power source before removing or repairing any part of the game. When removing or repairing the video display, extra precautions must be taken to avoid electical shock because high voltages may exist within the display circuitry and cathode-ray tube (CRT) even after power has been disconnected. Do not touch internal parts of the display with your hands or with metal objects! Always discharge the high voltage from the CRT before servicing this area of the game. To discharge the CRT: Attach one end of a large, well-insulated, 18-gauge jumper wire to ground. Momentarily touch the free end of the grounded jumper to the CRT anode by sliding it under the anode cap. Wait two minutes and discharge the anode again.

Use Only ATARI Parts. To maintain the safety integrity of your ATARI game, do not use non-ATARI parts when repairing the game. Use of non-ATARI parts or other modifications to the game circuitry may adversely affect the safety of your game, and injure you or your players.

Handle Fluorescent Tube and CRT With Care. If you drop a fluorescent tube or CRT and it breaks, it may implode! Shattered glass can fly six feet or more from the implosion.

Use the Proper Fuses. To avoid electrical shock, use replacement fuses which are specified in the parts list for this game. Replacement fuses must match those replaced in fuse type, voltage rating, and current rating. In addition, the fuse cover must be in place during game operation.

CAUTION

Properly Attach All Connectors. Make sure that the connectors on each printed-circuit board (PCB) are properly plugged in. Note that they are keyed to fit only one way. If they do not slip on easily, do not force them. A reversed connector may damage your game and void the warranty.

Handle the Laser-Disc Player With Care. Servicing of the laser-disc player should be performed only by a qualified technician who is familiar with laser devices.

Set Up

How to Use This Manual

This manual, written for game operators and service technicians, describes how to set up, maintain, and service your new ATARI game.

Chapter 1 contains game overviews, game specifications, inspection procedures, switch information, option information, and a description of game play.

Chapter 2 contains self-test procedures.

Chapter 3 contains maintenance and repair procedures.

Chapter 4 contains troubleshooting procedures.

Chapters 5, 6, and 7 appear in **TM-253-02**. Chapter 5 provides illustrated parts lists for the assemblies that are common to both the upright and sit-down cabinets.

Chapter 6 provides illustrations and parts lists for the assemblies that are unique to the upright cabinet.

Chapter 7 provides illustrations and parts lists for the assemblies that are unique to the sit-down cabinet.

Schematic diagrams of the game circuitry are included in the SP-253 supplement to this manual.

⚠ — WARNING — ⚠

To avoid electrical shock, do not plug in the game until it has been inspected and properly set up for the line voltage in your area.

This game should only be connected to a grounded 3-wire outlet. If you have only a 2-wire outlet, we recommend you hire a licensed electrician to install a grounded outlet. Players may receive an electrical shock if this game is not properly grounded.

Do not touch internal parts of the display with your hands or with metal objects!

Chapter 1

**Attraction Panel &
Speaker Board Assy**
See Figure 6-2

Head Assy
See Figure 6-1

Flight Control Assy
See Figure 5-1

Control Panel Assy
See Figure 6-3

Audio Jack Assy
See Figure 5-4

Body Assy
See Figure 6-1

Lower Speakers
See Figure 6-1

Pedestal Assy
See Figure 6-1

Coin Door Assy
See Figures 5-5 & 5-6

Utility Panel
See Figure 5-2

⚠ — **WARNING** — ⚠

Do not plug in the game until it has
been inspected. This game should
only be connected to a grounded 3-
wire outlet. If you have only a 2-wire
outlet, we recommend you hire a
licensed electrician to install a
grounded outlet. Players may re-
ceive an electrical shock if this game
is not properly grounded!

**Figure 1-1   Game Overview
Upright FIREFOX**

Video Display ★
See Technical Manual

Deflection PCB Assy ★
Used with Atari Display
See Technical Manual

Switching Power Supply ★
See Technical Manual

Laser-Disc Player ★
See Figure 5-3

★ Items with a serial number label

Access Panel

Game Identification Label ★

EMI Cage
See Figure 5-7
Game PCBs ★
See Figures 5-9,
5-10 & 5-11

Access Panel

EMI Shield PCB
See Figures 5-7 & 5-12

Fans
See Figure 6-1

Power On/Off Switch

Access Panel

**Figure 1-1 Game Overview, continued
Upright FIREFOX**

1-4

Flight Control Assy
See Figure 5-1

Video Display ★
See Figure 7-1

Lighted Control Panel Assy
See Figure 7-2

Attraction Panel Assys
See Figure 7-1

A041776-01
Audio Jack Assy
See Figure 5-4

Dust Filter

Caster

Coin Door
See Figures 5-5 & 5-6

Utility Panel
See Figure 5-2

★ Items with a serial number label
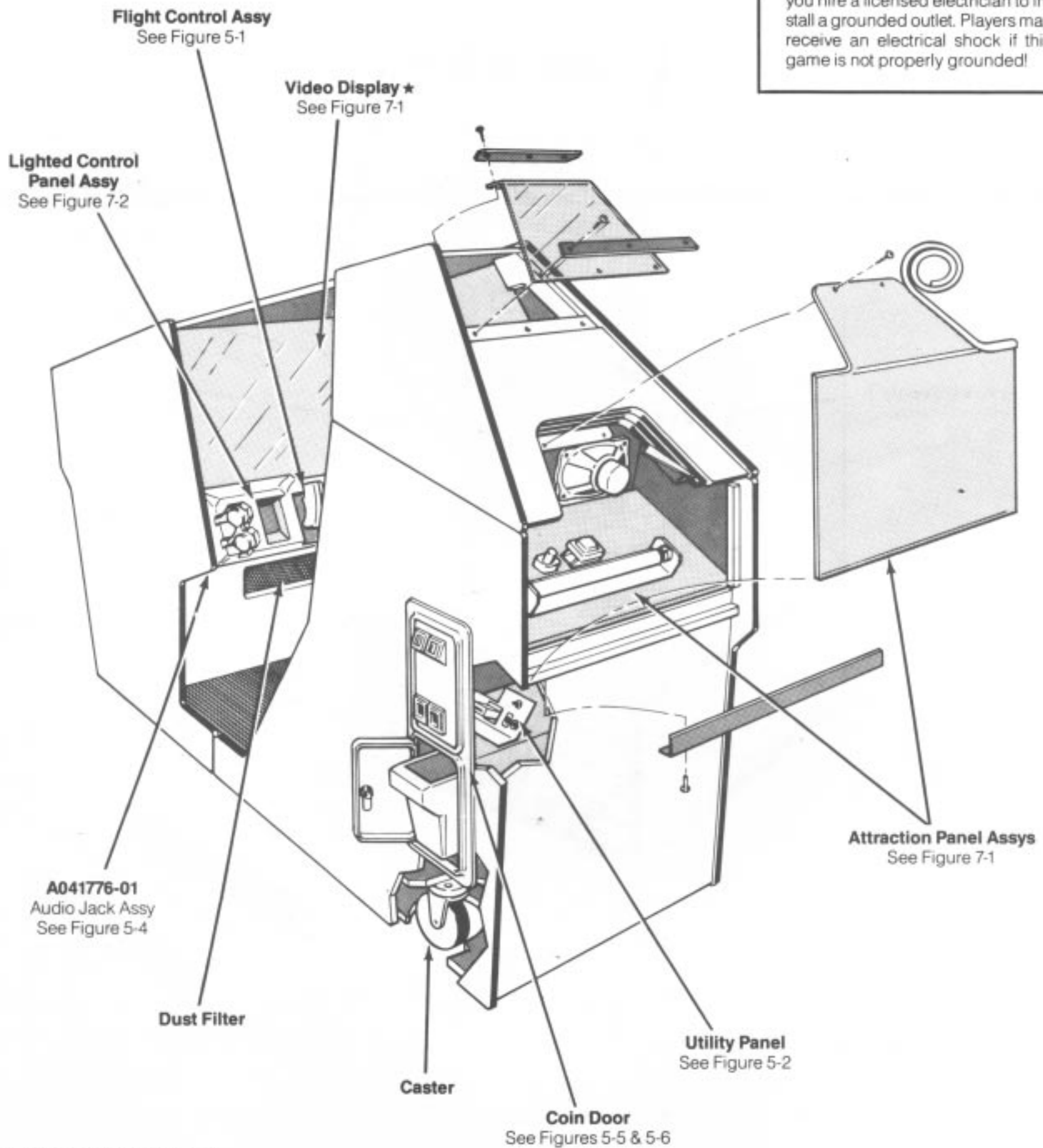
Figure 1-2 Game Overview
Sit-Down FIREFOX

Ventilation Grille

Side Window

Switching Power Supply ★
See Technical Manual

EMI Cage
See Figure 5-7

Game PCBs ★
See Figures 5-9,
5-10 & 5-11

Rear Access Door

EMI Shield PCB ★
See Figures 5-7 & 5-12

Fans
See Figure 7-1

Power On/Off Switch

Deflection PCB Assy ★
Used with Atari Display
See Technical Manual

Laser-Disc Player ★
See Figure 5-3
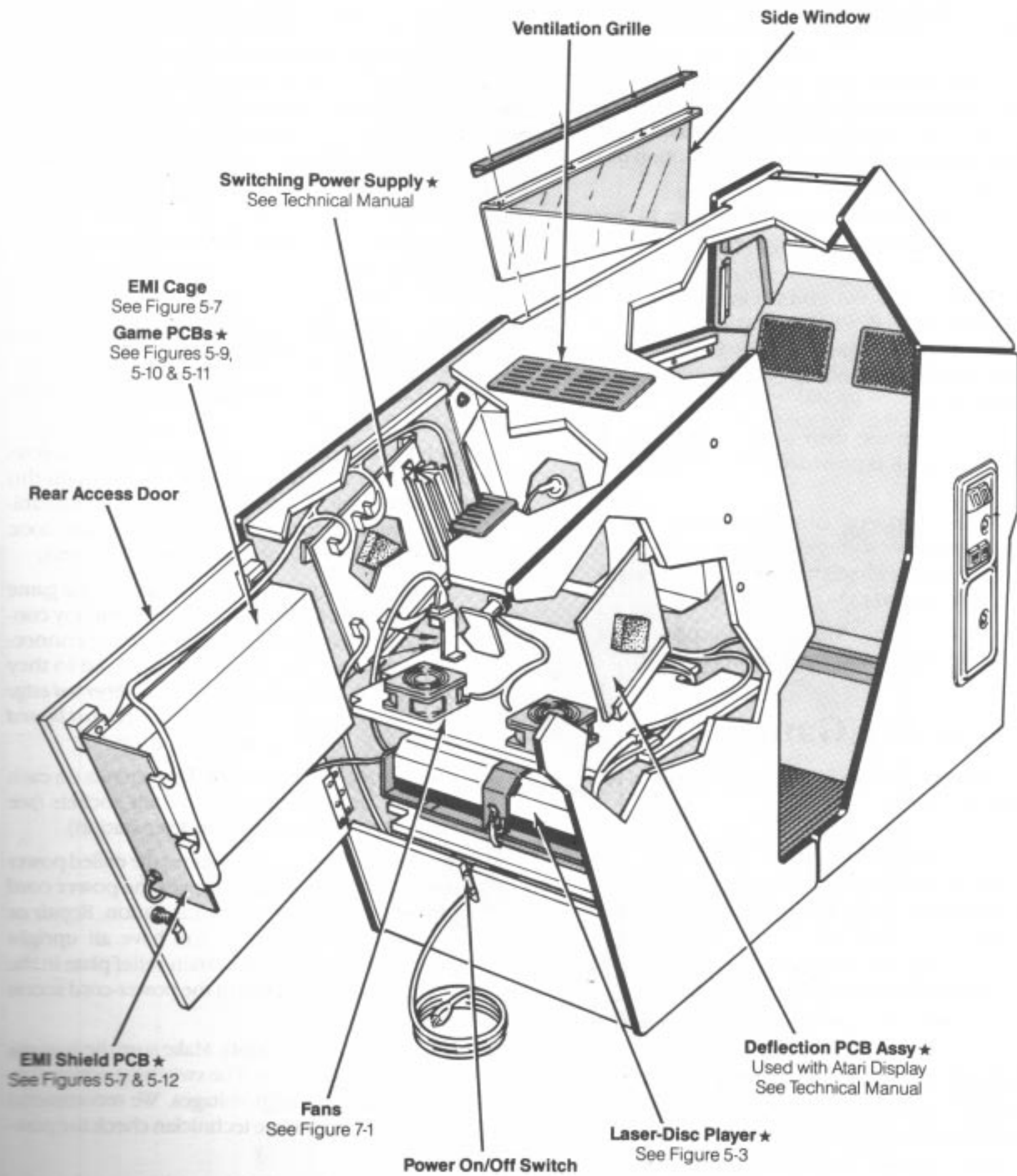
Figure 1-2 Game Overview, continued
Sit-Down FIREFOX

Game Overview

FIREFOX* is a one-player game based on the suspenseful FIREFOX movie which starred that foxy maverick—Clint Eastwood! The awesome footage for this game was carefully selected from actual outtakes of the movie. Even the voice you hear is Eastwood's own, lifted from the movie's voicetrack.

Sequences for FIREFOX are stored on a laser disc. ATARI LASERVIDEO™ technology has accomplished the union of laser disc and digitally-generated electronic graphics to allow the player to star in his own first-person motion picture experience!

For an overview of the upright cabinet, see Figure 1-1. For an overview of the sitdown cabinet, see Figure 1-2.

New Features

FIREFOX has several new features:

- FIREFOX is Atari's first laser disc game. ATARI LASER-VIDEO combines two technologies for an exciting experience for players.

- FIREFOX players can use their own headphones. A headphone audio jack is provided below the control panel.

- FIREFOX has four high-score tables. In addition, a *Most Recent High-Score Table* is provided that shows the best seven scores of the most recent players. This table appears in the Attract Mode.

- FIREFOX introduces the "Heads Up" display. For a complete description, see Game Play in this chapter.

Inspecting the Game

Table 1-1 lists space, power, and other environmental requirements for your game.

```
┌─────────────── CAUTION ───────────────┐
│                                        │
│  The ambient air temperature required  │
│  for proper operation of the disc      │
│  player must be more than +5° C        │
│  (+40° F).                             │
│                                        │
│  If the game is cold when unpacked,    │
│  allow it to reach room temperature    │
│  before turning it on.                 │
│                                        │
└────────────────────────────────────────┘
```

```
┌────▲──── WARNING ────▲────┐
│                            │
│  Do not plug in your game  │
│  until steps 1 through 2g  │
│  are completed!            │
│                            │
└────────────────────────────┘
```

Table 1-1 Installation Specifications

Characteristic	Specification
Power Consumption	240 W Nominal
Temperature	+5° to +38° C (+40° to +100° F)
Humidity	Not to exceed 95% relative
Line Voltage	100 to 132 VAC (or 200 to 264 VAC)
Upright Cabinet	
Width	25.25 in. (64.1 cm)
Depth	36 in. (91.4 cm)
Height	68.50 in. (174 cm)
Sit-Down Cabinet	
Width	25.25 in. (64.1 cm)
Length	83 in. (210.8 cm)
Height	59 in. (169.9 cm)

Please inspect your game carefully to ensure that it was delivered to you in good condition.

1. Examine the exterior of the game cabinet for dents, chips, or broken parts.

2. If you have an upright cabinet, remove the screws from the body access panel. Unlock and open this panel and the coin door. If you have a sit-down cabinet, unlock and open the rear door and the coin door. Then inspect the interior of the game as follows:

   a. Ensure that all plug-in connectors (on the game harnesses) are firmly plugged in. Replug any connectors found unplugged. Do not force connectors together. The connectors are keyed so they only fit in the proper orientation. *A reversed edge connector may damage a printed-circuit board (PCB) and will void your warranty.*

   b. Ensure that all plug-in integrated circuits on each PCB are firmly plugged into their sockets (see Figure 3-4, PCB Removal and Separation).

   c. Remove the tie-wrap that secures the coiled power cord inside the cabinet. Inspect the power cord for any cuts or dents in the insulation. Repair or replace it if required. If you have an upright cabinet, place the square strain-relief plate in the wood slot at the bottom of the power-cord access opening.

   d. Inspect the power supply. Make sure the harness is plugged in correctly. The switching power supply has exposed high voltages. We recommend that a qualified service technician check the power supply.

   e. Inspect other major subassemblies, such as the control panel, video display, EMI cage (US-built games only), fluorescent tube, and each PCB. Make sure they are mounted securely and that the green ground wires are connected.

┌───┐
│   ⚠──── **WARNING** ────⚠   │
│   │
│ Replace fuses only with an identical type fuse │
│ with the same electrical rating. Please refer to │
│ TM-261 (the switching power supply manual) │
│ for information about fuse values in your │
│ game.   │
└───┘

f. The disc player is installed in the cabinet before the game is shipped with the FIREFOX laser disc already in the disc player. Therefore, the disc player should require no special set up. If you have trouble with the disc player, see Chapter 3 for instructions on how and where to send it for service.

┌───┐
│   ⚠──── **WARNING** ────⚠   │
│   │
│ The disc continues to spin after the game is │
│ turned off and could spin out of the disc player │
│ and cause personal injury if the lid is opened im- │
│ mediately. To prevent personal injury, ALWAYS │
│ turn the game off and **wait for at least three** │
│ **minutes** before opening the lid.   │
└───┘

g. If you have an upright cabinet, proceed to part h. If you have a sit-down cabinet, you should immobilize it so that players will not roll the game around. To stabilize the cabinet, lift up the game from one side. Place a block of wood, a book, or another object at least 2 inches thick under the edge of the raised cabinet. Partially unscrew the adjustable glides until they extend below the casters (see Figure 1-3).

Lower the game and lift the other side. Partially unscrew the adjustable glides until they extend below the casters. Lower the game.

h. If access panels have been removed for inspection, replace them. Now plug the game into a **grounded** 3-wire outlet.

i. To calibrate the flight control, turn the game on and move the flight control so that the cursor reaches all four edges of the display. The game circuitry monitors the position of the cursor on the display in relation to the flight-control's vertical and horizontal position. Calibration is also accomplished during normal game play, but may take a few seconds to be optimized.
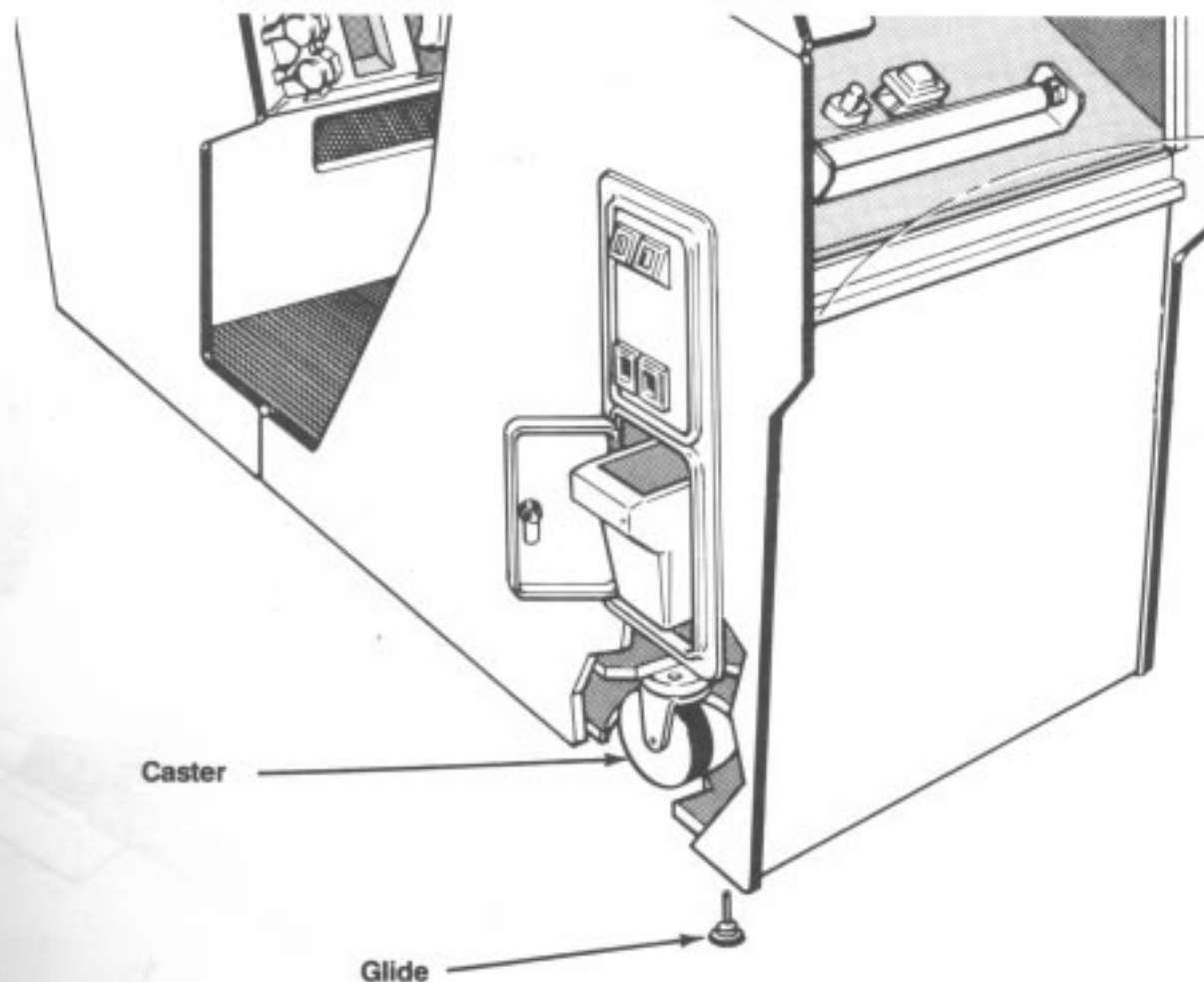
Figure 1-3 Stabilizing the Sit-Down Cabinet

Switch Information

Power On/Off Switch

The power on/off switch is located on the back of the cabinet toward the bottom (see Figures 1-1 and 1-2).

Utility Panel Switches

The volume control, coin counter(s), self-test switch, and auxiliary coin switch are on the utility panel. The utility panel is located inside the upper coin door (see Figures 1-1 and 1-2). The volume control adjusts the level of sound produced by the game. The coin counter(s) records the number of coins entered into the game. The self-test switch initiates the Self-Test Mode. The auxiliary coin switch credits the game without activating a coin counter. See Figure 1-4 and 5-2 for details of these switches.

> ── **NOTE** ──
>
> The utility-panel volume control adjusts the sound from the custom sound chips and from the stereo signal generated by the laser disc.

Volume Control for the Audio Jack

The volume control located below the control panel (see Figures 1-1 and 1-2) is used by the game player to adjust sound levels in his headphone set. The volume control on the utility panel does not affect the sound level in the headphones.

Option Switches

Three dual-inline-package (DIP) switches are located on the Main PCB at locations 3C, 6K, and 2M (see Figure 1-4). Switches 3C and 6K consist of eight toggle switches. Switch 2M consists of four toggle switches. Use these switches to select different game play and pricing options. (See Chapter 3 for PCB removal details and Tables 1-2 through 1-5 for option information.)

Figure 1-4 Switch Locations

Selecting the Game Options

FIREFOX has two eight-toggle option switches and one four-toggle option switch. These dual-inline package (DIP) switches are located on the Main PCB at locations 6K, 2M, and 3C (see Figure 1-4). The Main PCB is located between the Graphics PCB and the NTSC Demodulator PCB (see Figure 1-4).

- The DIP switch at location 6K is for selecting coin and credit options. These options include credits per coin, coin multipliers for the right and left coin mechanisms, the number of bonus coins added, and free play.

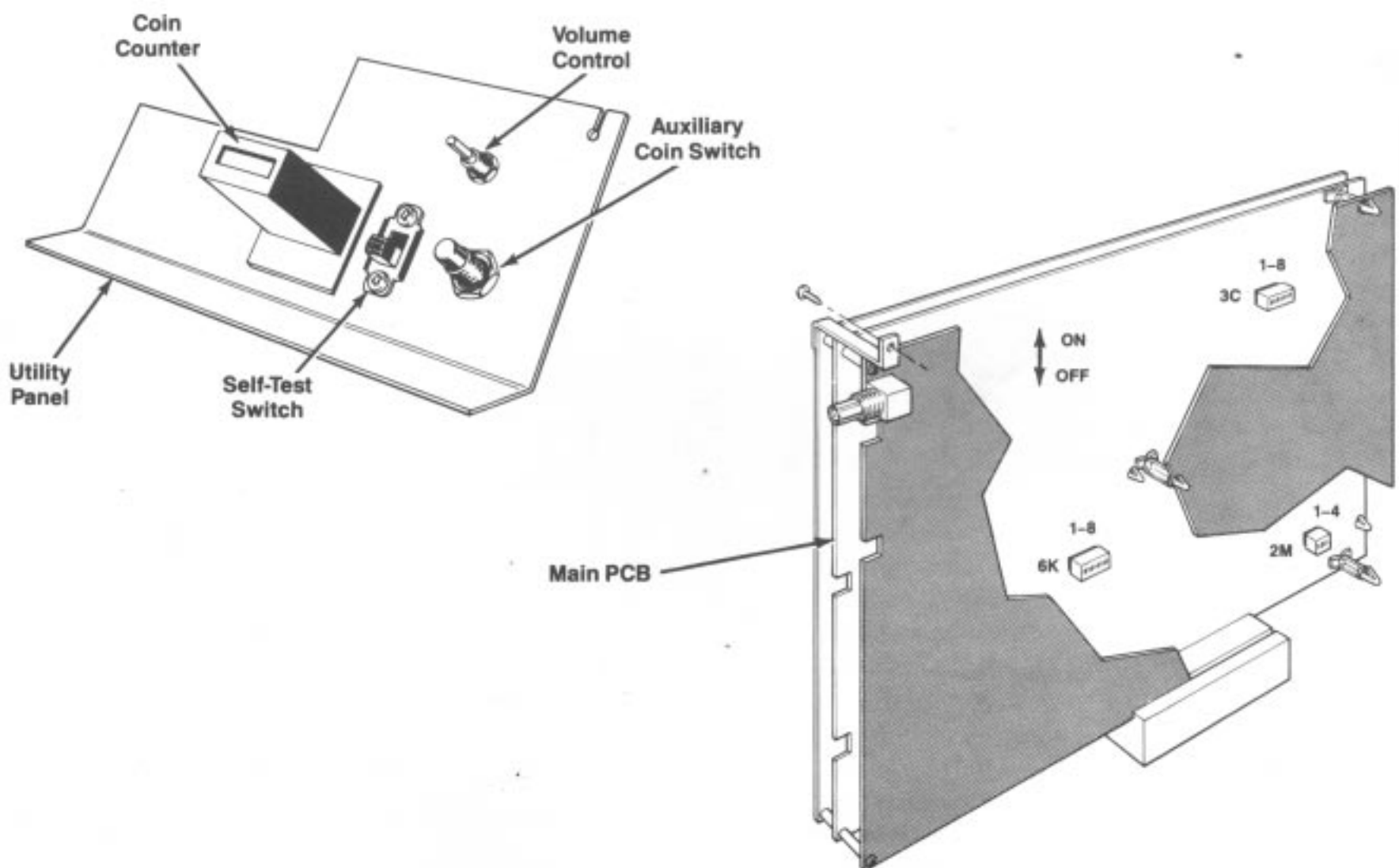- The DIP switch at location 2M is for selecting how the game will handle coin-counter outputs. The hardware either ties the outputs of the coin-counter drivers together (for domestic games) or leaves the outputs of the coin-counter drivers separate (for international games). If the outputs are separate, different coin denominations can be counted.

- The DIP switch at location 3C is for selecting options relating to credits per mission, the rate of fuel used when FIREFOX is shot, the rate of fuel used by FIRE-FOX during travel, the amount of bonus fuel awarded to FIREFOX when it lands, and the maximum number of waves allotted for the UNLIMITED MISSION.

NOTE

If the manufacturer's recommended settings are not satisfactory for your location, you can change the game's option settings from the front of the cabinet. To take advantage of this convenience, open the coin door and move the self-test switch to the *on* position. Refer to Chapter 2 and Tables 1-2 through 1-5 for detailed switch setting information.

You may change settings of the option switches to suit your needs. Please refer to *Which Options Do I Change?* for specific guidelines on how to select and verify options so that your game gives maximum performance at your location.

Settings for option switches are listed in Tables 1-2 through 1-4. Options preset at our American factory as of February, 1984, are shown by the ◄ symbol; options preset at our European factory are shown by the * symbol. To verify option settings, refer to Chapter 2.

Table 1-2 Switch Settings for Coin and Credit Options

Settings of 8-Toggle Switch on FIREFOX Main PCB *(at location 6K)*

1	2	3	4	5	6	7	8	Option
								Amount of Credit Per Coin Value
On	On							1 Credit ◄*
Off	On							½ Credit
On	Off							⅓ Credit
Off	Off							¼ Credit
								Left Coin Mechanism
		On						1 Coin ◄
		Off						2 Coins*
								Right Coin Mechanism
			On	On				1 Coin ◄*
			Off	On				4 Coins
			On	Off				5 Coins
			Off	Off				6 Coins
								Bonus Coin Adder
					On	On	On	0 Bonus Coins Added ◄
					Off	On	On	1 Bonus Coin Added for 2 Coins
					On	Off	On	1 Bonus Coin Added for 4 Coins
					Off	Off	On	2 Bonus Coins Added for 4 Coins
					On	On	Off	1 Bonus Coin Added for 5 Coins*
					Off	On	Off	1 Bonus Coin Added for 3 Coins
					On	Off	Off	0 Bonus Coins Added
					Off	Off	Off	Free Play

◄ *Manufacturer's recommended settings for American-made games*
* *Manufacturer's recommended settings for European-made games*

Table 1-3 Switch Settings for Special Options

Settings of 8-Toggle Switch on FIREFOX Main PCB *(at location 2M)*

1	2	3	4	Option
				Outputs of Coin Counters
On	On	On	On	Outputs of coin-counter drivers 1 and 2 tied together (for 1 counter) ◄
Off	On	On	On	Outputs of coin-counter drivers 1 and 2 separate (for 2 counters)*

◄ *Manufacturer's recommended settings for American-made games*
Manufacturer's recommended settings for European-made games

Sound in the Attract Mode

You can choose whether or not music is played in the Attract Mode **only** with the game software. To do this, open the coin door, set the self-test switch (on the utility panel) to *on* and press the auxiliary coin switch twice. The Game Options display will appear (see Figure 2-3). Move the flight control up or down. As you move the flight control, *YES* or *NO* will flash on the screen. If you pull the left trigger when *YES* is flashing, music will play every 7 minutes during the Attract Mode. If you pull the left trigger when *NO* is flashing, *NO* will appear at the bottom of the screen, and the game will be silent during the Attract Mode.

We recommend that games play music in the Attract Mode. The game is shipped with this option set to *YES*.

Option information is stored in the non-volatile random-access memory (NOVRAM). If the NOVRAM fails, the game defaults to silence in the Attract Mode. In this case, the Game Options display will show a *NO* to the right of *ATTRACT MUSIC*.

Table 1-4 Switch Settings for Game Play Options

Settings of 8-Toggle Switch on FIREFOX Main PCB *(at location 3C)*

1	2	3	4	5	6	7	8	Option
								Credits Per Mission
On								2 Credits for Any Mission*
Off								2 Credits Required for 3000- & 6000-Mile Mission & 3 Credits Required for 9000-Mile and UNLIMITED JOURNEY Mission ◄
								Game Difficulty (Rate of Fuel Lost When Shot)
	On	On						Easy Game Play
	Off	On						Medium Game Play ◄*
	On	Off						Hard Game Play
	Off	Off						Hardest Game Play
								Fuel Usage (During Travel)
			On	On				Easy—Fuel Used Slowly
			Off	On				Medium—Fuel Used at a Medium Rate ◄*
			On	Off				Hard—Fuel Used Quickly
			Off	Off				Hardest—Fuel Used Very Quickly
								Bonus Fuel Amount Awarded Upon Landing
					On	On		Easy—Maximum Amount of Fuel Received
					Off	On		Medium—Moderate Amount of Fuel Received ◄*
					On	Off		Hard—Small Amount of Fuel Received
					Off	Off		Hardest—Very Small Amount of Fuel Received
								Waves per UNLIMITED JOURNEY
							On	Moderate—4 Waves Maximum ◄*
							Off	Hardest—8 Waves Maximum

◄ *Manufacturer's recommended settings for American-made games*
Manufacturer's recommended settings for European-made games

Which Options Do I Change?

Before you change any option setting, be sure you can answer "yes" to all of the following questions:

1. Is your FIREFOX game set with the manufacturer's recommended options? If not, do you know for what options the game is set?

   If the game is set with the manufacturer's recommended options, proceed to question 2. If the game is not set with the manufacturer's recommended options, then:

   a. Enter the Self-Test Mode by setting the self-test switch (on the utility panel) to the *on* position.

   b. Reset the options (refer to Chapter 2).

   c. Set the self-test switch *off* to end the Self-Test Mode and return to the Attract Mode.

   d. Enter self-test again and verify your option settings on the Game Options display.

2. Do you know which option each toggle switch controls? Do you know the effect each different setting has on the overall game play?

   If you do know, proceed to question 3. If you do not, refer to *Option Switch Descriptions and Effects* and to Tables 1-2 through 1-5.

3. Do you have a general idea of what you want out of your game (e.g., the difficulty level for the player, the average game time, etc.)?

   If you do, you have been monitoring the statistics contained in the Self-Test and you should proceed to question 4. If you do not, you should:

   a. Enter the Self-Test Mode.

   b. Advance to the statistics display (see Chapter 2).

   c. Record the average game time and the percentage of play. Also record the date and time the information was taken. Continue to monitor these statistics to help you determine an answer to question 3. We recommend you monitor this information for a minimum of one full day; and for a maximum of one week.

4. Have you looked at Tables 1-2 through 1-5 to determine possible option settings?

   If you have, enter the Self-Test Mode and set the options you desire. Record and monitor the statistics as often as you can.

   If you haven't looked at these tables yet, refer to them now. Determine which options would best obtain the results you want.

Option-Switch Descriptions and Effects

Difficulty Option changes the amount of fuel lost when an enemy shot hits FIREFOX. This option immediately affects the player's fuel supply when the FIREFOX is hit.

Gas Usage Option changes the amount of fuel lost when FIREFOX is traveling at high or low altitudes. This option slowly, but continuously, affects the player's fuel supply throughout game play.

Bonus Gas Option changes the amount of fuel awarded when FIREFOX lands at the refueling station. This option greatly impacts the player's fuel supply at the end of a wave.

Unlimited Journey Option changes the maximum number of waves given (either 4 or 8) when a player selects the Unlimited Journey Mission. This option affects average game times and therefore, the game's earning potential.

Table 1-5   Difficulty Levels Based on Game Options

Difficulty Scale	Game Difficulty	Fuel Usage	Bonus Fuel
5	Easy	Easy	Easy
4	Moderate	Easy	Easy
3	Easy	Moderate	Moderate
2	Moderate	Moderate	Easy
1	Moderate	Easy	Moderate
0 ◀ *	Moderate	Moderate	Moderate
−1	Moderate	Hard	Moderate
−2	Moderate	Hardest	Moderate
−3	Moderate	Moderate	Hard
−4	Moderate	Hard	Hard
−5	Hard	Moderate	Moderate
−6	Moderate	Moderate	Hardest
−7	Hardest	Moderate	Moderate
−8	Hard	Hard	Moderate
−9	Hard	Hard	Hard
−10	Hard	Hardest	Hard
−11	Hard	Hardest	Hardest
−12	Hardest	Hardest	Hardest

◀ *Manufacturer's recommended settings for American-made games*
* *Manufacturer's recommended settings for European-made games*

In Table 1-5, zero (0) represents the difficulty level set at the factory. Using this or another known setting, you can use the table to produce settings which are incrementally easier or harder. Table 1-4 lists the specific settings for the general information listed in Table 1-5. Level 5 represents the easiest overall game play and level −12 represents the hardest. If you wish to change the game play from level 0, we suggest you choose the 1 or −1 difficulty level, because each additional level change will have a substantially increased effect over the previous settings.

— NOTE —

For most locations, we recommend staying between levels 3 and −5. Going out of this range will negatively affect the game play and profitability of this game.
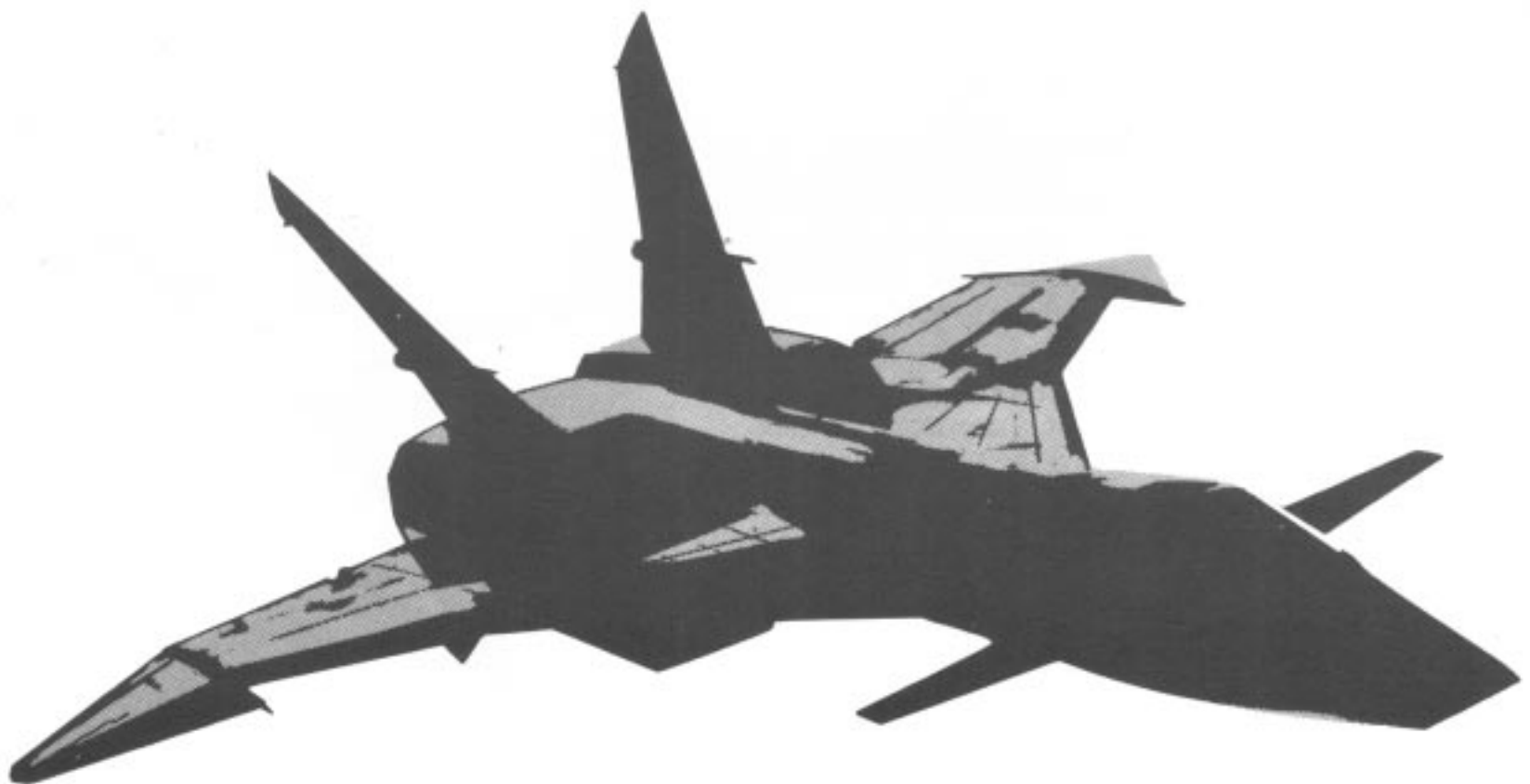
Game Play

FIREFOX is a one-player laser-disc game with a color raster video display. It has five modes of operation: Attract Mode, Select-A-Mission Mode, Play Mode, High-Score Mode, and Self-Test Mode.

The FIREFOX game is a first for Atari because it is:

- The first laser-disc game designed by Atari.

- The first ATARI game that allows a player to use headphones (his own).

- The first time that the ATARI flight control uses thumb buttons.

- The first generation of games that Atari is packaging in a high-tech cabinet.

The sound effects for FIREFOX are seismic! They intensify the Attract and Play Modes with music, sound effects, and lots of phrases from the movie soundtrack. You'll hear Clint Eastwood say the following:

> "Homing device attached."
> "I'm going to take her up."
> "I'm going to take her down."
> "I'm going to take her down low to avoid an infrared fix."
> "Let's see what this thing can do. . ."
> "Missile cruiser contact dead ahead. . ."
> "Polar pack's in sight now."
> "Homing device just activated."
> "ECM picking up infrared detection beams."
> "They've got me locked on."
> "Contact point 90 miles and I'm flying on air."
> "We've got visibility again."
> "Estimated 3 miles to target."
> "Radar says all clear."
> "Nothing can touch us now."
> "Better ice up a cold one."
> "I'm coming home."
> "Hope it burns up the sky."
> "Second FIREFOX. . ."
> 'Ah, we've got company. . ."
> "I'm on reserve tanks now."
> "I'm the best there is."
> "Boy is this a machine!"
> "They've spotted me."
> "Say brother, that's about as good as it gets."

During game play, Clint's voice is generated by the speech synthesizer chip, but during the Attract Mode, his voice and other sounds are from the laser disc. FIREFOX uses "stereo image enhancement" to simulate different distances between you and the sound source. This enhancement is particularly realistic if you use stereo headphones while playing the game.

Attract Mode

The Attract Mode displays exciting sequences and sound effects from the movie. Then the words *PULL TRIGGER TO START,* © *1982 WARNER BROS. INC.* and © *1983 ATARI, INC. ALL RIGHTS RESERVED* appear, while the footage continues to roll underneath it.

The targets (radar, oncoming shots, missiles, and planes) are defined.

The high-score table containing the most recent seven high scores appears during the Attract Mode.

Select-A-Mission Mode

When enough credits are registered to start game play, pull the trigger to start the Select-A-Mission Mode. Four missions appear on the screen—a 3000-mile mission, 6000-mile mission, 9000-mile mission, and a PRO MISSION. A map of each mission appears above the number of miles. (The PRO MISSION appears as a question mark because the course may vary.) All of the courses traverse western Russia and the Ural mountain range.

The 3000-mile mission has one leg, the 6000-mile mission has two legs, and the 9000-mile mission has three legs. In FIREFOX, a leg is similar to a wave.

You have nine seconds to select a mission. To make a selection, you must move the flight control to highlight the desired mission in gold. Then press the trigger.

The Play Mode starts when a mission is selected or after nine seconds of the Select-A-Mission Mode has elapsed.

Play Mode

Play is based on the FIREFOX movie—your mission is to escape detection and successfully deliver the FIREFOX super-plane to the United States government. You have one life, but during that life you may complete more than one mission.

ATARI LASERVIDEO™ graphics combine the laser-disc image with the digitized image of the FIREFOX nose. As you play the game, you can see your target through the graphic overlays. This is an aid during game play.

When the Select-A-Mission Mode ends, the FIREFOX engine revs and the instructions for your chosen mission appear on the screen.

Three numbers appear across the bottom of your screen. The number on the left is your score, the number in the middle is the number of targets you've shot down, and the number on the right is the number of fuel units you have remaining (you start with 80 units).

To begin your mission, fire with any switch. Messages appear during game play to guide you.

NOTE

When in the sky you use less fuel than when you're near the ground. However, in the sky you can be detected by twice as much radar. Radar detection increases as game play progresses.

There are up to seven "Altitude Select" screens, depending on the mission you chose. When you see the Altitude Select screen, move the flight control up or down to select whether you want to fly high or near the ground. The Altitude Select screen is a transitional third-person view of the FIREFOX (you'll notice that the FIREFOX and "Heads Up" display disappear from view).

If you are flying into a fatal situation (for example, flying into an ice cliff), an instruction clip from the movie intervenes. This clip shows a pilot's gloved hands pulling back on the flight control.

The words *HOMING DEVICE ACTIVATED* appear as you near the end of the mission leg. This is a tie-in with the movie and means you are approaching the American submarine. Entering the trench also marks the final leg of the mission. During the landing sequence, you'll see a quick overhead view of the submarine, which is where you refuel. After you refuel, a bonus screen appears. You receive bonus points for fuel remaining, the mission completed, rockets remaining, and a good landing.

Description of Targets. Radar is a target. You are in a stealth plane, so only infrared (not regular) radar can detect you. Infrared radar will appear on the screen as small concentric circles. If you do not destroy the infrared radar, it grows. The outer three rings of the radar turn black as you are detected.

Shots are also targets. You and the enemy both have two types of projectiles (or shots)—one is a guided missile that grows and hits head on; the other is a volley of shots that behaves like machine gun spray. When you hit an oncoming shot, black flak appears (it's like a black cloud.) When you are hit by a volley of shots, a yellow flash covers the screen and you lose one fuel unit. (It's a good thing you have a self-sealing tank!) When you are hit by a missile, a yellow and black flash covers the screen and you lose a larger amount of fuel units than the enemy projectile.

Planes are targets. When you hit a plane, flaming flak appears. Flaming flak also appears when you hit any other element (e.g., secret Soviet ground bases).

Description of Weapons. As the FIREFOX pilot, you have some useful weapons at your disposal. You have bullets, guided missiles, and a "Heads Up" display.

You start each mission leg with unlimited bullets and four guided missiles under your wings. The missiles *are fired with the thumb buttons on the flight control.* When you fire a missile, you guide it by moving the flight control. The missile always moves toward the crosshair. A missile will kill until its life is expired!

The "Heads Up" display is designed to communicate information to you quickly. This display includes the perimeter of the sight with the crosshair inside it. The horizontal red lines on either side of the crosshair show your fuel level. Each line represents three fuel units. Yellow rockets show you how many guided missiles you have left under your wings.

Scoring Information. When the Altitude Select screen appears, you get 10,000 bonus points if you were not detected. The screen will display either *10,000 BONUS* and *AVOIDED DETECTION* or *DETECTED*.

After you have landed, you get bonus points for:

- finishing each leg of the mission (3000 points for each leg completed)
- fuel remaining (500 points for each unit of fuel left)
- missiles remaining (1500 points for each missile left)

Hints for Game Play

- The amount of fuel you receive when you land depends upon the number of targets you've shot, so shoot all the targets you can!
- Use the guided missiles when the enemy is aggressively attacking you, because these missiles keep killing until they are spent.

- Change altitude if you have been detected.
- You are not shot at if you're undetected, so be sly.
- You are not penalized for missed shots, so shoot like crazy at targets and even shoot at things that aren't obvious, because you may destroy a secret object or camouflaged land base. These ground bases will shoot at you if you've been detected!

High-Score Mode

FIREFOX has four tables for entering initials—one table for each mission plus a table called *Most Recent High-Score Table.* This fifth table keeps track of the top seven scores for the most recent players, and acts as a multi-player score sheet for a group of players. The table displays only the best score of each player in the order of play (the same person cannot fill up the entire table). The *Most Recent High-Score Table* is displayed in the Attract Mode.

The first four tables contain space for 60 pilots' initials. To get into the high-score table desired, pull the flight control to the center, then to the right. To scroll a high-score table, pull the flight control up or down. To view previous tables, pull the flight control to the left.

If credits remain in the game, pull a trigger to start the Select-A-Mission Mode. In Attract Mode, turn the flight control to the right to view the high-score tables.

Self-Test Mode

Self-Test is divided into two sections. The first section shows game statistics and allows the operator to reset certain statistics or change options by using the flight control. The second section is designed to allow checking of game switches, hardware failures, potentiometer adjustments, and video display adjustment. Self-Test may be entered any time during the Attract Mode. See Chapter 2 for complete Self-Test information.
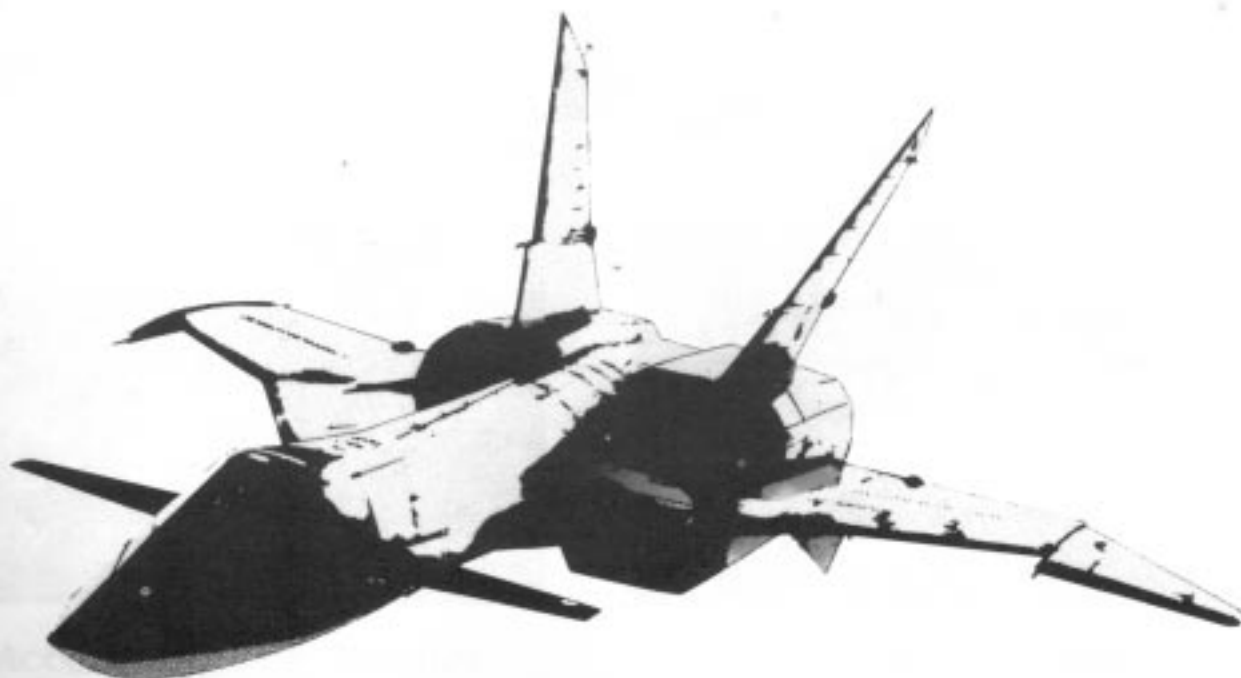
Self Test

This game will test itself and provide data to show that the game circuitry and controls are operating properly. Self-test data is presented visually on the video display and audibly through the speakers. No additional equipment is required.

We suggest you perform a self-test when you first set up, each time you collect money, change the game options, or suspect game failure.

Chapter 2
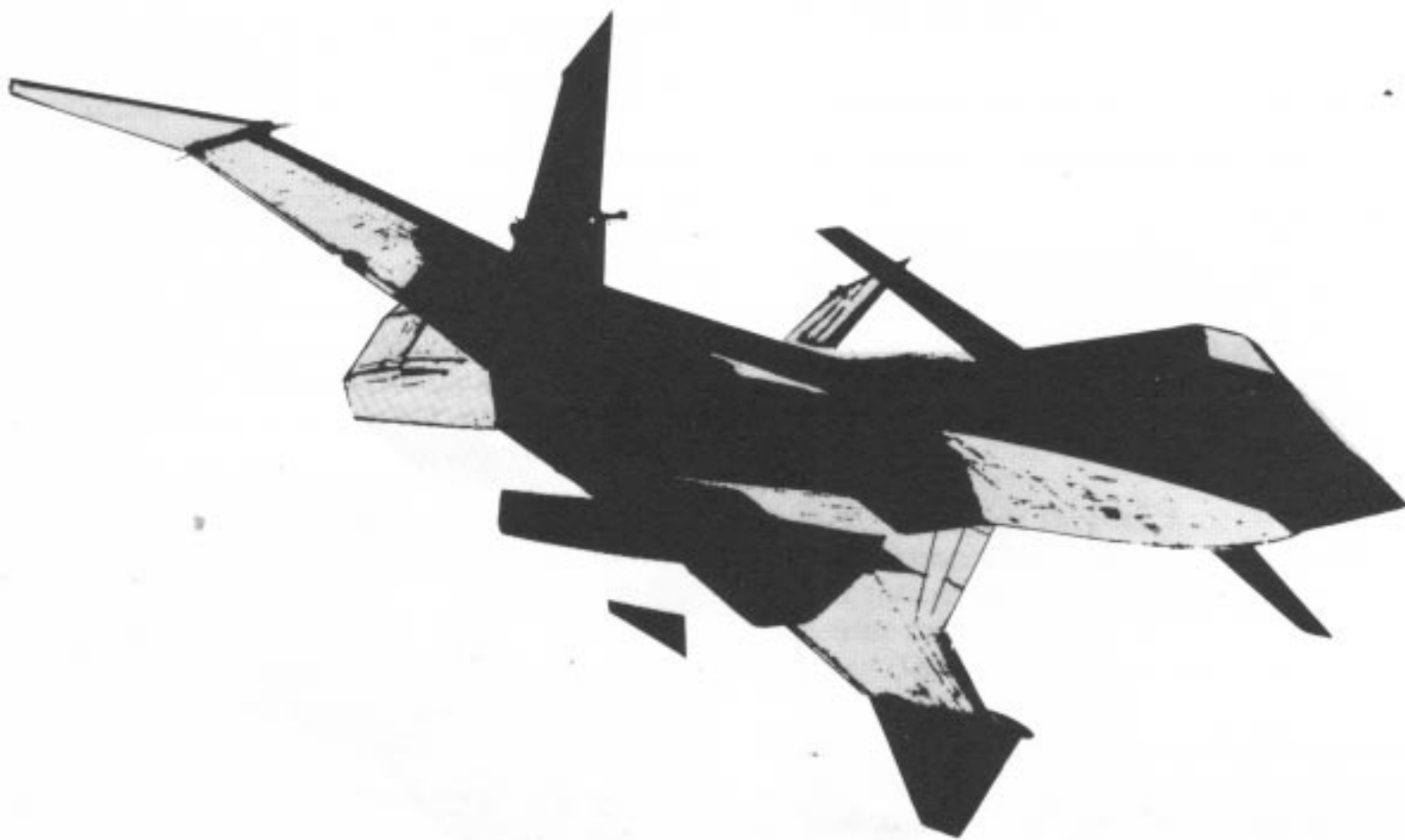
Self-Test Displays

Fifteen self-test displays provide a visual check of the game statistics, option-switch settings, flight control and coin-mechanism operation, display circuitry, the condition of the random-access memory (RAM), read-only memory (ROM), and sound circuitry. When the self-test switch (located on the utility panel) is turned *on* during the Attract Mode, the game enters the Self-Test Mode. Turning the self-test switch *off* at any time during the Self-Test Mode returns the game to the Attract Mode.

The following self-test displays are arranged in the sequence in which they occur. Press the auxiliary coin switch (located on the utility panel) to end each display and obtain the next display. Pressing the auxiliary coin switch will advance through the displays until the desired display is obtained. After the last display has ended, the sequence starts over with the RAM Errors display. To start with the first self-test display (Accounting Info), the self-test switch must first be turned *off* and then *on* again.

Accounting Info Display

Select the Self-Test Mode by setting the self-test switch to the *on* position. The Accounting Info display will appear as shown in Figure 2-1. The totals on this display are those accumulated since the game-times information was last reset. (Refer to *Game Options Display* for the reset procedure.) The coin-accounting information, which is the first four statistics in the accounting information section of the display, cannot be reset. It is accumulated from the date the game was manufactured, or since the non-volatile random-access memory (NOVRAM) last failed or was replaced. The following information is displayed:

- AUXILIARY COINS displays the number of free credits selected by the auxiliary coin switch in the normal play mode.

- LEFT MECH COINS displays the number of coins inserted into the left coin mechanism.

- RIGHT MECH COINS displays the number of coins inserted into the right coin mechanism.

- TOTAL COINS PAID displays the total number of coins inserted into both coin mechanisms.

NOTE

The following accounting and time information is accumulated since the game was last reset. Refer to *Game Options Display* for the reset procedure.

- GAMES PLAYED displays the total number of free and paid games played.

- TOTAL GAME TIME displays the total time, in actual seconds, of all the games played.

- AVERAGE GAME TIME displays the average time, in actual minutes and seconds, of all the games played.

- TOTAL TIME ON displays the total time, in actual seconds, the game has had power turned on.

- PERCENTAGE OF PLAY displays the percentage of time the game has been in Play Mode (as opposed to Attract Mode).

History of Game Times Display

Press the auxiliary coin switch to obtain the History of Game Times display as shown in Figure 2-2. The History of Game Times display shows the number of games played that were within each of 18 game-time increments (0 to 6 minutes in 20-second increments).
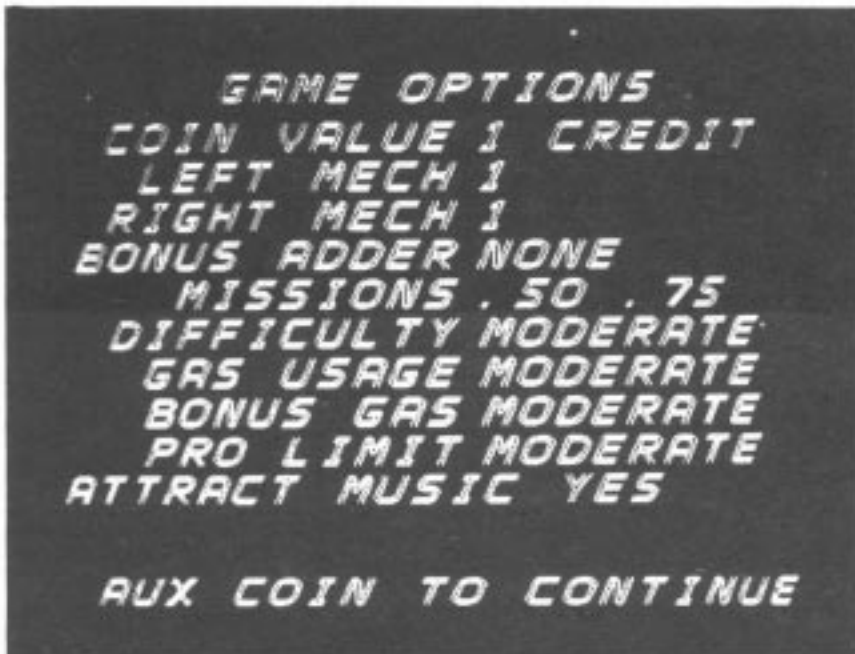

Figure 2-1 Accounting Info Display

Figure 2-2 History of Game Times Display

Game Options Display

Press the auxiliary coin switch to obtain the first section of the Game Options display as shown in Figure 2-3. Use these displays to view or change game option settings, reset high scores, reset accounting and game time information, or test the NOVRAM.

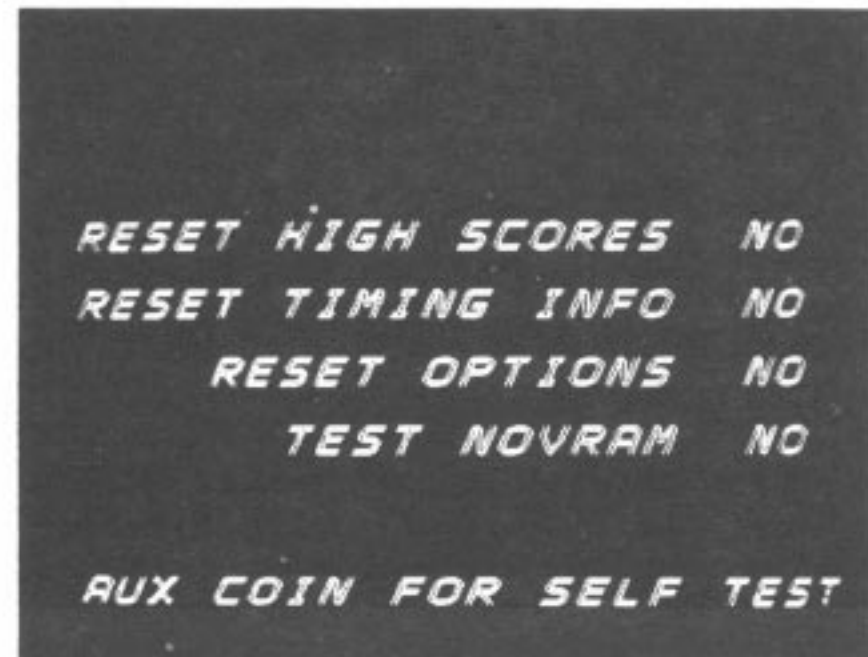**Figure 2-3 Game Options Display—
First Section**

The first section of the Game Options display shows the option settings that have been selected by either the option switches on the Main printed-circuit board (PCB) or by the flight control.

Changing the Game Options. Any of the options displayed in the first section of the Game Options display can be changed without setting the option switches on the Main PCB. Select the option to be changed by moving the flight control up or down. Press the left fire trigger to cycle through the available options as indicated in the right column; stop on the desired option setting.

The changed option is immediately stored in the NOVRAM and is unaffected by turning off the power or the self-test switch.

The options can also be changed to those selected by the option switches located on the Main PCB (see Chapter 1). If the self-test circuitry malfunctions or the option settings cannot be maintained by the software, the game will default to the hardware switch settings on the Main PCB (refer to *Resetting the Options* for more details).

Press the auxiliary coin switch to end this display and obtain the second section of the Game Options display as shown in Figure 2-4.

**Figure 2-4 Game Options Display—
Second Section**

The second section of the Game Options display shows the reset and NOVRAM test operations that are selectable with the flight control.

Resetting the High Scores. The last four scores and player initials are displayed in the high-score table during the Attract Mode. All high scores can be reset using the Game Options display. Select *RESET HIGH SCORES* by moving the flight control up or down. Press the left fire trigger and note that *YES* appears in the right column. Then press the right fire trigger to perform the reset operation, which is completed when *NO* appears in the right column.

Resetting the Timing Information. The games played and the timing information in the Accounting Info display (see Figure 2-1) can be reset using the second section of the Game Options display (see Figure 2-4). Select *RESET TIMING INFO* by moving the flight control up or down. Press the left fire trigger and note that *YES* appears in the right column. Then press the right fire trigger to perform the reset operation, which is completed when *NO* appears in the right column.

Resetting the Options. The option settings shown on the first section of the Game Options display (see Figure 2-3) can be reset (defaulted) to those selected by the option switches located on the Main PCB. Select *RESET OPTIONS* by moving the flight control up or down. Press the left fire trigger and note that *YES* appears in the right column. Then press the right fire trigger to perform the reset operation, which is completed when *NO* appears in the right column.

NOTE

Testing the NOVRAM should only be performed if a defective part is suspected because each test decreases the life of the NOVRAM.

To check for a suspected NOVRAM failure without actually testing the NOVRAM, set the game to the Self-Test Mode. Advance to the Game Options display. Change the settings of a few of the options using the flight control. Exit the Self-Test Mode and turn off the game. Wait at least two minutes, and turn the game on. Return to the Game Options display of the Self-Test Mode and check that the options just changed still reflect those changes. If not, test the NOVRAM.

The NOVRAM can be tested using the Game Options display. Select *TEST NOVRAM* by moving the flight control up or down. Press the left trigger and check that *NO ERRORS* appears in the right column. If the NOVRAM is defective, a message *ERROR AT* and a hexadecimal number will appear, which indicates that the NOVRAM should be replaced.

NOTE

If you advance the self test beyond this point, all game credits will be lost.
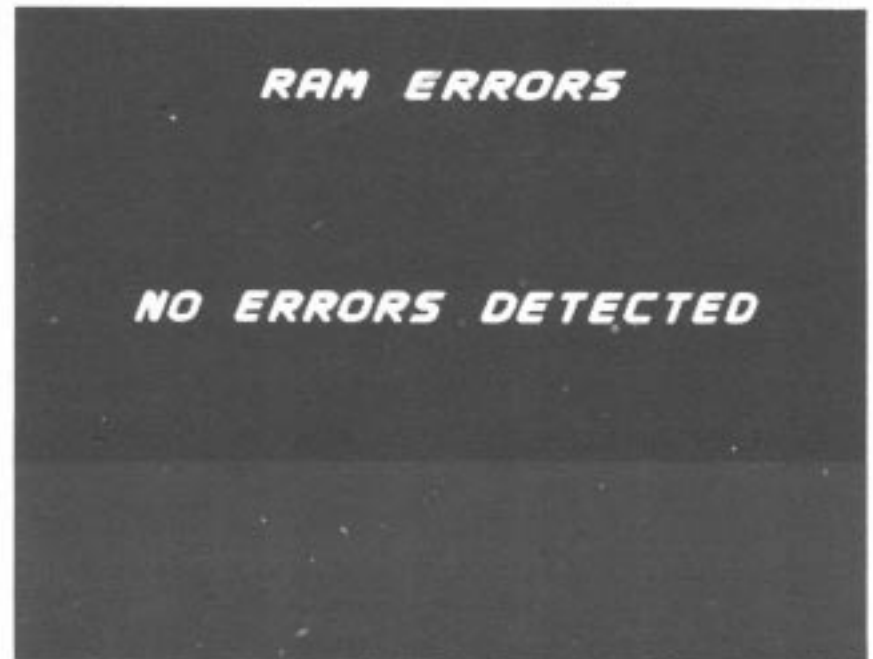

RAM and ROM Errors Displays

Press the auxiliary coin switch and wait about seven seconds to obtain the RAM Errors display as shown in Figure 2-5. This display shows the condition of the game RAMs on the Main PCB. A series of thirteen tones, each one separated by a short pause, will be repeated during the RAM Errors display.

A high tone indicates a good RAM; a low tone indicates a faulty RAM. Count the tones and use Table 2-1 to locate a faulty RAM on the Main and Graphics PCBs.

Table 2-1 Faulty RAM Locations

Tone	Location	Description
1	2D (Main PCB)	Program RAM 0
2	2C (Main PCB)	Program RAM 1
3	8N (Graphics PCB)	Graphics RAM
4	8P (Graphics PCB)	Graphics RAM
5	8H (Graphics PCB)	Graphics RAM
6	4H (Graphics PCB)	Color RAM
7	3H (Graphics PCB)	Color RAM
8	4F (Graphics PCB)	Color RAM
9	3F (Graphics PCB)	Color RAM
10	4E (Graphics PCB)	Color RAM
11	3E (Graphics PCB)	Color RAM
12	1D (Main PCB)	NOVRAM
13	1C (Main PCB)	NOVRAM

If no RAM errors exist, the message *NO ERRORS DETECTED* will be displayed. If the game has a RAM failure, the display will identify the failed RAM and give its location.

Figure 2-5 RAM Errors Display

After a few seconds the RAM Errors display will end and the ROM Errors display will appear as shown in Figure 2-6. This display shows the condition of the game ROMs. A series of seven tones, each one separated by a short pause, will be repeated during the ROM Errors display. A high tone indicates a good ROM; a low tone indicates a faulty ROM. Count the tones and use Table 2-2 to locate a faulty ROM on the Main PCB.

Table 2-2 Faulty ROM Locations

Tone	Location	Description
1	8 B/C	Program ROM 0
2	7 B/C	Program ROM 1
3	6 B/C	Program ROM 2
4	8A	Table ROM 0
5	7A	Table ROM 1
6	4A	Table ROM 4
7	3A	Table ROM 5

If no ROM errors exist, the message *NO ERRORS DETECTED* will be displayed. Also shown is a four-digit hexadecimal number used to indicate the version of ROM used on the Main PCB. If a ROM fails, the display will identify the failed ROM and give its location and show the hexadecimal checksum for that ROM. Press the auxiliary coin switch to end the ROM Errors display and obtain the Switch Test display. If the auxiliary coin switch is not pressed, the game will automatically switch back to the RAM Errors display and repeat the cycle until the auxiliary coin switch is pressed during the ROM Errors display.
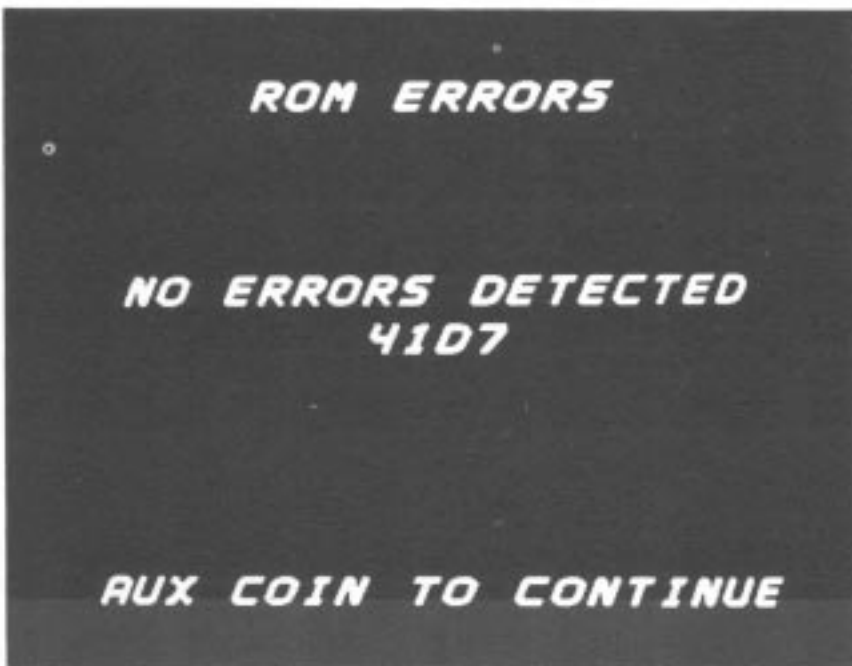
Figure 2-6 ROM Errors Display

Switch Test Display

Press the auxiliary coin switch to obtain the Switch Test display as shown in Figure 2-7. Perform the following procedure to verify that the game switches are operating properly.

1. One at a time, press the fire triggers and thumb pushbuttons. Note that a message appears on the display that indicates which switch was pressed.

2. Actuate the right- and left-coin mechanisms and note that a message appears that indicates which coin mechanism was actuated.

3. Tilt the flight-control handles forward or backward so that the first number after the *POT TEST* portion of the display reads *80.* Then, turn the flight control clockwise or counterclockwise so that the second number also reads *80.*

4. Carefully release the flight control and note that both numbers remain between 70 and 90. If the numbers do not remain around *80,* the flight-control potentiometers may be misaligned. Refer to *Aligning the Flight Control Potentiometers* in Chapter 3 for alignment information.

5. Tilt the flight-control handles to the extreme forward position. Note that the first digit of the hexadecimal number after the *POT TEST* portion of the display reads *(0).* Tilt the handles to the extreme backward position. Note that the first digit of the second hexadecimal number reads *(F).* If the readings are incorrect, the flight control potentiometers may be misaligned. Refer to *Aligning the Flight Control Potentiometers* in Chapter 3 for alignment information.

6. Turn the flight control to the fully counterclockwise position. Note that the first digit of the hexadecimal number after the *POT TEST* portion of the display reads *(0).* Turn the flight control to the fully clockwise position. Note that the first digit of the second hexadecimal number reads *(F).* If the readings are incorrect, the flight-control potentiometers may be misaligned. Refer to *Aligning the Flight Control Potentiometers* in Chapter 3 for alignment information.

7. Verify that the option settings for the switches at location 6K and 3C (shown at the bottom center of the display) match those selected on the corresponding option switches (F = off, N = on).

Figure 2-7 Switch Test Display

Sound Display

Press the auxiliary coin switch to obtain the Sound Display as shown in Figure 2-8. This display verifies that the music and sound effects generators are operating properly. Sounds 00 through 03 generate a series of four long tones (one for each channel or voice) should be heard with each succeeding tone rising in frequency, which indicates that the custom sound integrated circuit at location 3/4J is good. Press the right-hand fire trigger to cycle through a series of 44 available sounds numbered from 00 to 3E (not all are used during game play). Press the left-hand fire trigger to cycle through the same sound segments in the reverse direction from sound number 3E to 00. If either fire trigger is pressed after the sound segment starts, that sound segment will finish and the next segment selected will start. Table 3-3 describes the sounds selected with the Sound Test display. Sounds occur on top of each other; voices talk one at a time.

Table 2-3 Game Sounds

Sound No.	Description
00	Custom 1 Test Tones (4 single tones)
01	Custom 2 Test Tones (4 double tones)
02	Custom 3 Test Tones (4 triple tones)
03	Custom 4 Test Tones (4 quadruple tones)
04	Voice: *Homing device attached.*
05	*I'm going to take her up.*
06	*I'm going to take her down.*
07	*I'm going to take her down to avoid an infrared fix.*
08	*Let's see what this thing can do.*
09	*Missile cruiser dead ahead.*
0A	*Polar pack's in sight now.*
0B	*Homing device just activated.*
0C	*ECM picking up infrared detection beams.*
0D	*They've got me locked on.*
0E	*Contact point 90 miles and I'm flying on air.*
0F	*I've got visibility again.*
10	*Estimated 3 miles to target.*
11	*Radar says all clear.*
12	*Nothing can stop us now.*
13	*Better ice up a cold one.*
14	*I'm coming home.*
15	*Hope it burns up the sky.*
16	*Second Firefox.*
17	*Ah, we've got company.*
18	*I'm on reserve tanks now.*
19	*I'm the best there is.*
1A	*Boy, is this a machine.*
1B	*They spotted me.*
1C	Bing
1D	Short Tune

(continued)

Table 2-3 Game Sounds, continued

Sound No.	Description
1E	Branch Point (altitude select)
1F	Chime
20	Descending (not used in game)
21	Turbine Fade Out
22	Enemy Guns
23	Explosion of Enemy Guns
24	Windshield Hit of Enemy Guns
25	Screen flash for Enemy Guns
26	Enemy Missile Launch
27	Enemy Missile Explosion
28	Homing Signal 1 (2 or 3 tones)
29	Homing Signal 2 (2 or 3 tones)
2A	Homing Signal
2B	First Initial (low tone)
2C	Second Initial (medium tone)
2D	Third Initial (high tone)
2E	Long Explosion (left)
2F	Long Explosion (right)
30	Low Fuel Fast (multiple tones)
31	Low Fuel Slow
32	Na-Na-Na-Na-Na-Na
33	Player's Gun
34	Player's Missile
35	Radar Detection Left (2 tones)
36	Radar Detection Right (2 tones)
37	Radar Expansion Left (multiple tones)
38	Radar Expansion Right (multiple tones)
39	Warning Tones (high tones)
3A	Warning Tones (low tones)
3B	Rub-out (2 raspy tones)
3C	Screech
3D	High Score to Date Tune
3E	Voice: *Say brother, that's about as good as it gets.*
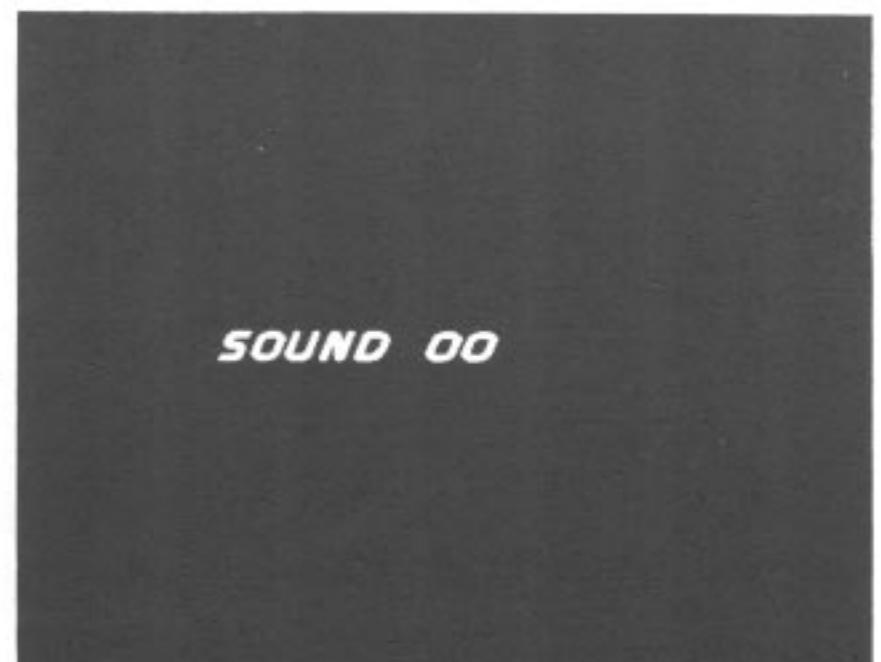
Figure 2-8 Sound Display

Screen Size Display

Press the auxiliary coin switch to obtain the Screen Size display as shown in Figure 2-9. This display is used to check and adjust the screen size. Verify that the sides of the displayed frame touch the sides of the cathode-ray tube (CRT) face as shown in Figure 2-9. If not, refer to the display manual for the appropriate adjustment procedures.
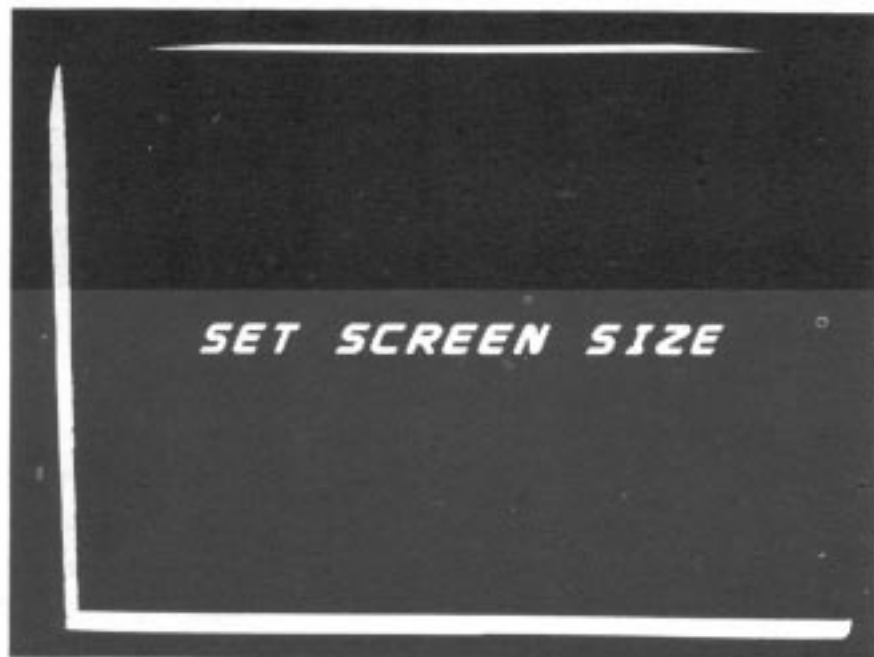
Figure 2-9 Screen Size Display

Color Bar Displays

There are five disc- and graphics-generated color bar displays available in the Self-Test Mode.

Disc-Generated Color Bar Display. Press the auxiliary coin switch to obtain the first Disc-Generated Color Bar display shown in Figure 2-10. Verify that three rows of distinctly separate color bars are displayed with the following characteristics.

- Top row of color bars are (from left to right): white, yellow, cyan, green, magenta, red, and blue.

- Middle row of color bars are (from left to right): blue, black, magenta, black, cyan, black, and white.

- Bottom three color bars are (from left to right): dark blue, white, and magenta, followed by five color bars of various shades of gray.

- All the color bars are the same intensity.
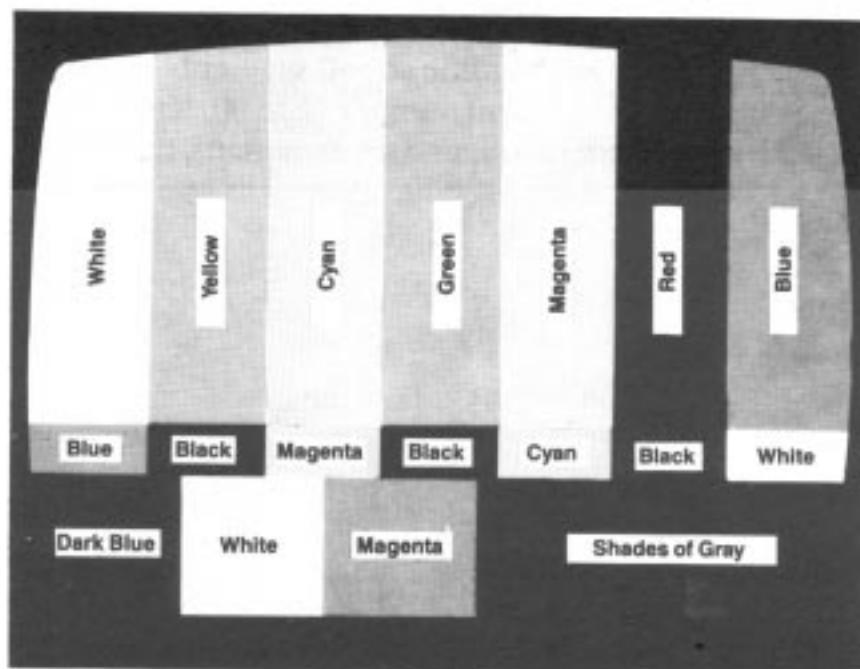
Figure 2-10 Disc-Generated Color-Bar Display

If the preceding display characteristics are not correct, refer to the adjustment procedures in the Schematic Package Supplement and the display manual.

Combined Graphics- and Disc-Generated Color-Bar Display. Press the auxiliary coin switch to obtain the Combined Graphics- and Disc-Generated Color Bar display shown in Figure 2-11. Verify that four rows of distinctly separate color bars are displayed with the following characteristics:
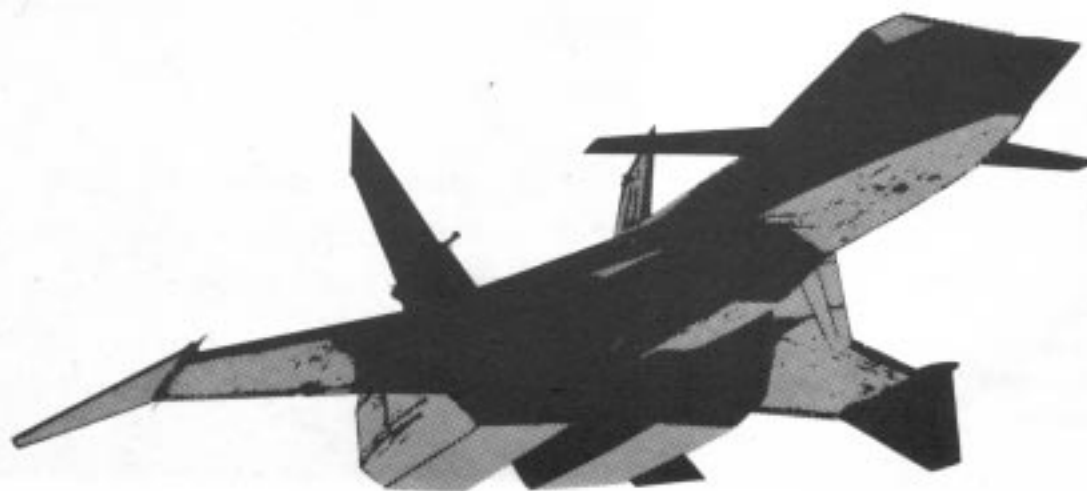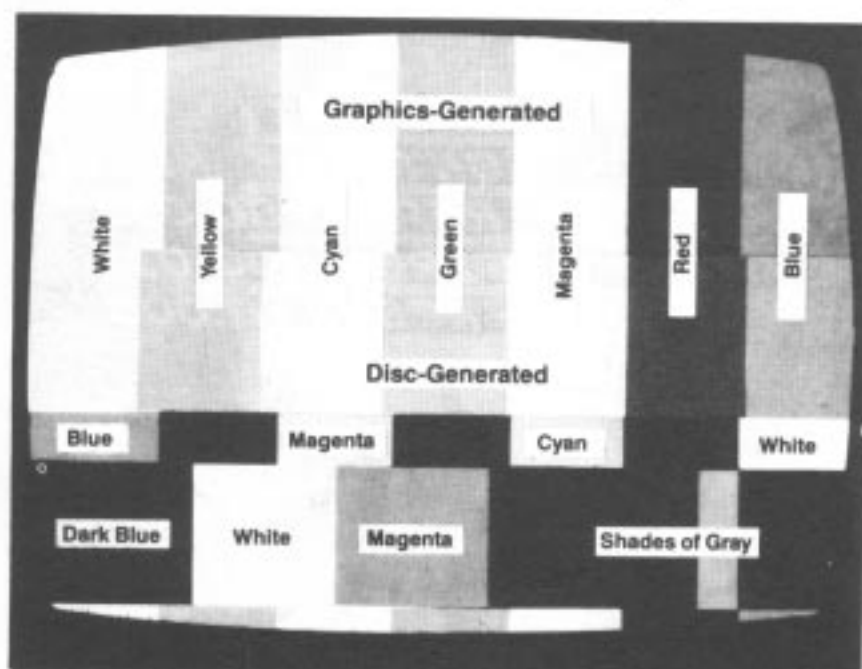
- Top and second row of color bars are (from left to right): white, yellow, cyan, green, magenta, red, and blue.

- Third row of color bars are (from left to right): blue, black, magenta, black, cyan, black, and white.

- Bottom three color bars are (from left to right): dark blue, white, and magenta, followed by five color bars of various shades of gray.

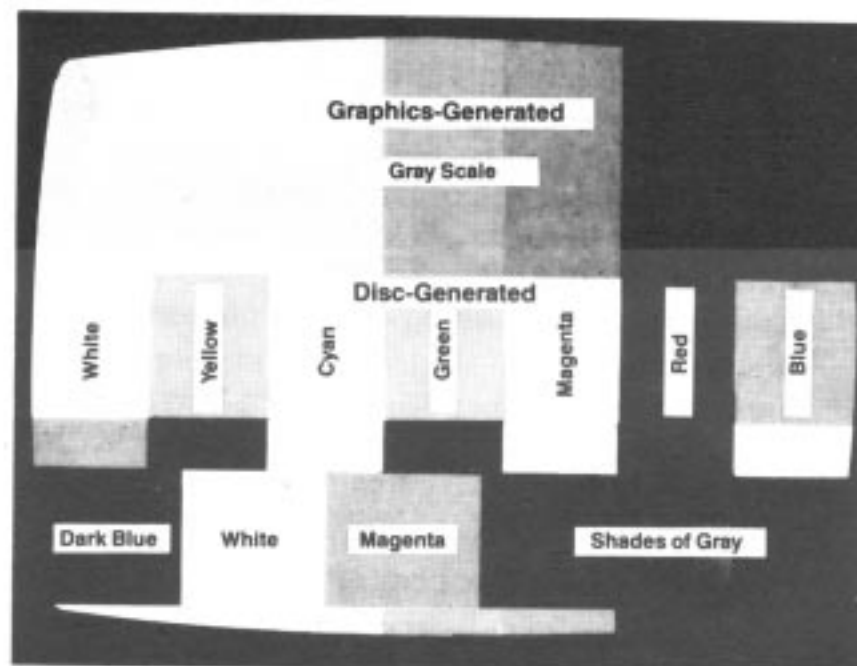- All the color bars are the same intensity.

Figure 2-11 Combined Graphics- and Disc-Generated Color Bar Display

If the preceding display characteristics are not correct, refer to the adjustment procedures in the Schematic Package Supplement and the display manual.

Combined Graphics-Generated Gray Scale and Disc-Generated Color-Bar Display. Press the auxiliary coin switch to obtain the Combined Graphics-Generated Gray Scale and Disc-Generated Color Bar display shown in Figure 2-12. Verify that a top row of distinctly separate gray-scale bars and three rows of distinctly separate color bars are displayed with the following characteristics:

- Top row of seven gray-scale bars are a sequence of increasingly darker shades of gray, from white on the extreme left bar to black on the extreme right bar.

- Second row of color bars are (from left to right): white, yellow, cyan, green, magenta, red, and blue.

- Third row of color bars are (from left to right): blue, black, magenta, black, cyan, black, and white.

- Bottom three color bars are (from left to right): dark blue, white, and magenta, followed by five color bars of various shades of gray.

- All the color bars are the same intensity.

Figure 2-12 Combined Graphics-Generated Gray Scale and Disc-Generated Color Bar Display

If the preceding display characteristics are not correct, refer to the adjustment procedures in the Schematic Package Supplement and the display manual.

Combined Graphics- and Disc-Generated Color-Bar Display. Press the auxiliary coin switch to obtain the same Combined Graphics- and Disc-Generated Color-Bar display shown in Figure 2-11. Verify that four rows of distinctly separate color bars are displayed with the following characteristics:

- Top and second row of color bars are (from left to right): white, yellow, cyan, green, magenta, red, and blue.

- Third row of color bars are (from left to right): blue, black, magenta, black, cyan, black, and white.

- Bottom three color bars are (from left to right): dark blue, white, and dark blue, followed by five color bars of various shades of gray.

- All the color bars are the same intensity.

If the preceding display characteristics are not correct, refer to the adjustment procedures in the Schematic Package Supplement and the display manual.

Disc-Generated Color Bar Display and Tone. Press the auxiliary coin switch to obtain the same Disc-Generated Color-Bar display as shown in Figure 2-10. Press the flight-control left fire trigger. Note that a low-frequency component of the tone is turned off and a higher-frequency tone remains on. Press the right fire trigger and note that the higher-frequency component of the tone is turned off. Pressing the left and right fire triggers again will turn the tones on and off. The left-fire trigger controls the tone recorded on the video disc. The right-fire trigger controls the test tone generated by the Main PCB sound circuitry. This test may be used for balancing the levels from both of these audio sources.

Disk Test Display

Press the auxiliary coin switch to obtain the Disk Test display shown in Figure 2-13. The information stored on the laser disc is displayed and/or heard in the Disk Test display. The flight control selects the desired frame and freezes the picture or repeats the sounds contained in that frame. An error display is provided if a problem exists when

- writing to the laser-disc player (WR)
- frame read does not match the frame desired (FR)
- reading from the laser disc (RD).

Slowly turning the flight control clockwise causes the disc player to track forward (increment) through the disc frames as indicated in the *FRAME READ* and *FRAME DE-SIRED* readout. Returning the flight control to the centered position freezes the display and continuously repeats the sounds (if any are present). The left fire trigger turns the audio from the disc's left channel on and off. The right fire trigger toggles the audio from the right channel. As the flight control nears the fully clockwise position, a point is

reached where the disc player will begin to skip frames, as indicated in the *FORWARD* readout. The exact number of frames skipped can be selected by turning the flight control backward or forward at the point where the frames first started to skip. Turning the flight control in the counterclockwise direction will count backward (decrement) through the frames, as indicated by the *BACK* readout, in the same manner as described for clockwise operation. Tilting the flight control back at the centered position will cause the disc player to track forward through the frames while skipping between 0 and 1 frame. Momentarily pressing the right thumb button will reset the disc player. Pressing the left thumb button causes the disc player to skip forward and backward, as indicated by the *FOR-WARD/BACK* readout.

Figure 2-13 Disk Test Display

Maintenance

This chapter includes preventive and corrective maintenance procedures for game components that are subject to the most use. To assure maximum trouble-free operation from this game, Atari recommends that preventive maintenance be performed as described in this chapter.

Removal, disassembly, reassembly, and replacement procedures are provided for those components that may require corrective maintenance. Appropriate references are provided to Chapters 5, 6, or 7 of the Illustrated Parts Lists (TM-253-02) to aid in locating the parts of this game that are mentioned but not illustrated in the maintenance procedures.

> ▲ ── **WARNING** ── ▲
>
> To avoid possible electrical shock, unplug the game before performing any maintenance procedures.

Chapter 3
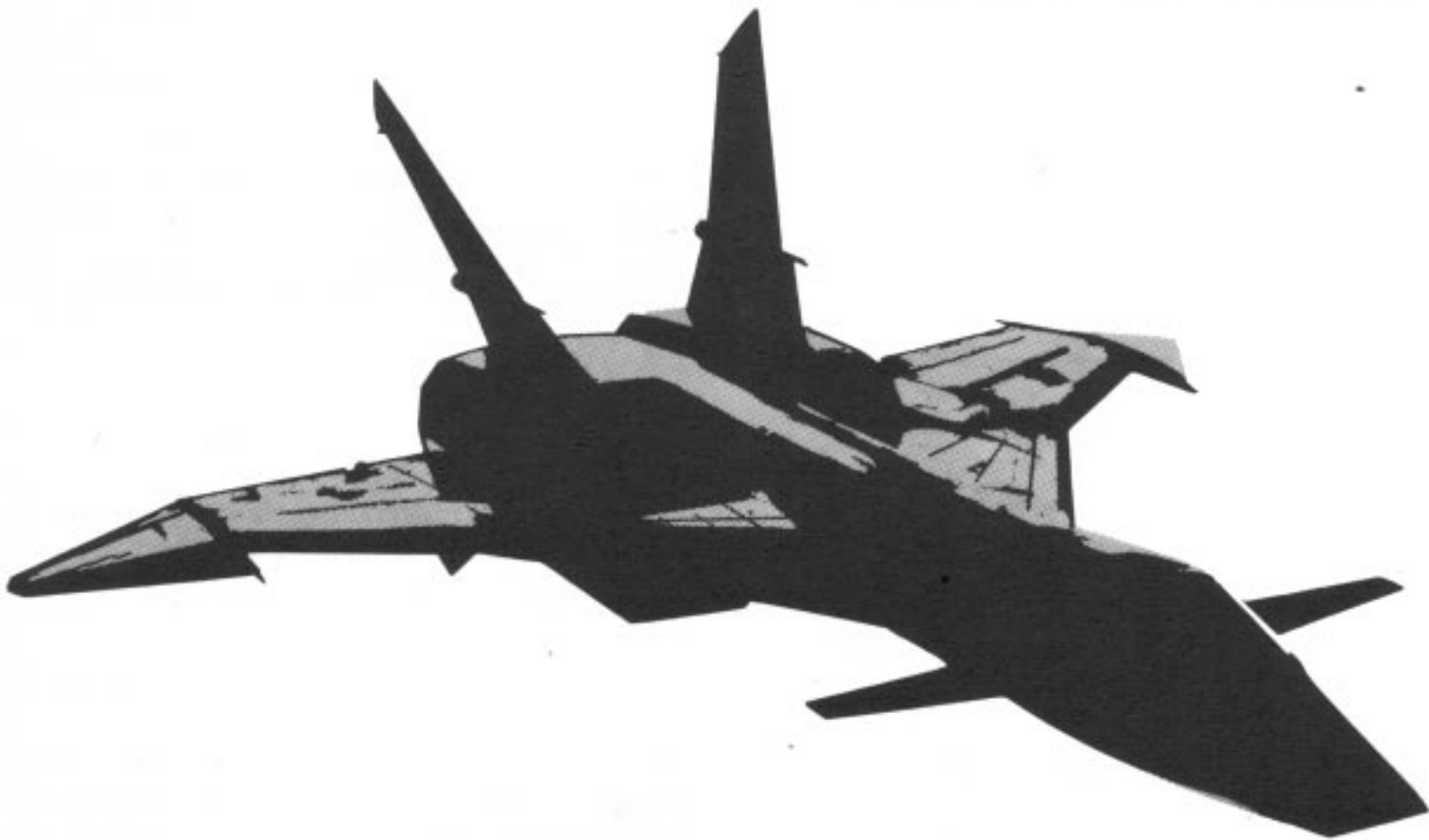
Preventive Maintenance

Preventive maintenance includes cleaning, lubricating, and tightening hardware. How often preventive maintenance is performed depends upon the game environment and frequency of play. However, for those components listed under *Preventive-Maintenance Intervals*, we recommend that preventive maintenance be performed at the specified intervals to assure maximum trouble-free operation from this game.

Preventive-Maintenance Intervals

The following preventive-maintenance intervals are the recommended minimum requirements for the component listed.

Component	Maintenance Interval
Disc Player and Filter	Clean at least twice a month.
Flight Control	Lubricate and tighten hardware at least every three months.
Coin Mechanism	Clean at least every three months.

⚠ — WARNING — ⚠

To avoid possible electrical shock, unplug the game before performing any maintenance procedures.

— CAUTION —

Moving the disc player while the disc is spinning may damage the laser disc or disc player. To prevent damage to the laser disc or disc player, **NEVER** move the game cabinet unless the game power has been turned off for at least three minutes.

Removing the Control Panel

Upright Cabinet

Perform the following procedure to remove the control panel from the upright cabinet (see Figure 6-3).

1. Turn the game power off.

2. Unlock and remove the body access panel on the rear of the game cabinet.

3. Carefully reach through the back of the cabinet and release the spring-draw latches located under the control panel on either side of the game cabinet.

4. Lift the control panel and tilt it toward you to clear the flight-control assembly from the game cabinet.

5. Disconnect the flight-control harness before moving the control panel to a clean work surface.

6. Replace the control panel in the reverse order of removal.

Cleaning the Disc Player and Filter

⚠ — WARNING — ⚠

The laser disc continues to spin after the game power is turned off. The laser disc could spin out of the disc player and cause personal injury or damage the laser disc if the player lid is opened immediately. To prevent personal injury or damage the laser disc, **ALWAYS** turn the game power off and wait for at least three minutes before opening the player lid.

— NOTE —

We recommend that the disc player be returned to your distributor for major maintenance or repair. Perform the procedures under *Removing the Disc Player* and *Packing the Disc Player for Shipment* before shipping the disc player to your distributor.

Perform the following procedure to clean the dust filter (in the game cabinet), the laser disc, and the objective lens in the disc player (see Figures 3-1, 3-2, and 6-1).

1. Turn the game power off.

2. Unlock and open the appropriate access panel or door.

3. Carefully remove the laser-disc player from the game cabinet and the laser disc from the disc player as described in steps 3 through 7 under *Removing the Disc Player*.

4. **Upright Cabinet.** Remove the dust filter from the back of the pedestal access panel.

   Sit-Down Cabinet. Remove the dust filter from the back of the disc-player compartment.

5. Clean the dust from the filter with a mild soap or detergent.

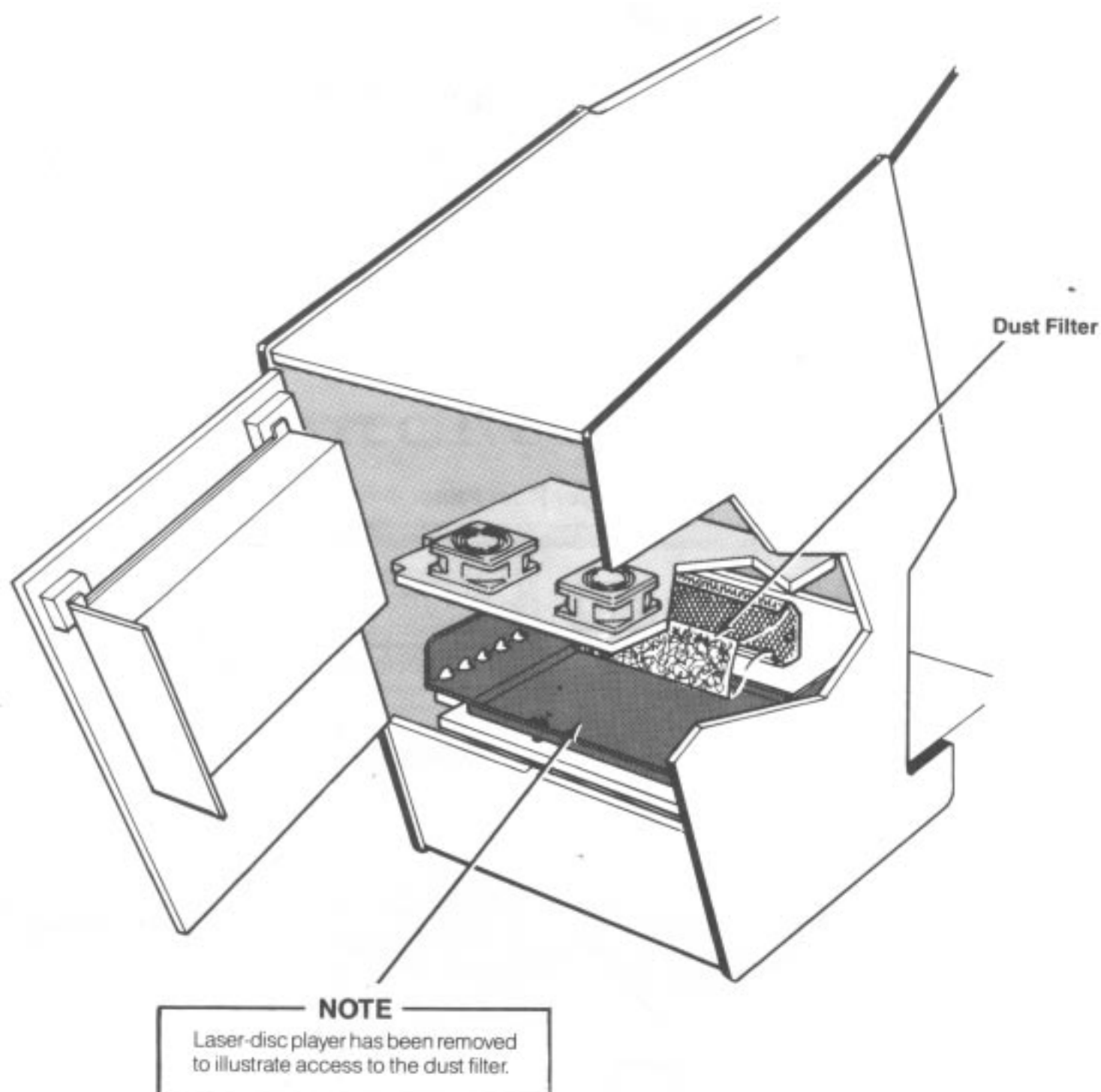6. Dry the filter thoroughly and reinstall.

┌─────────────── **CAUTION** ───────────────┐

Handle the laser disc by the outside edge or by
the spindle hole. Do not touch the playing sur-
face of the disc.

Do not use any form of abrasive cleaner, alco-
hol, or solvent to clean the laser disc or objec-
tive lens of the disc player because permanent
damage to the disc-playing surface or objective
lens may result.

└──┘

7. Clean the objective lens of the disc player with a non-
    abrasive, non-residue cleaner, such as Freon TF.

8. Clean the laser disc with a mild, liquid detergent. Rinse
    with clean water and wipe dry with a lint-free, 100%
    cotton cloth.

9. With the playing surface of the disc facing downward,
    reinstall the disc in the disc player and press it gently
    onto the center spindle.

10. Close the lid of the disc player and apply power to
    verify that the on/off pushbutton is in the on position.

11. Connect the cables to the disc player (see Figure 3-2).

12. Gently slide the disc player into the game cabinet.

13. Replace the retaining strap.

14. Replace and lock the access panel or door.

Dust Filter

┌─────────────── NOTE ───────────────┐
Laser-disc player has been removed
to illustrate access to the dust filter.
└────────────────────────────────────┘

Figure 3-1 Removing the Sit-Down Cabinet Dust Filter

Power Cord

Disc-Interface Cable

Video Input Cable

Audio Cables

Retaining Strap

Laser-Disc Player

Spring-Draw Latch

Mounting Assy

Laser-Disc Player Rear Panel

T.V.

ANT. in

AUDIO R out L

VIDEO/AUDIO out

Video-Input Cable

Audio Cable (Right and Left)

Disc-Interface Cable
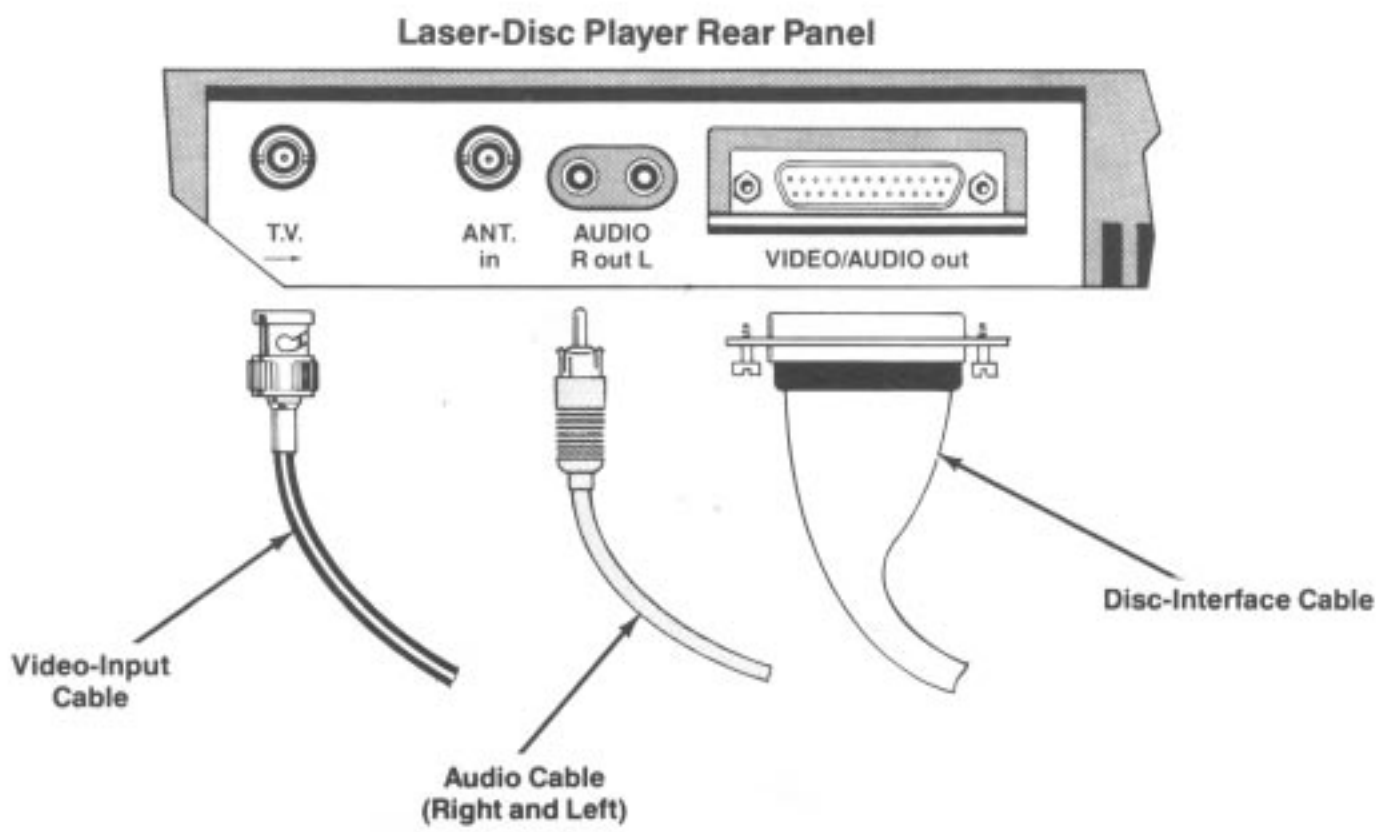
Figure 3-2   Removing the Laser-Disc Player

Lubricating the Flight Control

Perform the following procedure to lubricate the flight control. Lubrication can be performed without removing the flight-control assembly from the control panel (upright cabinet) or control-panel housing (sit-down cabinet). See Figures 3-7 and 3-8 for the location of the lubrication points and parts mentioned in the following procedure.

1. Remove the control panel as previously described.

> **NOTE**
>
> The handle-assembly cover is attached with tamper-proof socket screws. A special $\frac{5}{32}$-inch hex-key tool for removing the tamper-proof socket screws is supplied with each game (Atari part no. 178126-001).

2. Use the special $\frac{5}{32}$-inch hex-key tool to remove the four tamper-proof socket screws from the handle-assembly cover.

3. Lift the cover from the handle assembly and lubricate the following parts inside the flight control.

   a. Apply two drops of light machine oil lubricant (Atari part no. 107013-001) to the inside of the four shaft bearings.

   b. Brush a light film of Nyogel 779 lubricant (Atari part no. 178027-001) over the outside of the four torsion springs and on the teeth of the two small spur gears.

Tightening the Flight Control Hardware

Use the appropriate hex driver combination wrenches to tighten all the flight control screws and mounting nuts (see Figures 3-7 and 3-8).

Cleaning the Coin Mechanism

Use a soft-bristled brush to remove loose dust or foreign material from the coin mechanism. A toothbrush may be used to remove any stubborn build-up of residue in the coin path. After cleaning the coin mechanism, blow out all the dust with compressed air.

Cleaning the Cabinet and Display Shield

The game cabinet and display shield may be cleaned with any non-abrasive household cleaner. Compressed air is recommended for cleaning dust from the interior of the cabinet.

Corrective Maintenance

Corrective maintenance consists of removal, disassembly, reassembly, and replacement of game components. The following procedures are provided for those components that may require corrective maintenance.

Removing the Disc Player

Perform the following procedure to remove the laser-disc player from the game cabinet (see Figures 3-2, 3-3, 6-1, and 7-1).

1. Unplug the game.

> **CAUTION**
>
> Moving the disc player while the disc is spinning may damage the disc or disc player. To prevent damaging the laser disc or disc player, **NEVER** move the game cabinet unless the power has been turned off for at least three minutes.

2. Unlock and open the appropriate access panel or door.

3. Release the spring-draw latch on the disc-player retaining strap.

4. Remove the retaining strap by lifting the front of the retaining strap and sliding it back to release it from the disc-player mounting assembly.

5. Gently slide the disc player toward you until the wire and cable connections on the disc-player rear panel are accessible.

> ⚠ **WARNING** ⚠
>
> The disc continues to spin after the game is turned off and could spin out of the disc player and cause injury if the lid is opened immediately. To prevent injury, **ALWAYS** turn the game off and wait for at least three minutes before opening the lid.

6. To open the player lid, insert a small, flat-tipped screwdriver (or similar tool) into the rectangular access hole just below the ridges on the disc-player cover. Gently press down on the lid-release lever (see Figure 3-3).

> **CAUTION**
>
> Handle the laser disc by the outside edge or by the spindle hole. Do not touch the playing surface of the disc.

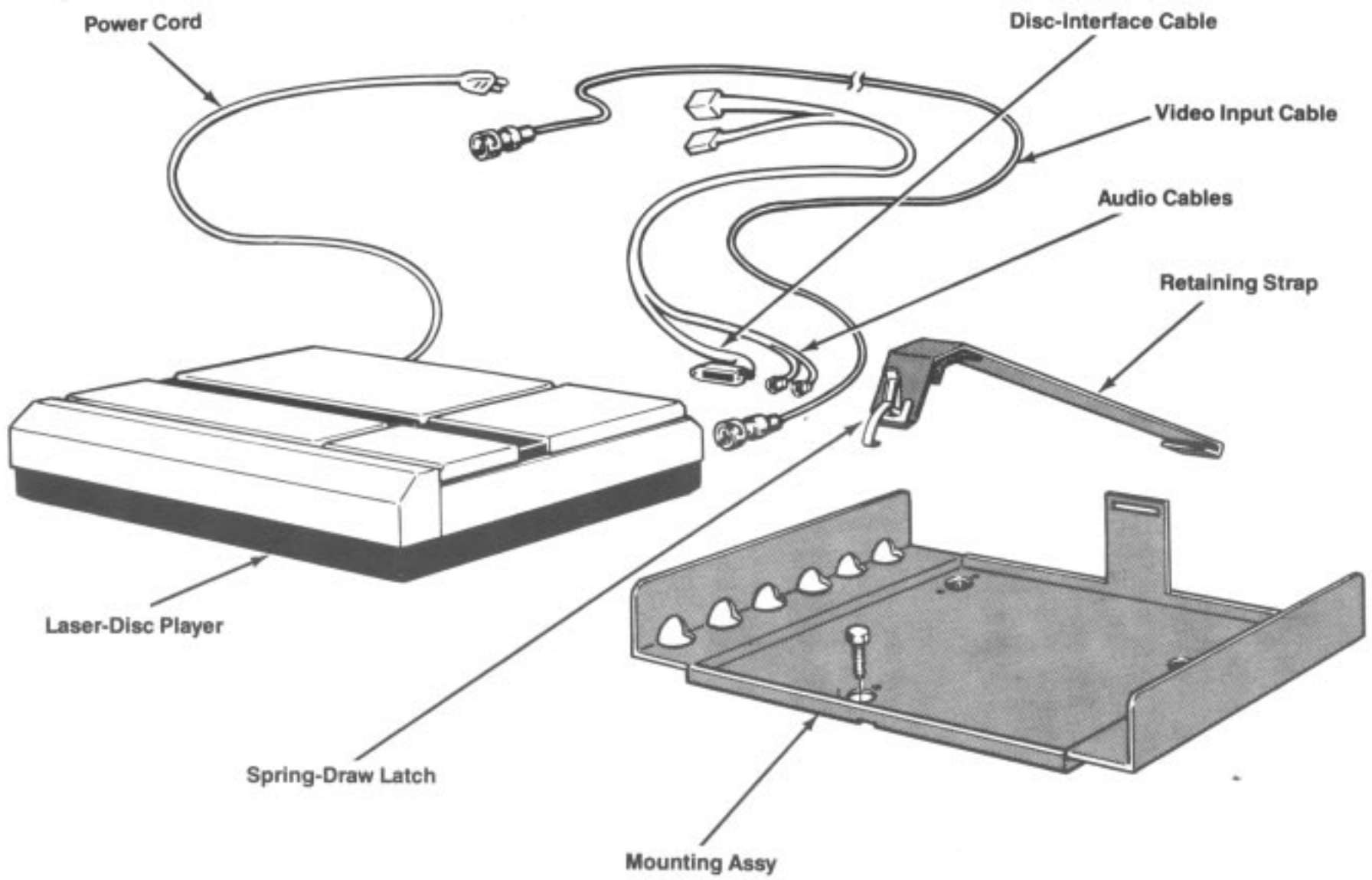7. Carefully remove the laser disc from the disc player.

┌─────────────── CAUTION ───────────────┐
│ Do not leave the laser disc unprotected. Place │
│ it in a protective envelope and store it *vertical-* │
│ *ly* in a cool, dry place. │
└──┘

8. Close the disc-player lid.

9. Disconnect the coaxial BNC connector and the two audio connectors from the back of the disc player (see Figure 3-2).

10. Loosen the two attaching screws and disconnect the disc-interface cable from the back of the disc player.

11. **Upright Cabinet.** Remove the body access panel from the rear of the game cabinet and disconnect the disc-player power cord from the power outlet located near the power on/off switch assembly (see Figure 6-1).

    Sit-Down Cabinet. Disconnect the disc-player power cord from the power outlet located on the left-hand side of the fan-panel assembly (see Figure 7-1).

12. Gently pull the power cord through the opening in the bottom of the body assembly.

13. Remove the disc player from the cabinet. Make certain the disc-player power cord clears the cabinet.

14. Replace the disc player in the reverse order of removal.

Packing the Disc Player for Shipment

Perform the following procedure before shipping the disc player.

1. After removing the disc player from the game and before packing it for shipment, check the window in the lid of the disc player to make certain the laser disc has been removed. If the laser disc is inside the disc player, remove the laser disc (follow steps 6 through 8 under *Removing the Disc Player*).

2. Seal the disc player in a plastic bag to provide moisture and dust protection during transit.

3. Pack the sealed disc player in a sturdy shipping container large enough to allow at least three inches of space around the top, bottom, and sides of the disc player.

4. Pack at least three inches of loose or rigid foam (or an equivalent shock-absorbent material) on the bottom of the container.

5. Place the disc player in the container and tightly pack all sides with packing material. Place enough packing material on the top of the disc player to hold the disc player firmly in place when the container is closed.

7. Seal the shipping container with an appropriate adhesive tape.
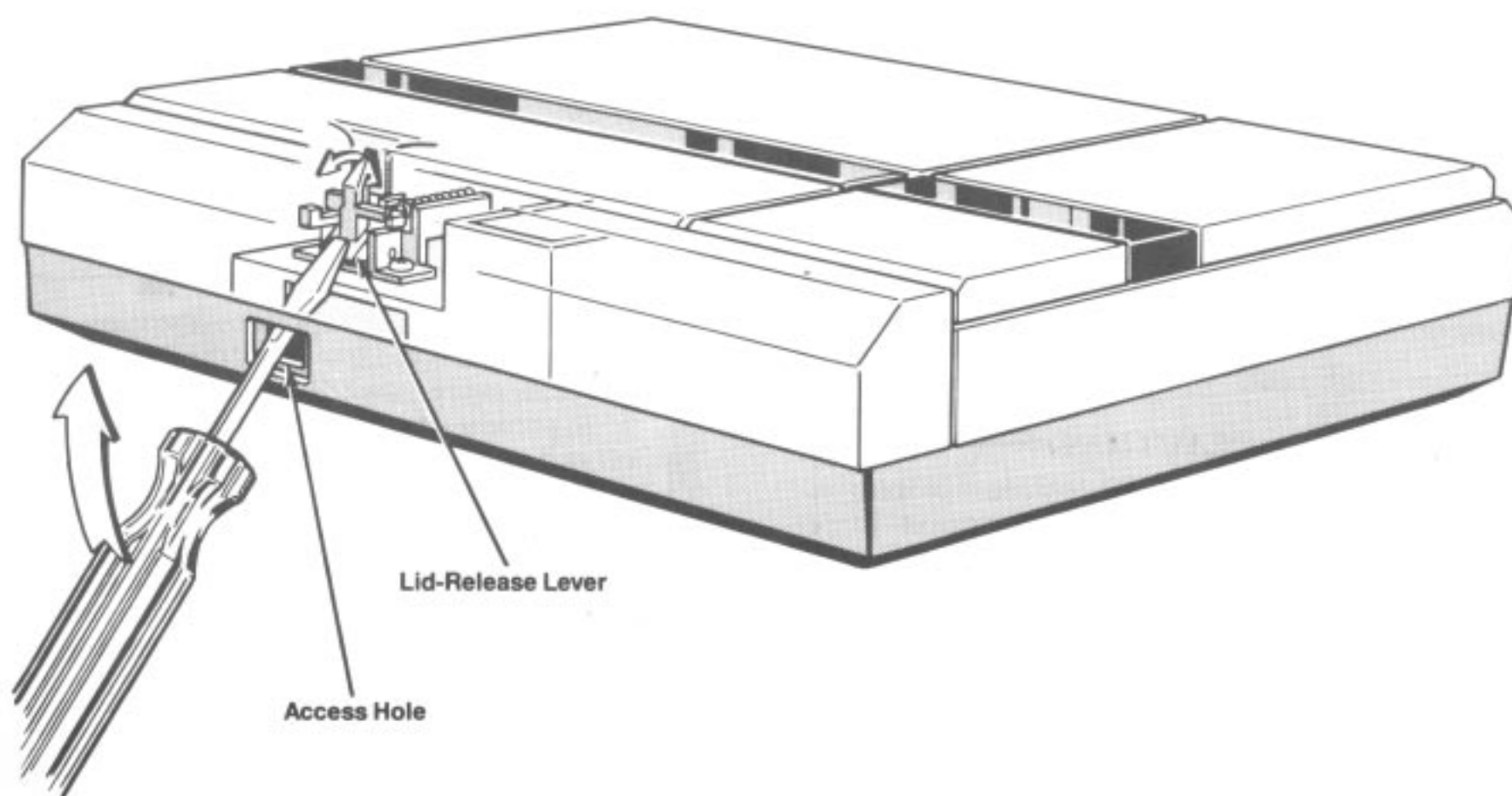
Figure 3-3 Opening the Laser-Disc Player Lid

Removing the Game Printed-Circuit Boards

The following procedure describes the method for removing the Main, Graphics, and NTSC Demodulator printed-circuit boards (PCBs) to: (1) gain access to the option switches on the Main PCB, (2) disassemble and remove the individual PCBs, and (3) attach interconnecting cables, wires, and extension harnesses to aid in troubleshooting.

In the US-built game, the PCBs are located inside an electromagnetic interference (EMI) cage. In the Ireland-built game, the PCBs are similarly mounted, but do not have an EMI cage or EMI Shield PCB. In the upright cabinet, the EMI cage is mounted to the wall of the cabinet behind the rear-body access panel. In the sit-down cabinet, the EMI cage is mounted to the back of the door panel.

The following procedure applies to both the US-built and Ireland-built games except where stated otherwise (see Figures 3-4, 5-7, and 5-8 for the location of the parts mentioned in this procedure).

1. Open the appropriate access or door panel.

2. Disconnect the two harness edge-connectors and the BNC video-input connector from the EMI Shield PCB.

3. **US-Built Cabinet.** Pull the six nylon snap-in fasteners on the EMI Shield PCB out to the unlocked position.

   Ireland-Built Cabinet. Remove the bracket-mounting screw that attaches the PCBs to the cabinet and carefully remove the game PCBs from the cleat. Be careful not to twist the PCBs because the connections or components could be loosened. Proceed to step 7.

4. Carefully remove the EMI Shield PCB from the EMI cage with the game PCBs attached to it. Be careful not to twist the PCBs, which could loosen connections or components.

5. Remove the four pan-head screws that attach the EMI Shield PCB to the spacers.

6. Disconnect the EMI Shield PCB from the game PCBs by gently pushing on the edge-connectors.

7. Remove the four pan-head screws that attach the PCBs to the spacers.

8. Disconnect the power-harness cable from connector J14 near the front corner of the Main PCB.

9. Release the three PCB supports and fold the NTSC Demodulator PCB back to expose the Main PCB components and option switches (see Figure 3-4A).

10. Release the three PCB supports and fold the Main PCB back (see Figure 3-4B).

11. Disconnect the interconnecting wire and cables to disassemble the individual PCBs.

12. To troubleshoot the game PCBs outside the game cabinet, connect the cables, harnesses, and +5 volt jumper wire extensions as shown in Figure 3-4C (refer to Chapter 4 for troubleshooting aids and techniques).

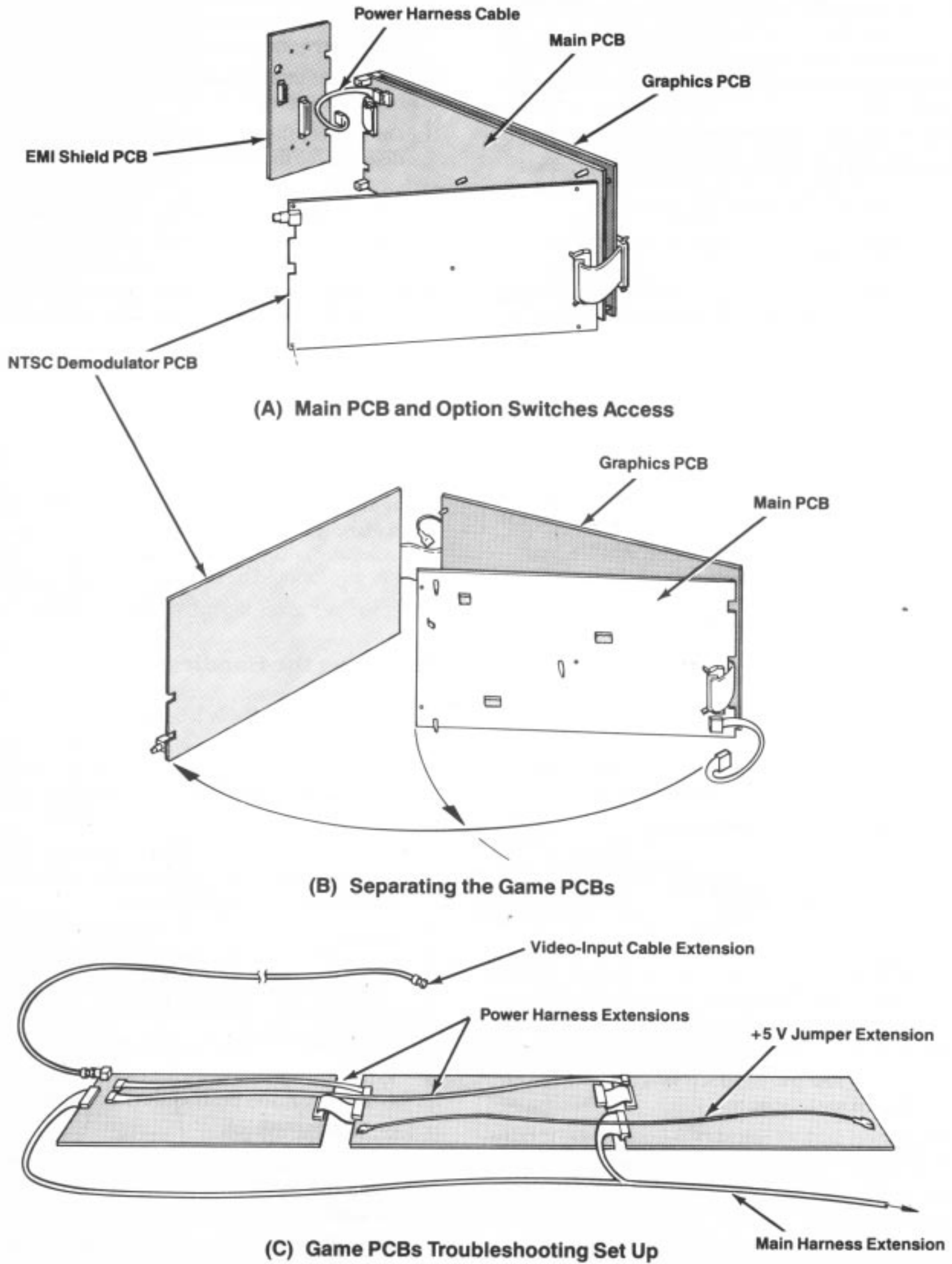13. Reassemble the game PCBs in the reverse order of removal.

Flight Control

The following corrective maintenance procedures apply to the flight control. The flight control consists of a handle assembly and a steering assembly. The handle assembly controls the vertical motion and the steering assembly controls the horizontal motion of the graphics on the display. After any corrective maintenance is performed, the flight control should be recalibrated as described in this chapter under *Calibrating the Flight Control.*

Removing the Handles

Perform the following procedure to remove the handles from the handle assembly (see Figure 3-7).

1. Use a $\frac{7}{64}$-inch hex driver to remove the four cap screws that hold the covers on the handles. Be careful when removing the covers because the trigger and pushbutton springs can fall free from the handles.

2. Unsolder the three harness wires from the trigger and pushbutton microswitches inside each handle and pull the harness out of the shaft.

3. Use a $\frac{7}{64}$-inch hex driver to remove the four cap screws that hold the handles to the shaft.

4. Use a $\frac{3}{16}$-inch punch to knock the roll pin (located between the two cap screws) into the hollow of the shaft.

5. Gently slide the handles from the shaft.

6. To reinstall the handles, solder the three harness wires to the trigger and pushbutton microswitches.

7. Reinstall the roll pin.

8. Replace the trigger and pushbutton springs and reinstall the cap screws that hold the covers on the handles.

9. Reinstall the four cap screws that secure the handles to the shaft.

Power Harness Cable

Main PCB

Graphics PCB

EMI Shield PCB

NTSC Demodulator PCB

(A) Main PCB and Option Switches Access

Graphics PCB

Main PCB

(B) Separating the Game PCBs

Video-Input Cable Extension

Power Harness Extensions

+5 V Jumper Extension

Main Harness Extension

(C) Game PCBs Troubleshooting Set Up

Figure 3-4 Removing and Separating the Game Printed-Circuit Boards

Removing the Flight Control

┌─────────────── **NOTE** ───────────────┐

The handle assembly can be disassembled
with the flight control attached to the control
panel (upright cabinet) or to the control-
mounting panel (sit-down cabinet). However,
for convenience and to avoid damaging the
control panel or housing, we recommend that
the flight control be removed from the game
before any corrective maintenance or repair is
performed.

└────────────────────────────────────┘

Perform the following procedure to remove the flight con-
trol from the control panel (upright cabinet) or the control-
mounting panel (sit-down cabinet). See Figures 3-5 and 3-6.

1. **Upright Cabinet.** Remove the control panel as pre-
   viously described.

   Sit-Down Cabinet. Use the special $\frac{5}{32}$-inch hex-key
   tool to remove the two tamper-proof cap screws from
   the control-mounting panel. Swing the flight control
   downward.

2. Disconnect the flight-control harness assembly.

3. Use $\frac{7}{16}$-inch combination wrench to remove the four
   locknuts and washers that secure the flight control to
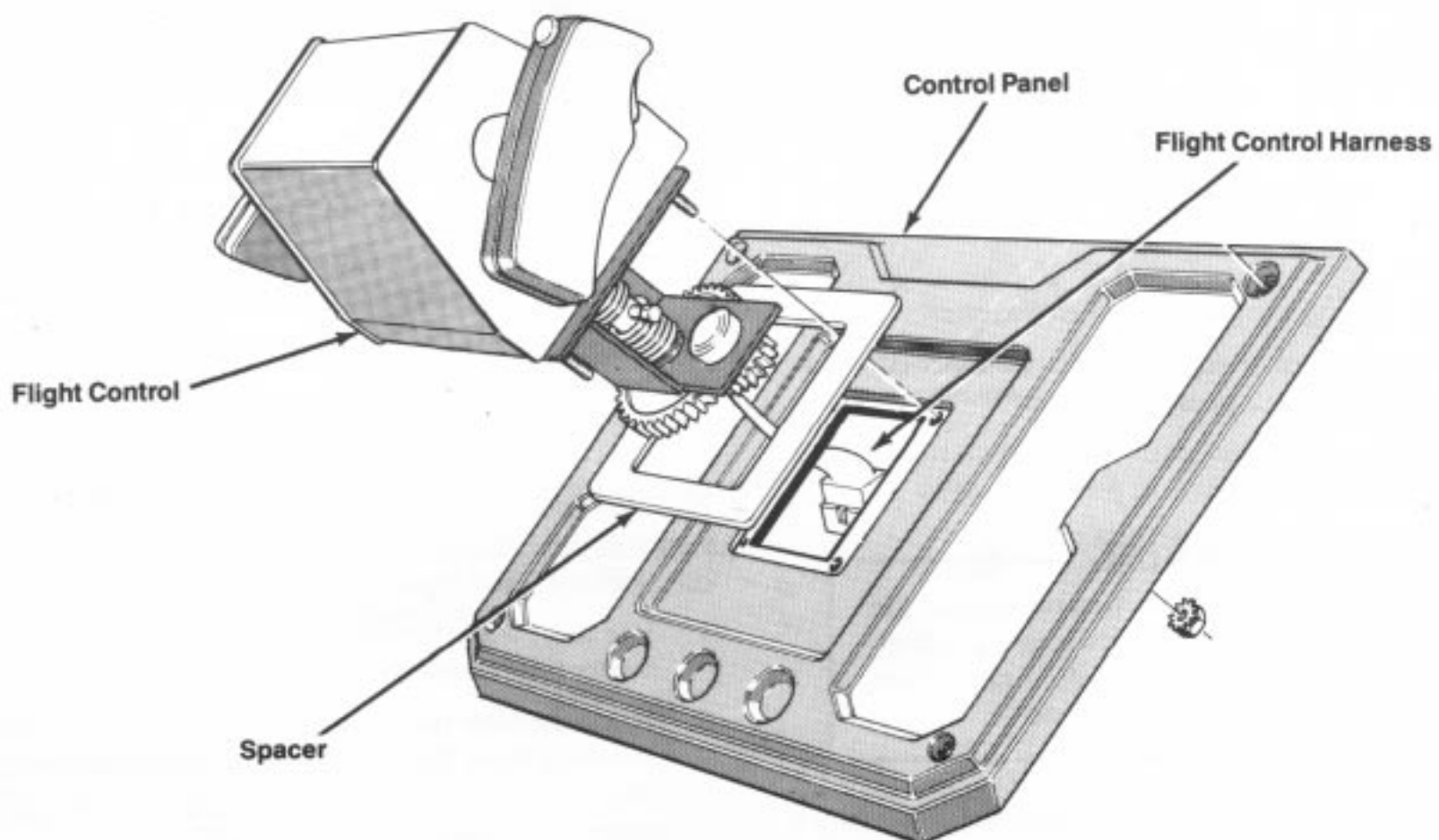   the control panel or control-mounting panel.

4. Carefully remove the flight control from the control
   panel or control-mounting panel.

5. To reinstall the flight control, guide the flight control
   back into the control panel or control-mounting
   panel.

6. Attach the four locknuts and washers that mount the
   flight control to the control panel or control-mount-
   ing panel.

7. Reconnect the flight-control harness assembly.

8. Reinstall the control panel or secure the control-
   mounting panel to the housing as previously de-
   scribed.

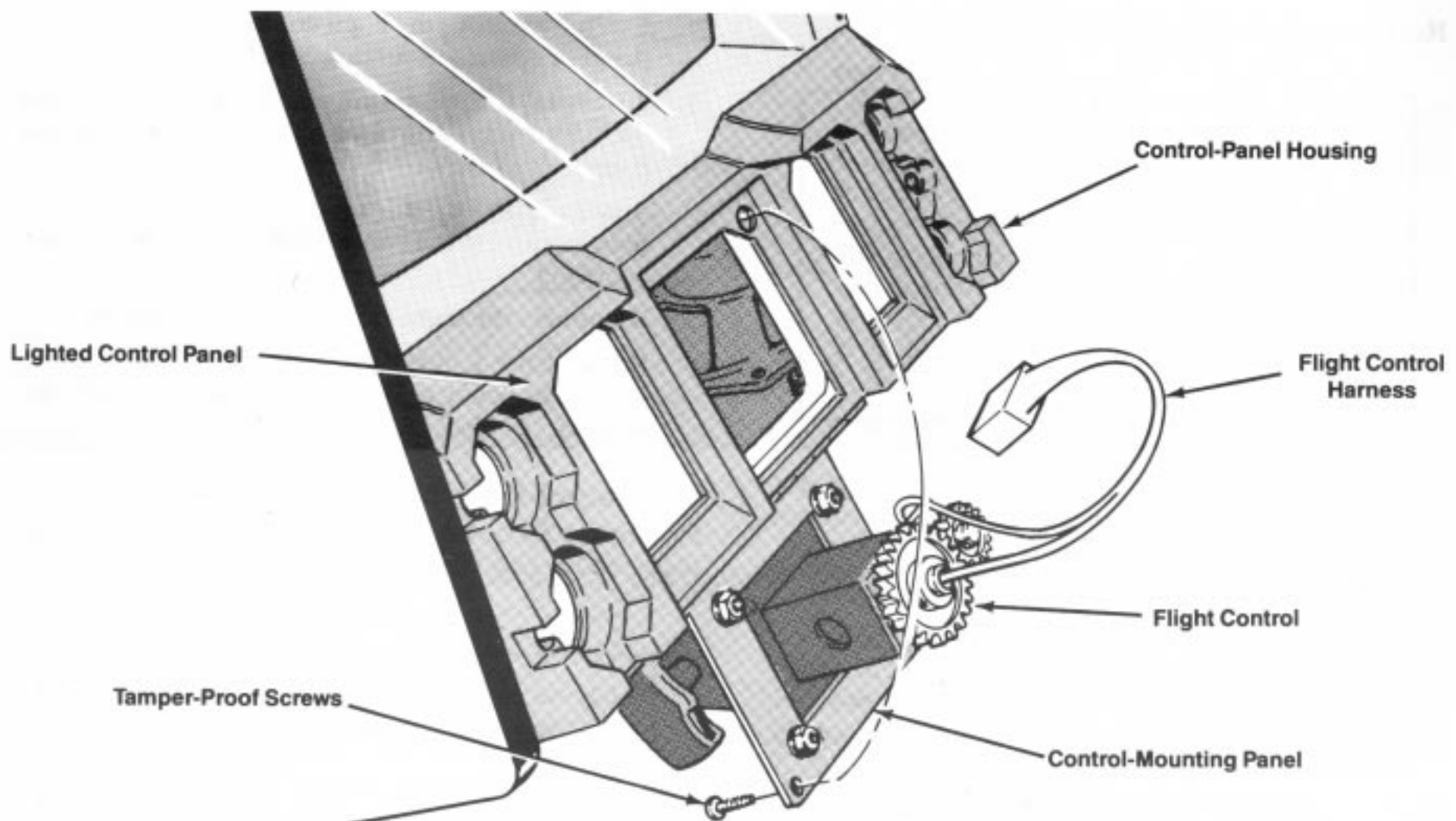## Disassembling the Handle Assembly

Perform the following procedure to disassemble the han-
dle assembly (see Figure 3-7).

┌─────────────── **NOTE** ───────────────┐

It is not necessary to remove the handle assem-
bly from the steering assembly to perform the
following disassembly procedure. However, if
you prefer, refer to steps 1 through 4 under
Disassembling the Steering Assembly for the
procedure that describes how to separate the
two assemblies.

└────────────────────────────────────┘

Figure 3-5 Removing the Upright Cabinet Flight Control

Control-Panel Housing

Lighted Control Panel

Flight Control Harness

Tamper-Proof Screws

Flight Control

Control-Mounting Panel

Figure 3-6 Removing the Sit-Down Cabinet Flight Control

1. Use the special $\frac{3}{32}$-inch hex-key tool to remove the four tamper-proof cap screws from the handle-assembly cover.

2. Remove the handles as previously described in this chapter.

3. Gently pull the harness wires out of the hollow shaft.

4. Use a $\frac{7}{64}$-inch hex driver to remove the cap screw and washer that hold the spring-handle pin to the handle-assembly shaft.

5. Slide the spring-handle pin out of the shaft.

6. Use a $\frac{7}{64}$-inch hex driver to loosen the cap screw that holds the large spur gear to the shaft.

7. Slide the large (60-tooth) spur gear down the shaft to expose the shaft retainer on the right side.
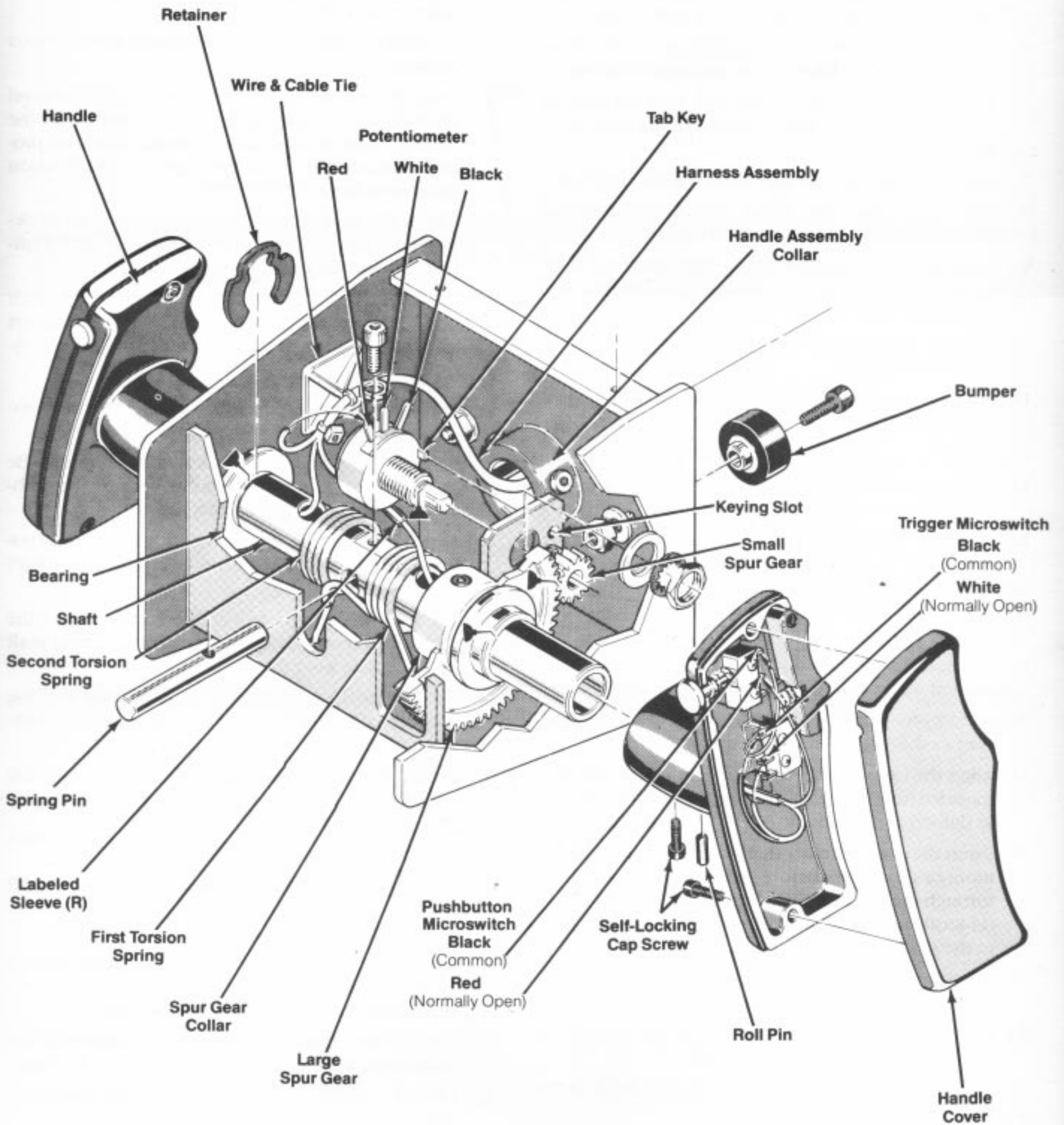
⚠ — **WARNING** — ⚠

Shield your face and eyes when prying out the retainers because they can fly loose at a high speed. Cover the retainers with a rag or any material that will trap the retainer.

8. Use a right-angle slotted screwdriver to pry the retainer from the shaft.

9. Repeat step 8 to remove the retainer on the left side.

10. Gently slide the shaft from the housing.

11. Use a $\frac{7}{64}$-inch hex driver to loosen the cap screw that holds the small (14-tooth) spur gear to the potentiometer shaft.

12. Use a ½-inch combination wrench to remove the nut and washer that hold the potentiometer to the mounting bracket.

13. Slide the potentiometer from the bracket. Be careful not to lose the small spur gear, nut, and washer.

14. Use a $\frac{3}{32}$-inch hex-driver and $\frac{3}{8}$-inch combination wrench to remove the two bumpers from the frame.

15. Reassemble the handle assembly as described in the following procedure.

Reassembling the Handle Assembly

Perform the following procedure to reassemble the handle assembly (see Figure 3-7).

1. Use a $\frac{3}{32}$-inch hex driver and $\frac{3}{8}$-inch combination wrench to install the two bumpers on the frame.

2. Insert the large (60-tooth) spur gear with the collar facing away from the bearing. Align and hold the gear in line with the bearing hole. (The gear fits through the slot on the right front of the frame.)

3. Slide the shaft through the right bearing and the spur gear. Do not insert the shaft past the outside edge of the spur-gear collar.

Retainer

Wire & Cable Tie

Handle

Potentiometer

Tab Key

Red   White   Black

Harness Assembly

Handle Assembly
Collar

Bumper

Keying Slot

Trigger Microswitch
Black
(Common)
White
(Normally Open)

Bearing

Small
Spur Gear

Shaft

Second Torsion
Spring

Spring Pin

Labeled
Sleeve (R)

First Torsion
Spring

Pushbutton
Microswitch
Black
(Common)
Red
(Normally Open)

Self-Locking
Cap Screw

Spur Gear
Collar

Roll Pin

Large
Spur Gear

Handle
Cover

Lubrication Points

Figure 3-7 Flight Control Handle Assembly

4. Apply a heavy film of Nyogel 779 lubricant (Atari part no. 178027-001) to the inside of the torsion spring.

5. Hook the straight end of the first torsion spring through the hole closest to the right side of the frame.

6. Hold the first torsion spring in line with the shaft so that the looped end of the spring is facing away from the spur gear.

7. Slide the shaft just through the first torsion spring.

8. Hook the straight end of the second torsion spring through the hole closest to the left bearing.

9. Hold the second torsion spring in line with the shaft so that the looped end of the spring is facing the first torsion spring.

10. Slide the shaft through the second torsion spring and the left bearing.

11. Position the shaft so that the retainer grooves are just inside the bearings.

12. Install the two retainers in the shaft grooves.

13. Turn the shaft so that the two large holes and the smaller centered hole are facing upward.

14. Locate the hole in the spring pin. Insert the end of the spring-handle pin that is closest to the hole through the slot in the frame and through the hole in the shaft. Make sure both torsion spring looped ends are wrapped over the spring pin.

15. Position the spring pin so that the hole in the pin is aligned with the hole in the shaft.

16. Use a $\frac{3}{64}$-inch hex driver to tighten the cap screw and washer that secure the pin to the shaft.

17. Align the cap screw in the spur-gear collar with the threaded hole in the shaft and use a $\frac{3}{64}$-inch hex driver to tighten the cap screw.

18. Insert the potentiometer shaft through the hole in the mounting bracket. Before fully inserting the shaft through the bracket, place the washer, nut, and small (14-tooth) spur gear (with the collar facing inward) onto the shaft.

19. Align the potentiometer so that the tab key is inserted into the keying slot.

20. Use a ½-inch combination wrench to slightly tighten the nut on the potentiometer shaft.

21. Turn the potentiometer shaft so that the flat side faces the center wire terminal.

22. Align the cap screw on the small (14-tooth) spur gear with the flat side of the shaft, and use a $\frac{3}{64}$-inch hex driver to tighten the cap screw.

23. Slide the potentiometer forward so that the teeth on the two spur gears are tightly meshed; then slide the potentiometer and small (14-tooth) spur gear about $\frac{1}{64}$-inch away from the large spur gear.

24. Use a ½-inch combination wrench to tighten the potentiometer to the mounting bracket.

25. Perform the procedure under *Installing the Harness Assembly*.

26. Install the handles in the reverse order of the removal procedure previously described. Do not install the handle covers until the harness is installed and the proper wires are soldered to the trigger and pushbutton microswitches.

27. Check the vertical potentiometer alignment as described in this chapter under *Aligning the Flight-Control Potentiometers*.

28. Install the handle-assembly cover and use a $\frac{5}{32}$-inch hex-key tool to tighten the four tamper-proof socket screws that secure the cover to the handle assembly.

Disassembling the Steering Assembly

Perform the following procedure to disassemble the steering assembly (see Figures 3-7 and 3-8).

1. Remove the handle covers as described previously. Be careful when opening the handles because the pushbutton and trigger springs may fall out.

2. Unsolder the three harness wires from the vertical potentiometer and the handle pushbutton and trigger microswitches.

3. Use a $\frac{7}{64}$-inch hex (or ball-end) driver to remove the three cap screws that hold the steering-assembly shaft to the handle-assembly frame.

4. Gently pull the two assemblies apart. Make sure the harness wires are free to slide out of the handle-assembly shaft.

5. Use a $\frac{9}{16}$-inch wrench to remove the anchor nut on the end of the anchor pin. (The anchor nut faces the open end of the frame.)

6. Slide the anchor pin from the shaft.

7. Grasp the large (60-tooth) spur gear and slide the shaft from the frame. The bearing spacer and torsion springs will fall free.

8. Use a $\frac{7}{64}$-inch hex driver to remove the cap screws that hold the large spur gear to the steering shaft and the small spur gear to the potentiometer shaft.

9. Use a ½-inch combination wrench to remove the nut and washer that hold the potentiometer to the frame.

10. Unsolder the three harness wires from the potentiometer terminals.

⚠ ——— **WARNING** ——— ⚠

Shield your face and eyes when prying the retainer from the shaft because the retainer can fly loose at a high velocity. Cover the retainer with a rag or any material that will trap the retainer.
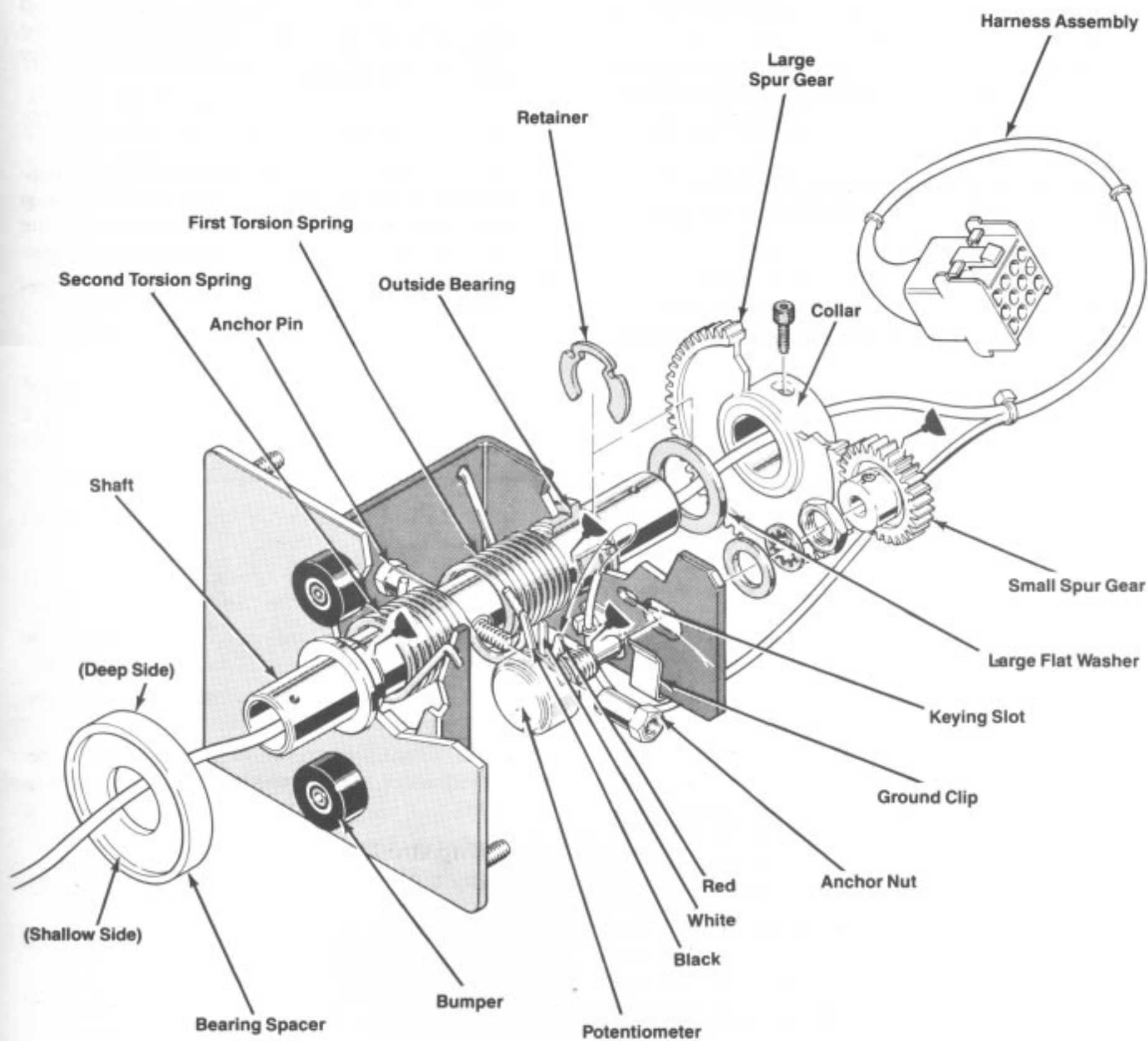

Harness Assembly

Large
Spur Gear

Retainer

First Torsion Spring

Second Torsion Spring

Anchor Pin

Outside Bearing

Collar

Shaft

Small Spur Gear

(Deep Side)

Large Flat Washer

Keying Slot

Ground Clip

Anchor Nut

Red

White

Black

Bumper

Potentiometer

Bearing Spacer

(Shallow Side)

Lubrication Points

Figure 3-8 Flight Control Steering Assembly

11. Use a slotted screwdriver to remove the retainer from the shaft.

12. Use a $\frac{5}{32}$-inch hex driver and $\frac{3}{8}$-inch combination wrench to remove the two bumpers from the frame.

13. Reassemble the steering assembly as described in the following procedure.

Reassembling the Steering Assembly

Perform the following procedure to reassemble the steering assembly (see Figure 3-8).

1. Use a $\frac{5}{32}$-inch hex driver and $\frac{3}{8}$-inch combination wrench to install the two bumpers to the frame.

2. Snap the retainer into the groove of the shaft and slide the large, flat washer down the long end of the shaft and against the retainer.

3. Apply a heavy film of Nyogel 779 lubricant (Atari part no. 178027-001) to the inside of the torsion springs.

4. Hook the straight end of the first torsion spring through the hole closest to the back of the frame. Slide the shaft through the outside bearing and the first torsion spring.

5. Hook the second torsion spring through the hole on the opposite side and closest to the front of the frame. Slide the shaft through the second spring and the opposite bearing.

6. Turn the shaft so that the threaded hole at the retainer end of the shaft faces up toward the open side of the frame. (The hole through the center of the shaft will then be perpendicular to the open side of the frame.)

7. Use a $\frac{9}{16}$-inch combination wrench to install the anchor pin and nut through the hole in the center of the shaft. Make sure the torsion spring looped ends are wrapped under the anchor pin and nut.

8. Slide the large (60-tooth) spur gear onto the shaft with the collar facing out.

9. Align the cap screw in the spur gear collar with the threaded hole in the shaft, and use a $\frac{7}{64}$-inch hex driver to tighten the cap screw.

10. Insert the potentiometer shaft through the hole in the frame and align the potentiometer so that the tab key is inserted into the keying slot.

11. Install the washer and nut on the potentiometer shaft, but do not tighten.

12. Turn the potentiometer shaft so that the flat side faces the center wire terminal.

13. Align the cap screw on the small (28-tooth) spur gear with the flat side of the shaft and slide the small spur gear (with the collar facing inward) onto the potentiometer shaft.

14. Position the spur gear so that its teeth mesh with those of the large spur gear and use a $\frac{7}{64}$-inch hex driver to tighten the cap screw.

15. Slide the potentiometer forward so that the teeth on the two spur gears are tightly meshed; then slide the potentiometer and small spur gear about $\frac{1}{64}$-inch away from the large spur gear.

16. Use a $\frac{1}{2}$-inch combination wrench to tighten the potentiometer to the frame.

17. Slide the bearing spacer over the shaft at the end opposite the spur gears. Check to make sure that the deep side of the bearing spacer sits over the head of the bronze flange bearing in the steering-assembly frame.

18. If necessary, lubricate the steering assembly as previously described in this chapter.

NOTE

The remaining steps describe the procedure for attaching the steering assembly to the handle assembly.

---

19. Insert the steering-assembly shaft into the collar on the handle-assembly frame.

20. Align the three holes in the steering-assembly shaft with the three holes in the handle-assembly collar.

21. Use a $\frac{7}{64}$-inch hex (or ball-end) driver to tighten the three cap screws. Make sure these screws are tight.

22. Install the harness assembly as described in the following procedure.

23. Check the horizontal potentiometer alignment as described under *Aligning the Flight-Control Potentiometers*.

Installing the Harness Assembly

Perform the following procedure to install the harness assembly to the flight control (see Figures 3-7 and 3-8).

1. If necessary, remove the handle covers as described under *Removing the Handles*.

2. Guide the harness wires into the spur-gear end of the hollow steering-assembly shaft.

3. Route and solder the wires to the potentiometers and microswitches. Note that the wire bundle that goes to the right handle is identified with a labeled sleeve (R).

4. Install the wire ties and the ground clip. Make sure the wires do not interfere with the gears when the flight-control assembly is mounted.

Aligning the Flight-Control Potentiometers

The following procedures describe the method for checking and aligning the vertical and horizontal flight-control potentiometers to ensure that the target cursor on the display is centered when the flight control is released.

Preliminary Procedure

Perform the following procedure to determine if the vertical or horizontal potentiometers are misaligned.

1. Turn off the game power.
2. Set the self-test switch to the *on* position.
3. Turn on the game power.
4. Perform the Switch Test Display procedure for checking potentiometer alignment as given in Chapter 2. If the self-test display (POT TEST portion) indicates that the flight-control vertical or horizontal potentiometer is out of tolerance, perform the appropriate procedure.

Vertical Potentiometer

Perform the following procedure to align the flight-control vertical potentiometer (see Figure 3-7).

1. Turn off the game power.
2. If necessary, remove the flight-control handle-assembly cover (with the special $\frac{3}{32}$-inch hex-key tool) to gain access to the vertical-motion potentiometer.
3. With the flight control centered (no tension on the return springs), check that the set screw on the potentiometer spur gear is facing the center (white) wire terminal. If not, use a ½-inch combination wrench and loosen the potentiometer mounting nut. Slide the potentiometer sideways in the mounting bracket until the gears disengage.
4. Turn on the game power.
5. Turn the small spur gear until the Switch Test Display (obtained in the Preliminary Procedure) indicates that the vertical potentiometer is within the allowable limits.
6. Gently slide the potentiometer forward so that the spur-gear teeth are tightly meshed. (If necessary, move the large gear slightly to align the gear teeth—do not turn the potentiometer shaft.) Recheck the Switch Test Display limits.
7. Pull the potentiometer and small spur gear about $\frac{1}{64}$-inch away from the large spur gear. Use the ½-inch combination wrench to tighten the potentiometer to the mounting bracket.
8. Install the handle-assembly cover by using the special $\frac{3}{32}$-inch hex-key tool to tighten the tamper-proof socket screws.

Horizontal Potentiometer

Perform the following procedure to align the horizontal potentiometer (see Figure 3-8).

1. Turn off the game power.
2. Open the control panel as described previously in this chapter.

3. With the flight control centered (no tension on the springs), check that the set screw on the potentiometer spur gear is facing the center (white) wire terminal. If not, use a $\frac{5}{64}$-inch hex driver and loosen the set screw on the potentiometer spur gear. Slide the spur gear off the potentiometer shaft.
4. Turn on the game power.
5. Turn the potentiometer shaft until the Switch Test Display (obtained in the Preliminary Procedure) indicates that the horizontal potentiometer is within the allowable limits.
6. Slide the spur gear onto the potentiometer with the set screw centered over the flat side of the shaft while aligning the gear teeth so they mesh with the large spur gear. (If necessary, the small spur gear can be turned slightly—do not turn the potentiometer shaft.)
7. Use the $\frac{5}{64}$-inch hex driver and tighten the spur-gear set screw. Recheck the Switch Test Display to make certain the potentiometer alignment is still within the allowable limits.

Calibrating the Flight Control

The flight control is self-calibrating. The game circuitry monitors the position of the target cursor on the display graphics in relation to the flight control's vertical and horizontal position. Calibrate the flight control after any corrective maintenance is performed by moving the target cursor to all four edges of the display graphics. Calibration is also accomplished during normal game play, but may take several seconds of game play to optimize. If the target cursor on the display graphics fails to return to center screen when the flight control is released, check the flight control's vertical and horizontal alignment as previously described in this chapter.

Removing the Display Shield and Bezel

Sit-Down Cabinet

Perform the following procedure to remove the display shield and bezel from the sit-down cabinet (see Figure 3-9).

1. Use the special $\frac{3}{32}$-inch hex-key tool to remove the two tamper-proof cap screws from the flight-control mounting panel.
2. Swing the flight control downward.
3. Carefully lift the bottom of the display shield, then pull out and down to remove it from the the cabinet.
4. Remove the securing staples and lift off the bezel.
5. Replace the display shield and bezel in the reverse order of removal.
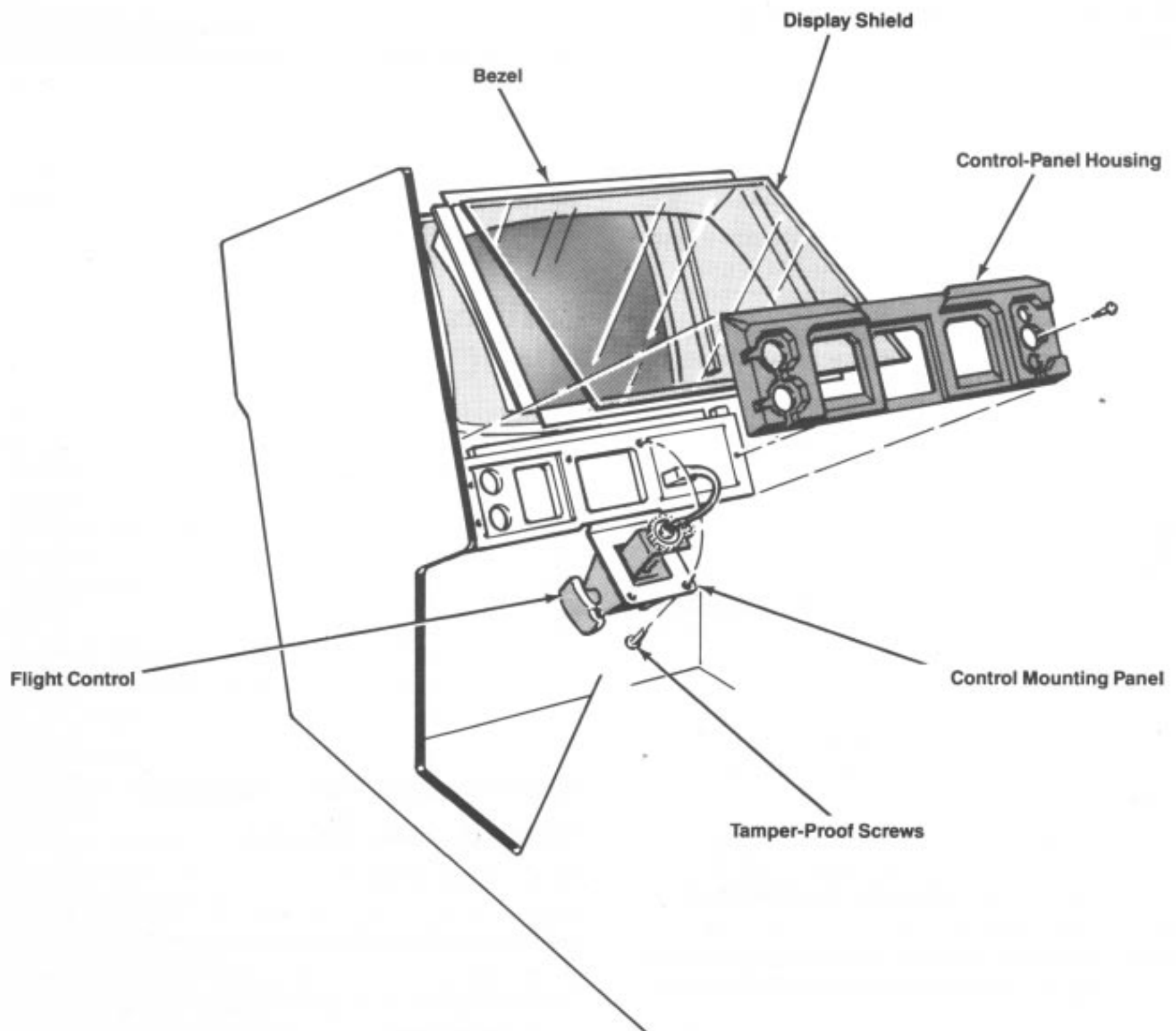
Figure 3-9 Removing the Sit-Down Cabinet Display Shield and Bezel

Removing the CRT

⚠ — WARNING — ⚠

High Voltage

This display contains lethal high voltages. To avoid injury, do not attempt to service this display until you observe all precautions necessary for working on high-voltage equipment.

X-Radiation

This display has been designed to minimize X-radiation. However, to avoid possible exposure to soft X-radiation, **never** modify the high-voltage circuitry.

Implosion Hazard

The cathode-ray tube assembly may implode if struck or dropped. Shattered glass may cause personal injury within a 6-foot radius. To avoid injury, we recommend that two people, wearing gloves and safety glasses, perform the following removal procedures.

Upright Cabinet

Perform the following procedure to remove the cathode-ray tube (CRT) from the upright cabinet (see Figure 3-10).

1. Turn the game power off.

2. Use a Phillips-head screwdriver to remove the head access panel from the game cabinet.

3. Discharge the high-voltage from the CRT before proceeding. The video display contains a circuit for discharging the CRT high voltage to ground when power is removed. However, to make certain, always discharge the CRT as follows.

   a. Attach one end of a large, well insulated, 18-gauge jumper wire to ground.

   b. Momentarily touch the free end of the grounded jumper to the anode by sliding it under the anode cap.

   c. Wait two minutes and repeat part b.

4. Disconnect the CRT neck-pin connector, anode lead, yoke connector, degaussing coil connector, and the 1-pin DAG spring connector.

5. Follow steps 2 through 8 under *Removing the Fluorescent Tube and Speaker Board.*

⚠ — WARNING — ⚠

Be extremely careful when removing the cathode-ray tube mounting bolts because the cathode-ray tube assembly can fall. We recommend that a second person **carefully** hold the cathode-ray-tube neck while the mounting bolts are being removed.

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6. Use a ¼-inch combination wrench to remove the bolts and washers from the front of the display-mounting bracket.

7. Carefully lift the CRT assembly from the front of the cabinet.

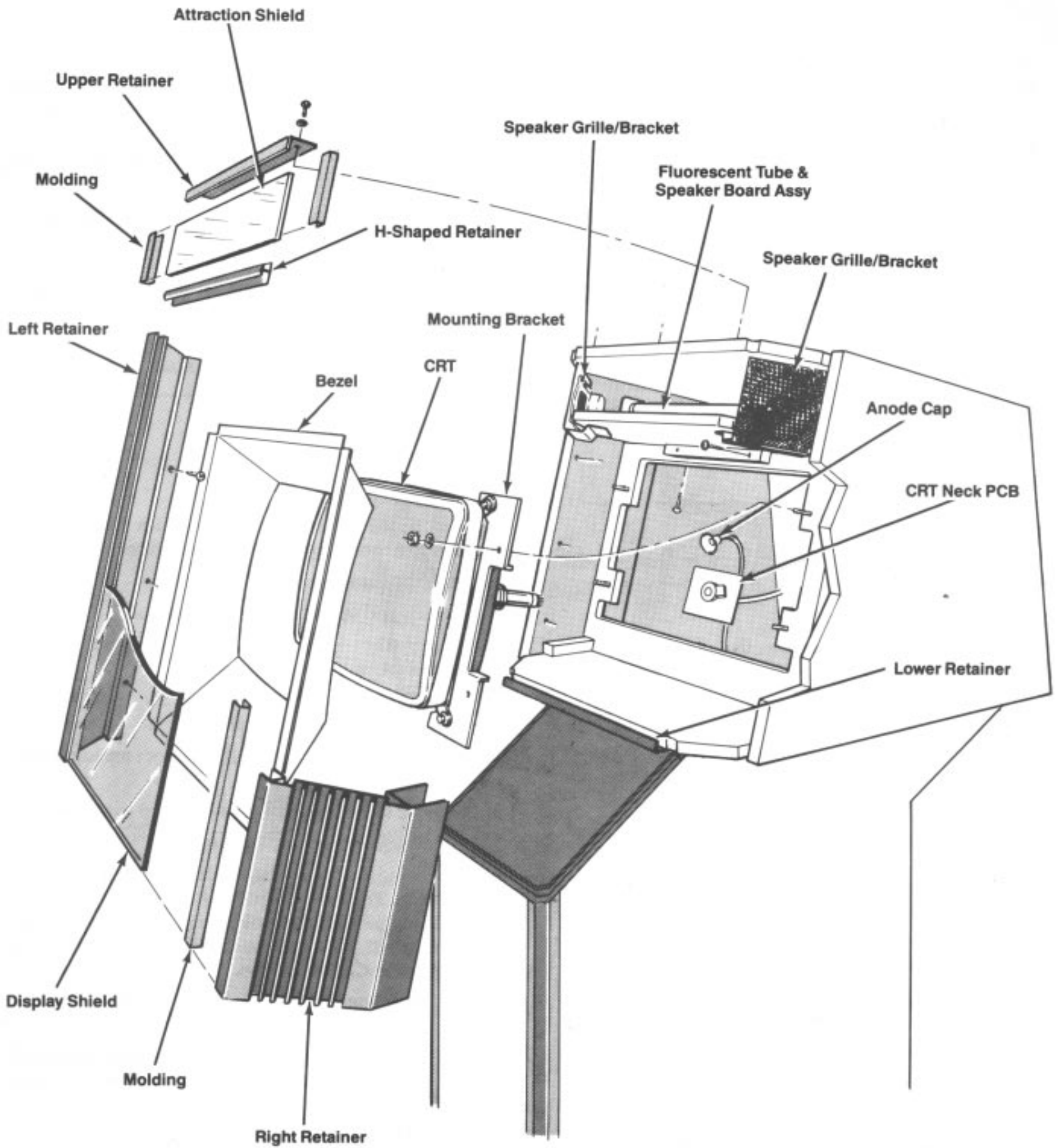8. Replace the CRT assembly in the reverse order of removal.

— NOTE —

Whenever the cathode-ray tube is replaced, readjust the brightness, purity, and convergence as described in the display manual.

Sit-Down Cabinet

Perform the following procedure to remove the cathode-ray tube from the sit-down cabinet (see Figures 3-9 and 3-11).

1. Turn the game power off.

2. Unlock and open the rear access door.

3. Remove the six screws and retaining plates from the top window.

4. Slide the top window to the right, swing the left side out, and remove the window.

5. Remove the four screws and the upper retaining plate from the side window.

6. Remove the screws that secure the top to the cabinet.

7. Slide back the top and lift it off.

8. Discharge the high-voltage from the CRT before proceeding. The video display contains a circuit for discharging the CRT high voltage to ground when power is removed. However, to make certain, always discharge the CRT as follows.

   a. Attach one end of a large, well insulated, 18-gauge jumper wire to ground.

   b. Momentarily touch the free end of the grounded jumper to the anode by sliding it under the anode cap.

   c. Wait two minutes and repeat part b.

9. Disconnect the CRT Neck PCB, anode lead, yoke connector, degaussing coil connector (located on the power supply), yoke connector (J2 on the Deflection PCB), and the two DAG-spring connections (located on the Neck PCB and Deflection PCB).

10. Remove the display shield and bezel as previously described (see Figure 3-9).

Attraction Shield

Upper Retainer

Molding

Speaker Grille/Bracket

Fluorescent Tube &
Speaker Board Assy

H-Shaped Retainer

Speaker Grille/Bracket

Left Retainer

Mounting Bracket

CRT

Bezel

Anode Cap

CRT Neck PCB

Display Shield

Lower Retainer

Molding

Right Retainer

**Figure 3-10 Removing the Upright-Cabinet CRT and
Fluorescent Tube and Speaker Board**

━━━ ⚠ ━ WARNING ━ ⚠ ━━━

Be extremely careful when removing the cathode-ray tube mounting nuts because the cathode-ray tube assembly can fall. We recommend that a second person **carefully** hold the cathode-ray-tube neck while the mounting nuts are being removed.

11. Remove the four $\frac{7}{16}$-inch nuts, lock washers, and washers that secure the CRT to the mounting brackets.

12. Standing in the cabinet, carefully lift the CRT out. Be careful not to strike the neck.

13. Replace the CRT in the reverse order of removal.

━━━ NOTE ━━━

Whenever the cathode-ray tube is replaced, readjust the brightness, purity, and convergence as described in the display manual.

Removing the Fluorescent Tube and Speaker Board

Upright Cabinet

Perform the following procedure to remove the fluorescent tube and speaker board from the upright cabinet (see Figure 3-10).

1. Use a Phillips-head screwdriver to remove the display access panel from the rear of the game cabinet.

2. Disconnect the harnesses from the fluorescent tube assembly and from the speakers.

3. From the front of the cabinet, use an Allen wrench to remove the upper retainer of the attraction panel. Save the hardware for reassembly.

4. Slide the attraction panel and the semi-rigid film that is behind the panel up and out of the left and right retainers.

━━━ NOTE ━━━

Molding is firmly fitted on each side of the attraction panel and on each side of the display shield. These moldings should stay on the attraction panel and display shield.

5. Remove the H-shaped retainer between the attraction shield and the display shield.

6. Slide the display shield up and out of the right and left retainers. If necessary, loosen the lower retainer to break the foam tape seal on the bottom of the display shield.

7. Carefully remove the display bezel.

8. Remove the four screws securing the right and left retainers to the cabinet.

9. Remove the two screws that secure the cleat at the top of the display shelf.

10. Pull the fluorescent tube and speaker board out of the front of the cabinet.

11. Replace the fluorescent tube and speaker board as described later in this chapter.

Sit-Down Cabinet

Perform the following procedure to remove the light and speaker panel from the sit-down cabinet (see Figure 3-12).

1. Use the special $\frac{5}{32}$-inch hex-key tool to remove the two tamper-proof cap screws from the flight-control mounting panel.

2. Swing the flight control downward.

3. Disconnect the two headphone and light/speaker harness connectors.

4. Remove the six screws and carefully lower the light and speaker panel.

5. Replace the light and speaker panel in the reverse order of removal.

Replacing the Fluorescent Tube and Speaker Board

Upright Cabinet

Perform the following procedure to replace the fluorescent tube and speaker board in the upright cabinet (see Figure 3-10).

1. Carefully slide the fluorescent tube and speaker board into the upper front of the cabinet.

2. Replace the screws securing the cleat to the top of the display shelf.

3. Replace the right and left retainers.

4. Slide the bottom edge of the display bezel into the lower retainer. Press the right and left tabs of the bezel behind (not in) the slots in the right and left retainers. The top tab rests against the front edge of the fluorescent tube and speaker board.

5. Replace the display shield (with the moldings attached) by sliding it into the slots of the right and left retainers on either side of the display.

6. Tighten the lower retainer.

7. Slide the H-shaped retainer onto the top edge of the display shield.

8. Slide the attraction panel and semi-rigid film (with the moldings attached) into the right and left retainer slots. Make certain the bottom edge of the attraction panel and semi-rigid film is inserted completely into the H-shaped retainer slot.
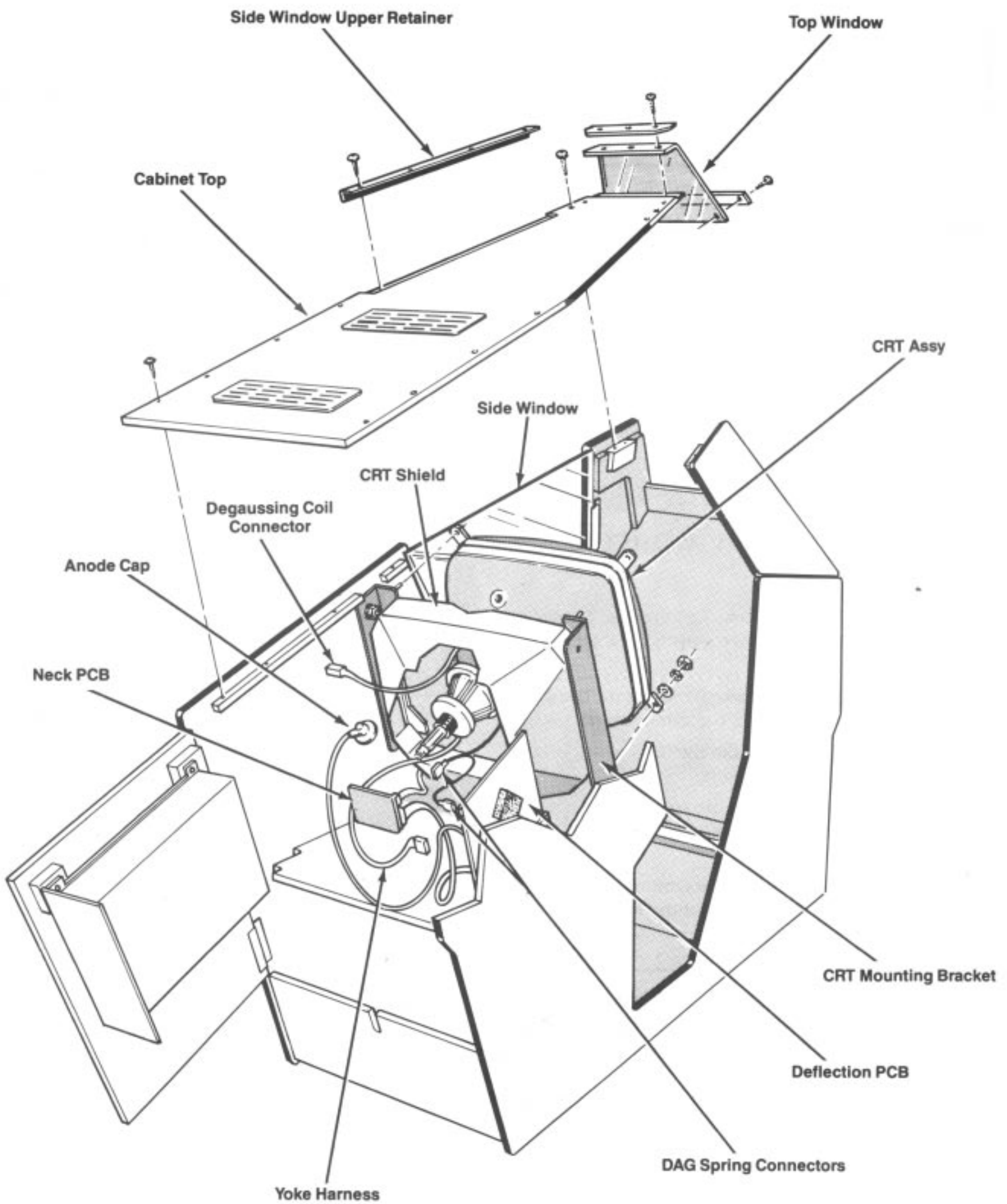
Side Window Upper Retainer

Top Window

Cabinet Top

CRT Assy

Side Window

CRT Shield

Degaussing Coil
Connector

Anode Cap

Neck PCB

CRT Mounting Bracket

Deflection PCB

DAG Spring Connectors

Yoke Harness

Figure 3-11 Removing the Sit-Down Cabinet CRT

9. Use an Allen wrench to replace the upper retainer of the attraction panel.

10. From the back of the cabinet, reconnect the 3-pin connector from the fluorescent tube harness and the 4-pin connector from the speakers.

11. Use a Phillips-head screwdriver to replace the head access panel.

Removing the Speakers

Upright Cabinet

Upper Speakers. Perform the following procedure to remove the upper speakers from the upright cabinet (see Figures 3-10 and 6-2).

1. Remove the fluorescent tube and speaker board as previously described in this chapter.

2. With the fluorescent tube and speaker board out of the cabinet, disconnect the two snap-on connectors from each speaker.

3. Remove the speaker grille/bracket from the fluorescent tube and speaker board.

4. Remove the speaker from its grille/bracket.

5. Mount each new speaker to its grille/bracket with the appropriate hardware.

6. Mount each grille/bracket to the fluorescent tube and speaker board.

7. Reconnect the two snap-on connectors to each speaker.

8. Replace the fluorescent tube and speaker board as previously described.

Lower Speakers. Perform the following procedure to remove the lower speakers from the upright cabinet.

```
────────── CAUTION ──────────
The lower speaker grille is riveted to the cabi-
net and is not removable.
```

1. Remove the control panel as previously described in this chapter.

2. Reach in from the front of the game cabinet and disconnect the speaker harness and the two snap-on connectors.

3. Remove the speakers from the cabinet.

4. Replace the speakers in the reverse order of removal.

Sit-Down Cabinet

Control-Panel Speakers. Perform the following procedure to remove the control-panel speakers from the sit-down cabinet (see Figure 3-12).

1. Remove the light and speaker panel as previously described in this chapter.

2. Disconnect the two snap-on connectors from the speaker.

3. Remove the speaker from the light and speaker panel.

4. Replace the speaker in the reverse order of removal.

Seat Speakers. Remove the attraction panel from the front of the sit-down cabinet to gain access to the seat speakers (see Figure 7-1).

Headphone/Light/Speaker Harness

Flight Control

Control-Mounting Panel

Light and Speaker Panel
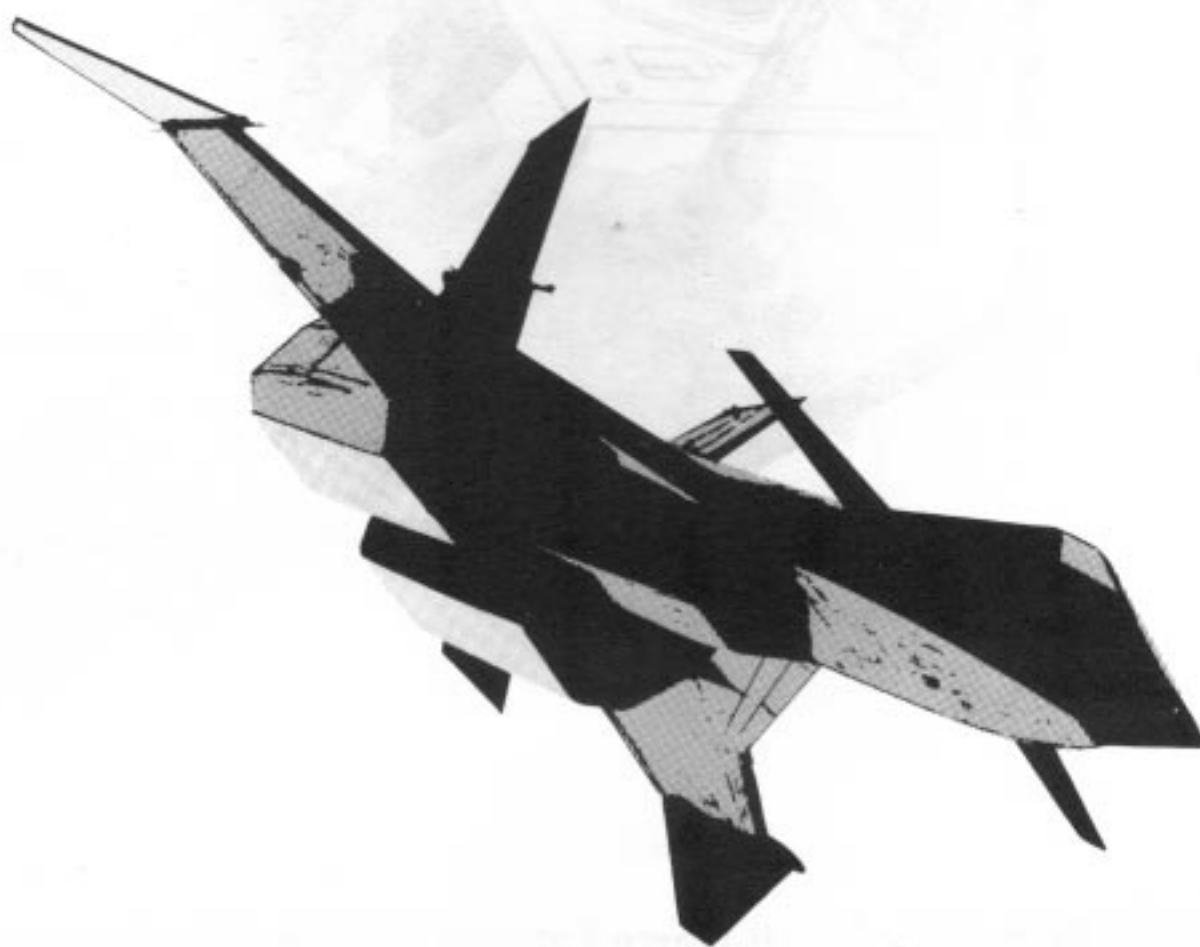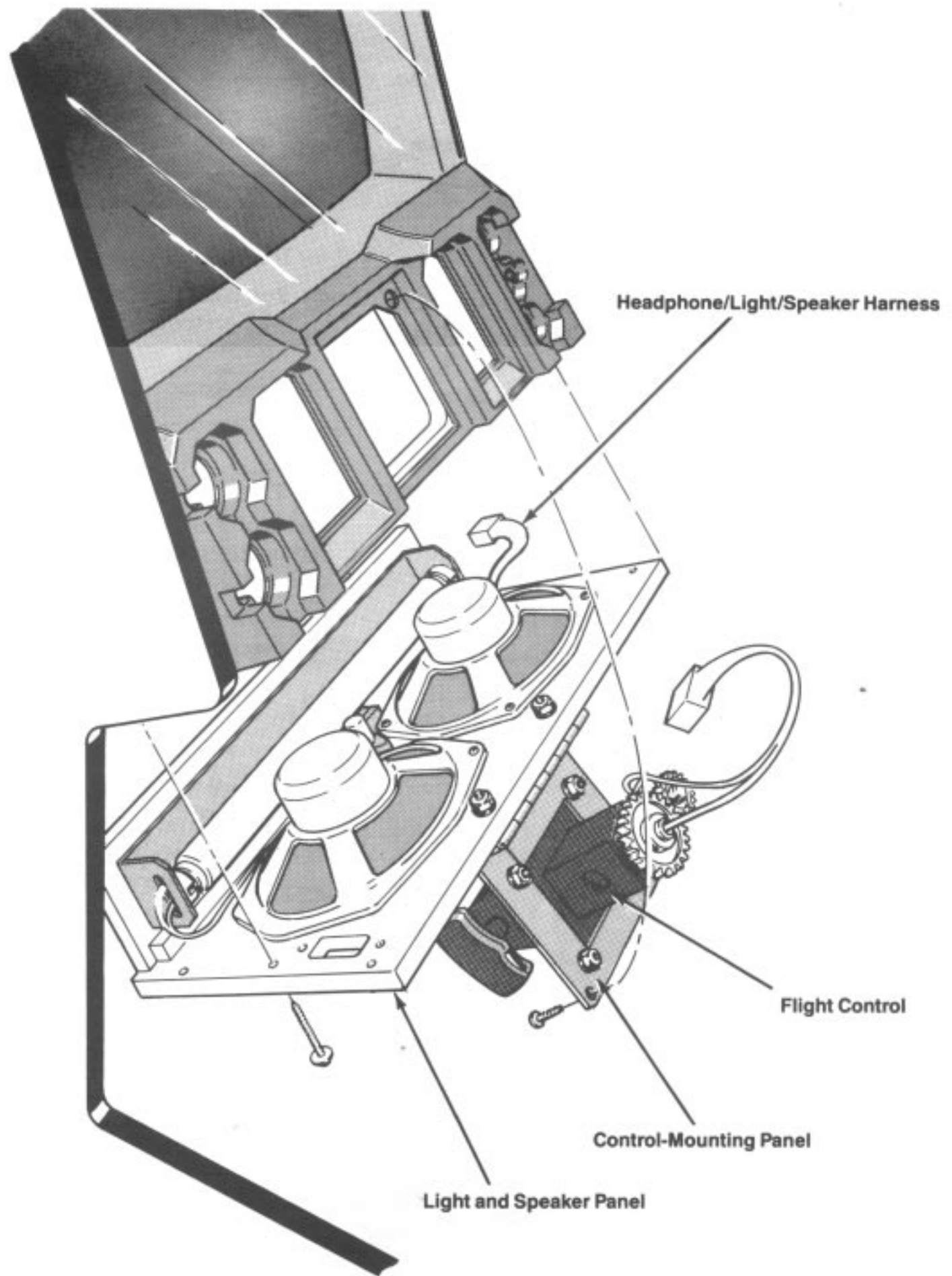
Figure 3-12 Removing the Sit-Down Cabinet Light and Speaker Panel

Troubleshooting

This chapter contains a discussion of troubleshooting aids and techniques to assist the service technician when a trouble is suspected in this game. Most troubles can be located quickly by following the information in this chapter. However, if problems persist, contact your nearest Atari Customer Service office listed on the inside front cover of this manual for assistance.

A thorough knowledge of game operation is desirable for effective troubleshooting. In addition to the operation and service information in the Schematic Package Supplement included with this manual, refer to *The Book, A Guide To Electronic Game Operation and Servicing,* this publication is available from Atari, Inc., and has more information on coin-operated electronic games.
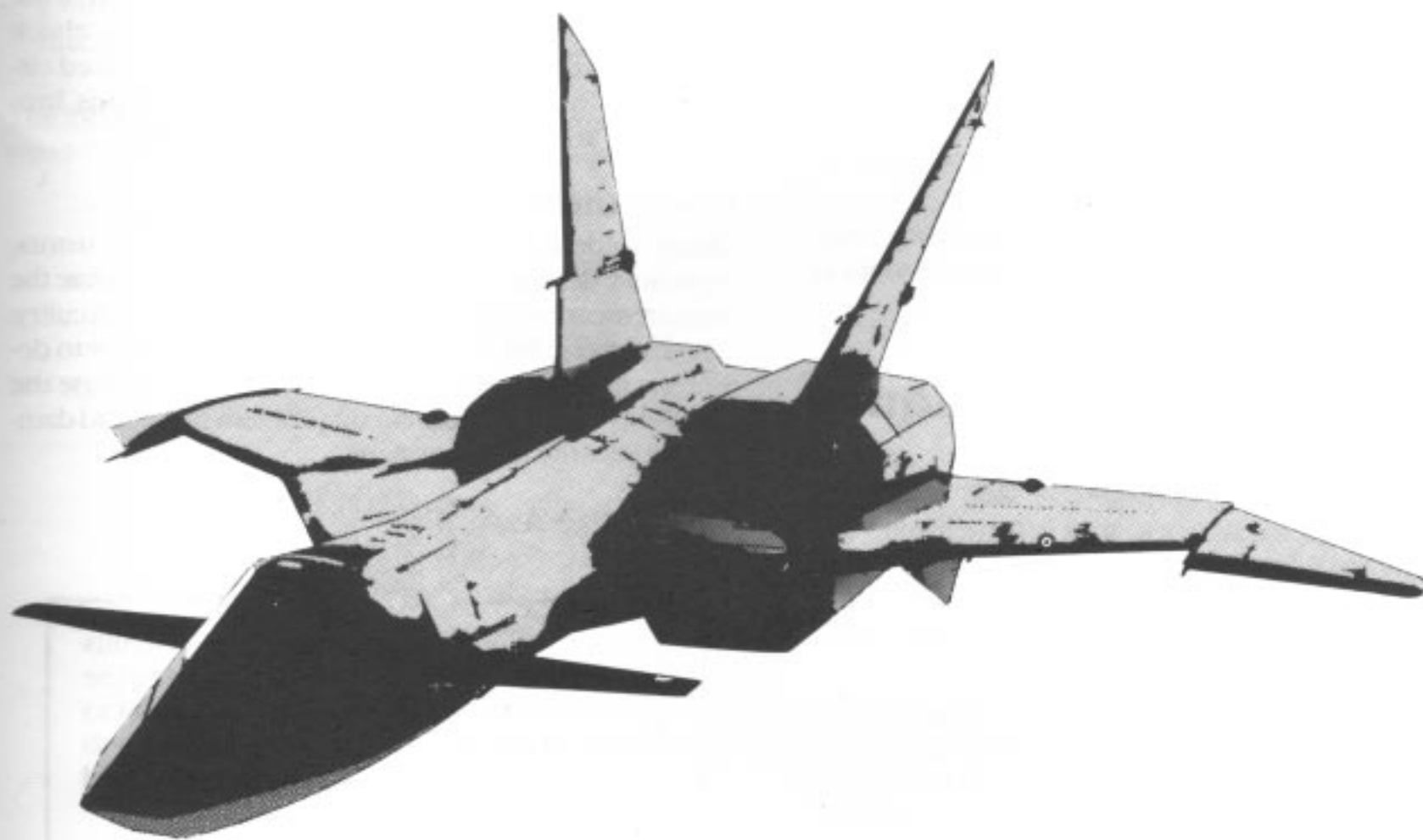
Chapter 4

Troubleshooting Aids

Troubleshooting aids are provided throughout this manual and the Schematic Package Supplement. The following information is intended to acquaint the service technician with the portions of these documents that contain useful troubleshooting and repair information.

Assembly and Component Locations

The parts lists in Chapters 5, 6, and 7 illustrate the locations of assemblies and components. Printed-circuit board (PCB) illustrations aid in rapidly locating components shown on the corresponding schematic diagram(s).

Diagrams

The Schematic Package Supplement included with this game contains schematic diagrams with component locations, active component type numbers, and electrical values.

Troubleshooting Procedures

Refer to the following section, *Troubleshooting Techniques*, for a suggested troubleshooting sequence to aid in locating defective components.

Troubleshooting Techniques

The following troubleshooting steps are arranged in a sequence recommended for locating a defective component. The procedure begins with a check of the simple trouble possibilities and progresses to more extensive procedures for localizing the problem to an assembly or major circuit, and then to a defective component.

Check Switch Settings

Incorrect switch settings can sometimes indicate a problem that does not exist. Refer to Chapter 1 to verify that the game has been installed properly and that the switches are set to their correct positions. Check for proper operation in all game play modes.

Check Fuses

Check for open fuses. Refer to the Power Supply Manual and to the Display Manual for the location and rating of each fuse used in this game. Make sure that replacement fuses are the proper type and rating.

Check Power-Supply Voltages

Improper operation of all circuits usually indicates a power supply problem. Be sure that the proper line voltage is available to the power supply. Check for correct voltages.

Localize Trouble

Determine the trouble symptom. Use the wiring diagrams in the Schematic Package Supplement to determine which assemblies or major circuits could cause the trouble. Perform the self-test procedure provided in Chapter 2.

Visual Check

Visually check for obvious problems in the portion of the game where the trouble is suspected. For example, check for loose or defective solder connections, integrated circuits loose in their sockets, loose cable connections, broken wires, and damaged PCBs or components.

Check Individual Components

Check soldered-in passive components (e.g., resistors, capacitors, diodes) by disconnecting one end to isolate the measurement from the effects of the surrounding circuitry. Often, direct substitution is the most practical way to determine if a component is faulty. However, eliminate the possibility of some other circuit problem that could damage the substitute component.

Repair the Assembly

Repair or replace the defective part. Refer to Chapter 3 and information in this chapter for special removal and replacement procedures. Check for proper operation of the repaired circuit.

Soldering Techniques

Observe the following recommendations when removing or replacing components soldered to a PCB. Poor soldering practices can damage a PCB or heat-sensitive electrical components.

Choosing the proper soldering iron is essential before attempting to remove or replace soldered-in components. Excessive heat is a common cause of damage to a component or PCB. However, transient voltages from solder guns or improperly grounded soldering irons can also damage certain voltage-sensitive semiconductor devices. Refer to *Troubleshooting Static-Sensitive Devices* for more specific information.

A 15- to 27-watt pencil-tip soldering iron is recommended to avoid separating the etched circuit wiring from the board material and to avoid damaging active components. A temperature-controlled soldering station rated at 700°F with a fine cone or a very fine chisel tip can also be used.

CAUTION

Solder guns are not recommended for removing or replacing soldered-in components on a printed-circuit board. The added possibility for overheating and the large transient voltage induced by the solder gun could cause damage to heat or voltage-sensitive devices.

The following additional equipment is recommended for removing and replacing soldered-in components.

- Solder Sucker—Hand-operated vacuum tool used to remove liquified solder from the PCB. Top-of-the-line Soldapullt® brand is recommended.

- Solder Wick—Resin-soaked copper braid used for removing excess solder from the lead connections on the PCB. See *Removing Integrated Circuits* for precautions relating to the use of a solder wick on a multi-layer PCB with plated-through holes.

- Flux Remover—Non-corrosive chemical used to clean foreign material from the PCB before soldering and to remove any flux residue where components have been replaced. Also used to clean any foreign material from the PCB during preventive maintenance. Isopropyl alcohol is recommended.

- Acid Brush—Small stiff-bristled paint or toothbrush used with flux remover to clean flux and other foreign material from the PCB.

Removing Integrated Circuits

The easiest and safest method for removing soldered-in integrated circuits (IC) from a PCB is to cut off each pin as close to the IC case as possible with a tip dyke (diagonal cutter) as shown in Figure 4-1.

Use the proper soldering iron as previously described under *Soldering Techniques*. Then, to avoid excessive heat buildup in one area of the PCB, apply heat directly to each pin in a random order. Remove the loosened pin with the tip of the soldering iron or a needle-nose pliers as shown in Figure 4-2. Allow a moment for the PCB to cool before proceeding to the next pin. Apply just enough heat to remove any stubborn pins.
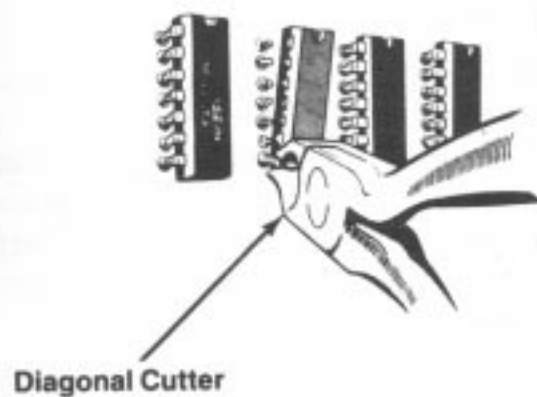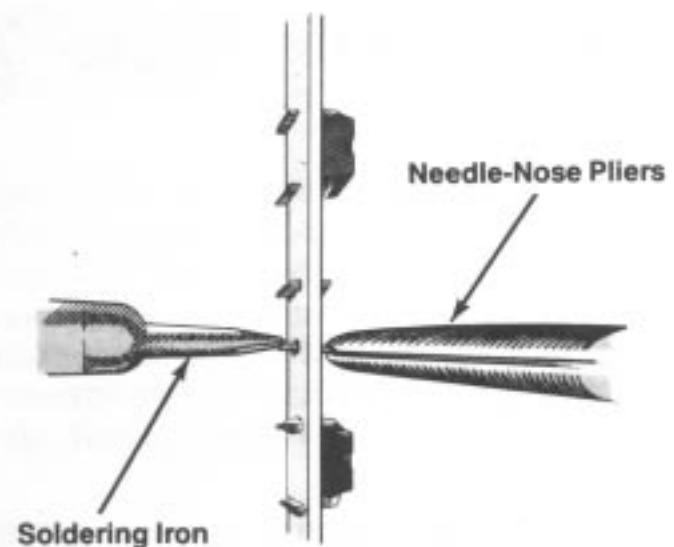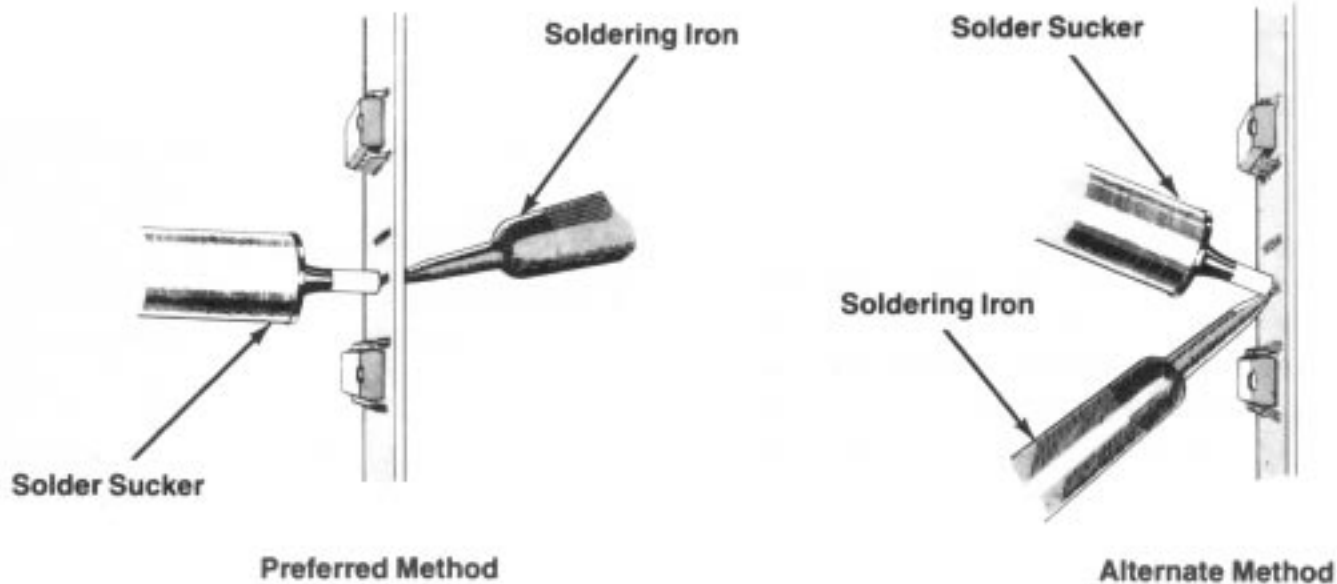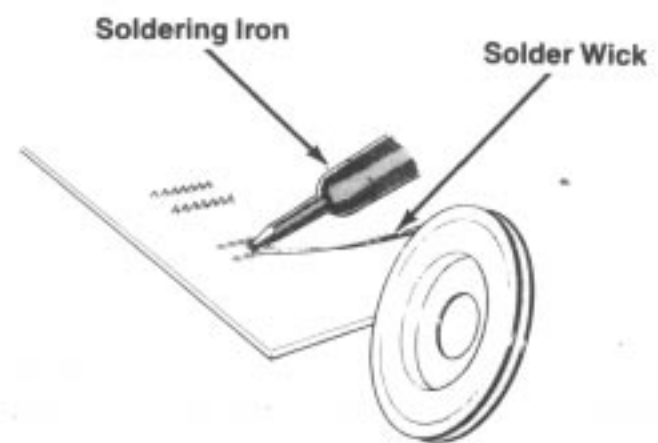

Figure 4-1 Removing ICs (Cut Pin Method)

Figure 4-2 Removing IC Pins

Preferred Method   **Alternate Method**

Figure 4-3 Removing Solder from Plated-Through Holes

For a multi-layer PCB with plated-through holes, use a solder sucker to remove the remaining solder from inside each hole as shown in Figure 4-3. If possible, suck the solder from the opposite side of the PCB from where the heat is applied.

Use a solder wick to remove excess solder from around the lead connection pads on the top and/or bottom surface of the PCB as shown in Figure 4-4.

```
───────────── CAUTION ─────────────
Do not use a solder wick to remove solder
from inside plated-through holes. The heat re-
quired for the solder wick to remove the solder
from inside the hole could damage the PCB.
```


Figure 4-4 Removing Solder from Lead Connection Pads

Troubleshooting Static-Sensitive Devices

Certain precautions must be taken when working with static-sensitive devices, e.g., microprocessors, field-effect transistors (FET), complementary metal-oxide semiconductors (CMOS), and other large-scale integration (LSI) devices that use metal-oxide semiconductor (MOS) technology. Static charge buildup in a person's body or leakage from an improperly grounded soldering iron can cause static-sensitive device failure.

Before handling a static-sensitive device or a PCB with such devices attached to it, ground any static voltage that may have accumulated in your body by touching an object that has been earth grounded. A bare wire wrapped around your wrist and attached to an earth ground is effective when working extensively with static-sensitive

devices. When soldering on a static-sensitive device, use a soldering iron with a properly grounded three-wire cord. (Refer to *Soldering Techniques* for a discussion of recommended soldering irons and procedures.)

A static-sensitive device may appear defective due to leakage on a PCB. Observe the precautions for grounding static voltages described in the preceding paragraph and clean both sides of the PCB with flux remover or an eraser before replacing what may be a good static-sensitive device. For discrete FETs, clean thoroughly between the gate, drain, and source leads.

Static-sensitive devices may be packaged in conductive foam or have a protective shorting wire attached to the pins. Remove the conductive foam just prior to inserting the device in its socket or soldering to a PCB. Remove the shorting wire only *after* the device is inserted in its socket or *after* all the leads are soldered in place.

Warranty

Seller warrants that its printed-circuit boards and parts thereon are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from date of shipment. Seller warrants that its video displays and laser-video disc players (in games supplied with displays and video-disc players) are free from defects in material and workmanship under normal use and service for a period of thirty (30) days from date of shipment. None of the Seller's other products or parts thereof are warranted.

If the products described in this manual fail to conform to this warranty, Seller's sole liability shall be, at its option, to repair, replace, or credit Buyer's account for such products which are returned to Seller during said warranty period, provided:

(a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;

(b) Such products are returned prepaid to Seller's plant; and

(c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by accident, misuse, neglect, alteration, improper repair, installation, or improper testing.

In no event shall Seller be liable for loss of profits, loss of use, incidental or consequential damages.

Except for any express warranty set forth in a written contract between Seller and Buyer which contract supersedes the terms herein, this warranty is expressed in lieu of all other warranties expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose, and of all other obligations or liabilities on the Seller's part, and it neither assumes nor authorizes any other person to assume for the Seller any other liabilities in connection with the sale of products by Seller.

The use of any non-Atari parts may void your warranty, according to the terms of the warranty. The use of any non-Atari parts may also adversely affect the safety of your game and cause injury to you and others. Be very cautious in using non-Atari-supplied components with our games, in order to ensure your safety.

Atari distributors are independent, being privately owned and operated. In their judgment they may sell parts or accessories other than Atari parts or accessories. Atari cannot be responsible for the quality, suitability or safety of any non-Atari part or any modification including labor which is performed by such distributor.